SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E-Electrical and Electronics Engineering

CURRICULUM and SYLLABI

[For students admitted in 2020-2021]

B.E / B.Tech Regulation 2019

Approved by BOS and Academic Council meetings

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester I under Regulations 2019 (CBCS)
Branch: Electrical and Electronics Engineering

S. No.	Course Code	Course Title	L	T	P	C	Category
Theory							
1	U19ENG101B	English for Engineers - I	1	0	2	2	HS
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS
3	U19CHE104D	Chemistry for Electrical Engineers	3	0	0	3	BS
4	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES
5	U19EGR106	Engineering Graphics **	2	0	2	3	ES
Laboratory							
6	U19CHL109	Chemistry Laboratory	0	0	3	1.5	BS
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES
8	U19WPL112	Workshop Practice	0	0	2	1	ES
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC
			Total Credits			18.5	
Optional Language Elective*							
10	U19OLE1101	French	0	0	2	1	HS
11	U19OLE1102	German					
12	U19OLE1103	Japanese					

* Students may opt for foreign languages viz., German/French/Japanese with additional one credit

(Not accounted for CGPA calculation)

** The examination will be conducted for 3 hours through CAD software and manual drafting.

Approved By

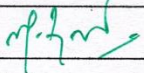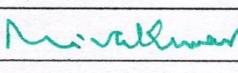| Chairperson, Science and Humanities BoS	Chairperson, Electrical and Electronics Engineering BoS	Member Secretary, Academic Council	Chairperson, Academic Council & Principal
Dr.M.Renuga	**Dr.S.Padma**	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

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

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / B Tech Semester II under Regulations 2019 (CBCS)
Branch: Electrical and Electronics Engineering

S.N	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
		Theory						
1	U19ENG201B	English for Engineers -II	1	0	2	2	HSMC	45 (15L+30P)
2	U19MAT202C	Transforms and Differential Equations	3	1	0	4	BSC	60
3	U19PHY203C	Physics for Electrical Engineers	3	1	0	4	BSC	60
4	U19EE201	Electric Circuits and Electron Devices	3	1	0	4	PCC	60
5	U19EE202	Measurements and Instrumentation	3	0	0	3	PCC	45
		Practical						
7	U19PHL210	Physics Laboratory	0	0	3	1.5	BSC	45
8	U19EE203	Electric Circuits and Electron Devices Laboratory	0	0	3	1.5	PCC	45
9	U19GE201	Basic Aptitude - II	0	0	2	0	EEC	30
					Total Credits	20		
		Optional Language Elective*						
10	U19OLE1201	French						
11	U19OLE1202	German	0	0	2	1	HSMC	30
12	U19OLE1203	Japanese						

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved by

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

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

04.06.2021   B.E/B. Tech Regulations-2019

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19EE301	Network Analysis and Synthesis	3	1	0	4	60
2	U19EE302	Analog Electronics	3	0	0	3	45
3	U19EE303	Electromagnetic Fields	3	1	0	4	60
4	U19EE304	Electrical Machines – I	3	0	0	3	45
5	U19EE305	Applied Thermodynamics	3	0	0	3	45
6	U19CS309	Object Oriented Programming in C++	3	0	0	3	45
7	U19GE302	**Mandatory Course:** Environment and Climate Science	2	0	0	0	30
Practical							
8	U19EE306	Analog Electronics Laboratory	0	0	2	1	30
9	U19EE307	Electrical Machines Laboratory – I	0	0	2	1	30
10	U19CS310	Object Oriented Programming in C++ Laboratory	0	0	2	1	30
11	U19GE301	Soft Skills and Aptitude-I	0	0	2	1	30
					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**

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	U19MAT401B	Probability and Statistical Methods	3	1	0	4	60
2	U19EE401	Signals and Systems	2	1	0	3	45
3	U19EE402	Electrical Machines – II	3	0	0	3	45
4	U19EE403	Power Electronics and Drives	3	0	0	3	45
5	U19EE404	Digital Electronics and Microcontroller	3	0	0	3	45
6	U19CS408	Data Structures	3	0	2	4	75
7	U19GE403	**Mandatory Course** - Essence of Indian Traditional Knowledge	2	0	0	0	30
		Practical					
8	U19EE405	Electrical Machines Laboratory – II	0	0	2	1	30
9	U19EE406	Power Electronics and Drives Laboratory	0	0	2	1	30
10	U19EE407	Digital Electronics and Microcontroller Laboratory	0	0	3	1.5	45
11	U19GE401	Soft Skills and Aptitude - II	0	0	2	1	30
					Total Credits	24.5	

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19EE501	Generation, Transmission and Distribution Systems	2	1	0	3	45
2	U19EE502	Control Systems	2	1	0	3	45
3	U19EE503	Embedded Systems and IoT	3	0	0	3	45
4	U19EE504	Electrical Machine Design	2	1	0	3	45
5	U19EE505	Total Quality Management in Electrical Industries	3	0	0	3	45
6	noc22_cs95	**NPTEL** - Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3	45
Practical							
7	U19EE506	Instrumentation and Control Laboratory	0	0	2	1	30
8	U19EE507	Embedded Systems and IoT Laboratory	0	0	2	1	30
9	U19GE501	Soft Skills and Aptitude – III	0	0	2	1	30
					Total Credits	**21**	

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

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	U19EE601	Power System Analysis	3	1	0	4	60
2	U19EE602	Power System Protection and Switchgear	3	0	0	3	45
3	U19EE603	Special Electrical Machines and their Controllers	3	0	0	3	45
4	U19EE918	**Professional Elective** - Renewable Energy Sources	3	0	0	3	45
	U19EE928	**Professional Elective** - Electric Vehicle Technology					
5	U19EE929	**Professional Elective** - Electrical System Design	1	0	4	3	75
6	U19CS1002	**Open Elective** - Cloud Computing	3	0	0	3	45
	U19EC1007	**Open Elective** - CMOS VLSI Design					
	U19CE1003	**Open Elective** - Energy Efficiency and Green Building					
	U19MC1004	**Open Elective** - Fundamentals of Robotics					
	U19BM1001	**Open Elective** - Hospital Management					
	U19EC1006	**Open Elective** - Mobile Technology and its Applications					
	U19CE1002	**Open Elective** - Municipal Solid Waste Management					
	U19IT1001	**Open Elective** - Problem Solving Techniques using Java Programming					
	U19ME1004	**Open Elective** - Renewable Energy Sources					
	U19MC1003	**Open Elective** - Smart Automation					
		Practical					
7	U19EE604	Mini Project	0	0	6	3	90
8	U19ENG601	Communication Skills Laboratory	0	0	2	1	30
9	U19GE601	Soft Skills and Aptitude - IV	0	0	2	1	30
					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**
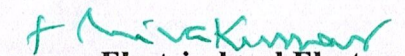
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HOD/Electrical and Electronics Engineering, Sixth Semester BE EEE Students and Staff, COE

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII Regulations 2019
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	U19GE701	Professional Ethics and Human Values	3	0	0	3	45
2	U19EE916	**Professional Elective** – Power System Operation and Control	3	0	0	3	45
3	U19EE919	**Professional Elective** – Power Quality Engineering	3	0	0	3	45
4	U19EE923	**Professional Elective** – Electrical Energy Conservation and Auditing	3	0	0	3	45
5	-	**Professional Elective ***	3	0	0	3	45
6	U19BM1001	**Open Elective** - Hospital Management	3	0	0	3	45
	U19BM1002	**Open Elective** - Basic Life Support					
	U19CE1004	**Open Elective** - Disaster Management					
	U19CS1002	**Open Elective** - Cloud Computing					
	U19EC1006	**Open Elective** - Mobile Technology and its Applications					
	U19EE1003	**Open Elective** - Innovation, IPR and Entrepreneurship Development					
	U19MC1004	**Open Elective** - Fundamentals of Robotics					
	U19ME1002	**Open Elective** - Industrial Safety					
	U19ME1004	**Open Elective** - Renewable Energy Sources					
		Practical					
7	U19EE701	Power Systems Laboratory	0	0	4	2	60
					Total Credits	20	

*All 127 Students have completed 3 one credit industry oriented courses during their summer vacation (dropped one professional elective course).

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

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HOD/Electrical and Electronics Engineering, Seventh Semester BE EEE Students and Staff, COE
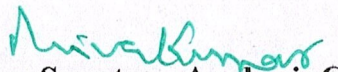
05.07.2023

Regulations-2019

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII Regulations 2019
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Practical					
1	U19EE801	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 28/12/23

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

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22.12.2023

Regulations-2019

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester I under Regulations 2019 (CBCS)
Branch: Electrical and Electronics Engineering

S. No.	Course Code	Course Title	L	T	P	C	Category
Theory							
1	U19ENG101B	English for Engineers - I	1	0	2	2	HS
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS
3	U19CHE104D	Chemistry for Electrical Engineers	3	0	0	3	BS
4	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES
5	U19EGR106	Engineering Graphics **	2	0	2	3	ES
Laboratory							
6	U19CHL109	Chemistry Laboratory	0	0	3	1.5	BS
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES
8	U19WPL112	Workshop Practice	0	0	2	1	ES
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC
					Total Credits	18.5	
Optional Language Elective*							
10	U19OLE1101	French					
11	U19OLE1102	German	0	0	2	1	HS
12	U19OLE1103	Japanese					

* Students may opt for foreign languages viz., German/French/Japanese with additional one credit

(Not accounted for CGPA calculation)

** The examination will be conducted for 3 hours through CAD software and manual drafting.

Approved By

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Dr.M.Renuga	**Dr.S.Padma**	**Dr.R.Shivakumar**	**Dr.S.R.R.Senthil Kumar**

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

U19ENG101B - ENGLISH FOR ENGINEERS – I
COMMON TO CSE, ECE, EEE, MCT, BME

L T P C
1 0 2 2

Course Outcomes: At the end of 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 email, formal letters and descriptions of graphics
5. Develop skills for writing reports and proposals, and for general purpose and technical writing.

UNIT I

- General Vocabulary, Parts of speech
- 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.
- Instructions, Email – fixing an appointment, cancelling appointments, conference details, hotel accommodation, order for equipment, training programme details, paper submission for seminars and conferences
- Paragraph writing – Describing – defining – providing examples or evidences

UNIT II

- Tenses, active and passive voice
- Welcome address, vote of thanks, special address on specific topic.
- Checklists, letter writing – business communication, quotations, placing orders, complaints, replies to queries from business customers, inviting dignitaries, accepting and declining invitations

UNIT III

- Prefixes and Suffixes
- Mini presentation in small groups of two or three on office arrangements, facilities, office functions, sales, purchases, training recruitment, advertising, applying for financial assistance, applying for a job, team work, discussion, presentation.
- Job application letter and resume, recommendations,

UNIT IV
- Modal verbs and probability, concord
- 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
- Note making, Proposal

UNIT V
- If conditionals
- Situational Role Play - 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.
- Memo, technical report writing, feasibility reports, accident report, survey report

TOTAL: 45 hours

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

Text Book
- Technical English I & II, Dr. M. Renuga et al. Sonaversity, 2016

Extensive Reading
- The Story of Amazon.com- Sara Gilbert, published by Jaico
- The Story of Google – Sara Gilbert, published by Jaico

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

U19MAT102A - LINEAR ALGEBRA AND CALCULUS
Common to CIVIL, MECH, EEE, CSE, IT and MCT

	L	T	P	C
	3	1	0	4

Course Outcomes: At the end of the course, the students will be able to
- find the rank of the matrix and solve linear system of equations by direct and indirect methods
- apply the concepts of vector spaces and linear transformations in real world applications
- apply the concepts of eigen values and eigen vectors of a real matrix and their properties in diagonalization and the reduction of a real symmetric matrix from quadratic form to canonical form
- find the Taylor's series expansion, Jacobians and the maxima and minima of functions of two variables
- apply appropriate techniques of multiple integrals to find the area and volume.

UNIT I - LINEAR SYSTEM OF EQUATIONS   12
Rank of a matrix – Solution of linear system of equations by matrix method, Gauss elimination, Gauss-Jordan, Gauss-Jacobi and Gauss-Seidel methods.

UNIT II - VECTOR SPACES   12
Vector Space – Linear independence and dependence of vectors – Basis – Dimension – Linear transformations (maps) – Matrix associated with a linear map – Range and kernel of a linear map – Rank-nullity theorem (without proof).

UNIT III - EIGEN VALUES AND EIGEN VECTORS   12
Eigen values and eigen vectors of real matrices – Properties of eigen values and eigen vectors – Cayley-Hamilton theorem – Diagonalization of real symmetric matrices – Reduction of quadratic form to canonical form.

UNIT IV - MULTIVARIABLE CALCULUS   12
Functions of several variables – Partial differentiation – Total derivative – Jacobians – Taylor's theorem for function of two variables – Maxima and minima of function of two variables without constraints – Constrained maxima and minima by Lagrange's method of undetermined multipliers.

UNIT V - MULTIPLE INTEGRALS   12

Double integrals – Change of order of integration – Change of variables from Cartesian to polar coordinates – Area as double integrals in Cartesian coordinates – Triple integrals – Volume as triple integrals in Cartesian coordinates.

Theory: 45 hours, Tutorial: 15 hours
TOTAL: 60 Hours

TEXT BOOKS

1. T. Veerarajan, "Linear Algebra and Partial Differential Equations", McGraw Hill Publishers, 1st Edition, 2018.
2. T. Veerarajan, "Engineering Mathematics for Semesters I & II", McGraw Hill Publishers, 1st Edition, 2019.

REFERENCE BOOKS

1. S. Lipschutz and M. L. Lipson, "Linear Algebra", McGraw Hill Publishers, 6th Edition, 2018.
2. E. Kreyszig, "Advanced Engineering Mathematics", Wiley Publishers, 10th Edition, Reprint, 2017.
3. C. Prasad and R. Garg, "Advanced Engineering Mathematics", Khanna Publishers, 1st Edition, 2018.
4. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Publishers, 29th Reprint, 2017.
5. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018.

U19CHE104D - CHEMISTRY FOR ELECTRICAL ENGINEERS

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

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

1. Analyze the types of polymers, polymerization reactions, polymerization techniques and fabrication methods of polymers for engineering applications.
2. Describe the construction, working principle and applications of energy storage devices for electronic appliances.
3. Discuss the principles, advantages and applications of organic electronic materials in electronic devices.
4. Explain the electrochemical processes carried out in electronic industries.
5. Outline the principle and process of fabrication of Integrated Circuits.

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 - Tacticity in polymers – Methods of Polymerization-bulk-solution-emulsion and suspension – Plastics – Moulding constituents of plastic – Moulding of plastics into articles-Intrution, Compression and Blow moulding – Thermoplastic and Thermosetting Resins – Engineering Plastics-Nylon 6,6-Polycarbonate and Polyurethane-preparation-properties and applications – Composites-Constituents of composites – Types of composites – Rubbers-types-applications-vulcanization of rubber.

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 cell – Nano Batteries- Construction-Working-Advantages and Applications.

UNIT III - CHEMISTRY OF ORGANIC ELECTRONIC MATERIALS   9

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 – Conducting polymers, types and applications – 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 working methodology of aluminium anodizing process - Chemical sensors - optical and heat sensors – definitions and applications.

UNIT V - FABRICATION OF INTEGRATED CIRCUITS   9

Introduction – Classification – IC chip size and circuit complexity – Fundamentals of monolithic IC technology – Basic planar process – Silicon wafer preparation, Epitaxial growth, X-ray and electron beam lithography, Diffusion, Isolation techniques, Metallization, Assembly processing and packaging – Fabrication of a typical circuit – Active and passive components of ICs – Transistors only.

TOTAL: 45 Hours

TEXT BOOKS

- P.C.Jain and Monica Jain, "Engineering Chemistry" DhanpatRai Pub, Co., New Delhi , 2010.
- M.Raja *et al.,* "Chemistry For Electrical and Electronics Engineering" Sonaversity, Sona College of Technology, Salem, New Edition, 2019.

REFERENCE BOOKS

- Gowariker V.R. , Viswanathan N.V. and Jayadev Sreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai, 2006
- Electroplating, Anodizing and Metal treatment", Hand book, NIIR board, 2004.
- Hagen Klauk, "Organic Electronics: Materials, Manufacturing and Applications", Wiley-VCH, 2006.
- D. Roy Choudhuryshail Jain, "Linear Integrated Circuits", New age international publishers, 2000.

U19PPR105 - PROBLEM SOLVING USING PYTHON PROGRAMMING

	L	T	P	C
	3	0	0	3

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

1. Develop algorithmic solutions to simple computational problems
2. Write simple Python programs
3. Write programs with the various control statements and handling strings in Python
4. Develop Python programs using functions and files
5. Analyze a problem and use appropriate data structures to solve it.

UNIT I - ALGORITHMIC PROBLEM SOLVING   9

Need for computer languages, Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion).

UNIT II - BASICS OF PYTHON PROGRAMMING   9

Introduction-Python Interpreter-Interactive and script mode -Values and types, variables, operators, expressions, statements, precedence of operators, Multiple assignments, comments, input function, print function, Formatting numbers and strings, implicit/explicit type conversion.

UNIT III - CONTROL STATEMENTS AND STRINGS   9

Conditional (if), alternative (if-else), chained conditional (if-elif-else). Iteration-while, for, infinite loop, break, continue, pass, else. Strings-String slices, immutability, string methods and operations.

UNIT IV - FUNCTIONS AND FILES   9

Functions - Introduction, inbuilt functions, user defined functions, passing parameters - positional arguments, default arguments, keyword arguments, return values, local scope, global scope and recursion. Files -Text files, reading and writing files.

UNIT V - DATA STRUCTURES: LISTS, SETS, TUPLES, DICTIONARIES   9

Lists-creating lists, list operations, list methods, mutability list functions, searching and sorting, Sets-creating sets, set operations. Tuples-Tuple assignment, Operations on Tuples, lists and tuples, Tuple as return value- Dictionaries-operations and methods, Nested Dictionaries.

TOTAL: 45 Hours

TEXT BOOKS
- Reema Thareja, "Problem Solving and Programming with Python", Oxford University Press, 2018.
- Allen B. Downey, "Think Python: How to Think Like a Computer Scientist'', 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think- python/)

REFERENCES
- Ashok Namdev Kamthane, Amit Ashok Kamthane, "Programming and Problem Solving with Python" , Mc-Graw Hill Education, 2018.
- Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach", Pearson India Education Services Pvt. Ltd., 2016.
- Timothy A. Budd," Exploring Python", Mc-Graw Hill Education (India) Private Ltd., 2015.
- Kenneth A. Lambert, "Fundamentals of Python: First Programs", CENGAGE Learning, 2012.
- Charles Dierbach, "Introduction to Computer Science using Python: A Computational Problem Solving Focus", Wiley India Edition, 2013.

U19EGR106 - ENGINEERING GRAPHICS

	L	T	P	C
	2	0	2	3

Course Outcomes: Upon completion of this course the students will be able to

CO1   Predict the construction of various curves in civil elevation, plan and machine components.

CO2   Analyze the principles of projection of various planes by different angle to project points, lines and planes.

CO3   Draw the principles of projection of simple solid by the axis is inclined to one reference plane by change of position method.

CO4   Understand the interior details of complex components, machineries by sectioning the solid body. Study the development of surfaces for prisms and pyramids.

CO5   Draw the projection of three dimensional objects representation of machine structure and explain standards of orthographic views by different methods.

CONCEPTS AND CONVENTIONS (Not for Examination)   **L 3**

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)   **L 3**

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

UNIT I - PLANE CURVES (Manual drafting)   **L 6**

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 - PROJECTION OF POINTS, LINES AND PLANE SURFACES   **L 12**
(CAD Software)

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 III - PROJECTION OF SOLIDS   L 12
(CAD Software)

Creation of 3D CAD models of pyramids, prisms and solids of revolutions - Sectional views - **(Not for Examination)**

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

UNIT IV - SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES L 12
(CAD Software)

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.

UNIT V - CONVERSION OF ISOMETRIC VIEWS TO ORTHOGRAPHIC VIEWS   L 12
(Manual drafting)

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.

TOTAL: 60 Hours

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

REFERENCE BOOKS
- Dhananjay A. JoIhe, Engineering Drawing with an introduction to AutoCAD, Tata McGraw Hill Publishing Company Limited, 2008.
- Basant Agarwal and Agarwal C.M., Engineering Drawing, Tata McGraw Hill Publishing Company Limited, New Delhi, 2008.
- K. R. Gopalakrishnana, Engineering Drawing (Vol. I & II), Subhas Publications, 1998.
- Bertoline & Wiebe fundamentals of graphics communication III edition McGrawhill 2002.

U19CHL109 - CHEMISTRY LABORATORY

L   T   P   C
0   0   3 1.5

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

- Estimate the amount of total, temporary and permanent hardness in the given water sample.
- Analyse the different types of alkalinity and determine their amount in the given water sample.
- Analyse the two given water samples and find which one possesses more chloride content in the given water samples by argentometric method.
- Analyse the two given brass samples and find which one possesses more copper content in the brass samples.
- Estimate the amount of hydrochloric acid present in the given solution using pH metry.
- Evaluate the iron content of the water by spectrophotometry.
- Estimate the amount of hydrochloric acid present in the given solution using conductivity meter.
- Estimate the amount of hydrochloric acid and acetic acid present in the given solution using conductivity meter.
- Describe the estimation of ferrous iron present in the given solution using potentiometer.
- Describe the method of determining the molecular weight of a given polymer.
- Analyse the two given water samples and find which one possesses more dissolved oxygen in the given water samples by Winkler's method.
- Analyse the two given waste waters and find which one possesses more chromium content.

List of Experiments

1. Estimation of hardness of water sample by EDTA method.
2. Estimation of alkalinity of water sample by indicator method.
3. Estimation of chloride ion present in the sample water by argentometric method.
4. Estimation of copper in brass by EDTA method.
5. Estimation of HCl by pH metry.
6. Determination of iron content in water by spectrophotometric method.
7. Estimation of HCl by conductometry. (HCl vs NaOH)
8. Estimation of mixture of acids by conductometry. (HCl + CH_3COOH vs NaOH)

9. Estimation of ferrous ion by potentiometric titration.
10. Determination of Molecular weight of a polymer by viscosity measurements.
11. Determination of Dissolved Oxygen of water by Winkler's method.
12. Estimation of chromium in waste water.

Total: 45 Hours

U19PPL111 - PYTHON PROGRAMMING LABORATORY

	L	T	P	C
	0	0	2	1

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

1. Implement the algorithms using basic control structures in Python
2. Develop Python programs to use functions, strings and data structures to solve different types of problems
3. Implement persistent storing information through file operations

LIST OF EXPERIMENTS

1. Draw flowchart using any open source software.
2. Implement programs with simple language features.
3. Implement various branching statements in python.
4. Implement various looping statements in python.
5. Develop python programs to perform various string operations like concatenation, slicing, indexing.
6. Implement user defined functions using python.
7. Implement recursion using python.
8. Develop python programs to perform operations on list and tuples
9. Implement dictionary and set in python
10. Implement python program to perform file operations.

TOTAL: 30 Hours

U19WPL112 - WORKSHOP PRACTICE

L	T	P	C
0	0	2	1

Course Outcomes: Upon completion of this course the students will be able to

CO1 Familiarize with the basic of tools and equipment's used in fitting, carpentry, welding and sheet metal.

CO2 Fabricate the different simple products in above trades.

CO3 Produce different joining of metals.

LIST OF EXPERIMENTS

SECTION 1: FITTING

Tools and Equipment's- Practice in filling.

Making of Vee joint and square (T-fitting) joint.

SECTION 2: SHEET METAL

Tools and Equipment's- Practice

Making of Dust Pan and Funnel.

SECTION 3: WELDING

Tools and Equipment's – Practice

Arc welding of Butt joint and Lap Joint.

SECTION 4: CARPENTRY

Tools and Equipment's- Planning Practice

Making of Half Lap joint and Dovetail Joint.

TOTAL: 30 Hours

U19GE101 - BASIC APTITUDE – I
(Common to All Departments)

	L	T	P	C
	0	0	2	0

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

1. Solve fundamental problems in specific areas of quantitative aptitude
2. Solve basic problems in stated areas of logical reasoning
3. Demonstrate rudimentary verbal aptitude skills in English with regard to specific topics

1. Quantitative Aptitude and Logical Reasoning
Solving simple problems with reference to the following topics:

a. Numbers – HCF & LCM
b. Decimal fractions
c. Square roots & cube roots
d. Surds & Indices
e. Logarithms
f. Percentage
g. Averages
h. Coding and Decoding & Visual language

2. Verbal Aptitude
Demonstrating plain English language skills with reference to the following topics:

a. Synonyms
b. Antonyms
c. Verbal analogy
d. Editing passages
e. Sentence filler words
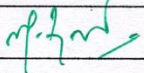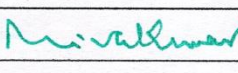
TOTAL: 30 hours

Sona College of Technology, Salem – 636 005
(An Autonomous Institution)
Courses of Study for BE / B Tech Semester II under Regulations 2019 (CBCS)
Branch: Electrical and Electronics Engineering

S.N	Course Code	Course Title	L	T	P	C	Category	Total Contact Hours
		Theory						
1	U19ENG201B	English for Engineers -II	1	0	2	2	HSMC	45 (15L+30P)
2	U19MAT202C	Transforms and Differential Equations	3	1	0	4	BSC	60
3	U19PHY203C	Physics for Electrical Engineers	3	1	0	4	BSC	60
4	U19EE201	Electric Circuits and Electron Devices	3	1	0	4	PCC	60
5	U19EE202	Measurements and Instrumentation	3	0	0	3	PCC	45
		Practical						
7	U19PHL210	Physics Laboratory	0	0	3	1.5	BSC	45
8	U19EE203	Electric Circuits and Electron Devices Laboratory	0	0	3	1.5	PCC	45
9	U19GE201	Basic Aptitude - II	0	0	2	0	EEC	30
		Total Credits				20		
		Optional Language Elective*						
10	U19OLE1201	French						
11	U19OLE1202	German	0	0	2	1	HSMC	30
12	U19OLE1203	Japanese						

*Students may opt for foreign languages viz., German/French/Japanese with additional one credit (Not accounted for CGPA calculation)

Approved by

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

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

U19ENG201B- English for Engineers – II

First year II semester

EEE

Course Outcome: At the end of 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.

	COURSE OUTCOMES	PROGRAMME OUTCOMES												Pso 1	Pso 2
		1	2	3	4	5	6	7	8	9	10	11	12		
1	Frame sentences correctly, both in written and spoken forms of language with accuracy and fluency	2	1	2	3	2	3	3	3	3	3	3	3	3	3
2	Develop and demonstrate listening skills for academic and professional purposes	2	2	2	3	2	3	3	3	3	3	3	3	3	3
3	Draw conclusions on explicit and implicit oral information	3	2	2	3	2	3	3	3	3	3	3	3	3	3
4	Develop effective reading skills and reinforce language skills required for using grammar and building vocabulary	3	3	2	3	2	3	3	3	3	3	3	3	3	3
5	Read for gathering and understanding information, following directions and giving responses.	3	3	2	3	2	3	3	3	3	3	3	3	3	3

UNIT –I
- Cause and effect expressions, adjectives, comparative adjectives
- 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 notices, messages, timetables, advertisements, graphs, etc.
- Reading passages for specific information transfer

UNIT – II
- Prepositions and dependent prepositions
- Understanding short conversations or monologues
- Taking down phone messages, orders, notes etc
- Listening for gist, identifying topic, context or function
- Reading documents for business and general contexts and interpreting graphical representations

UNIT – III
- Collocations
- Listening comprehension, entering information in tabular form
- Error correction, editing mistakes in grammar, vocabulary, spelling, etc.
- Reading passage with multiple choice questions, reading for gist   and reading for specific information, skimming for comprehending the general idea and meaning and contents of the whole text

UNIT – IV
- Articles, adverbs
- Intensive listening exercises and completing the steps of a process.
- Listening exercises to categorise data in tables.
- 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.

UNIT – V
- Pronouns
- Listening to extended speech for detail and inference
- Listening and developing hints
- 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

The listening test will be conducted for 20 marks and reading for 20 marks internally and evaluated along with English for Engineers – II in the End Semester Valuation.

Textbook:
Technical English I & II, Dr. M. Renuga et al. Sonaversity, 2016

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

Reference
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.

B. E. / ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – II	TRANSFORMS AND DIFFERENTIAL EQUATIONS	L	T	P	C
U19MAT202C		3	1	0	4

COURSE OUTCOMES

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

1. apply the classical method to solve linear ordinary differential equations with constant coefficients.
2. apply the Laplace transforms technique and its properties to solve an ordinary differential equation.
3. express a periodic signal as an infinite sum of sine and cosine wave components using Fourier series.
4. apply the Fourier transform techniques to convert the signal in terms of the frequencies of the waves.
5. find the general and singular solutions of linear and nonlinear partial differential equations.

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	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2		3	2						2	2	3	3
CO2	3	2		3	2						2	2	3	3
CO3	3	2		3	2						2	2	3	3
CO4	3	2		3	2						2	2	3	3
CO5	3	2		3	2						2	2	3	3

UNIT – I   ORDINARY DIFFERENTIAL EQUATIONS   12

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   LAPLACE TRANSFORMS   12

Laplace transform: Conditions for existence – Transform of elementary functions – Basic properties – Transform of derivatives and integrals – Transform of unit step function and impulse function – Initial and final value theorems – Transform of periodic functions.

Inverse Laplace transform: Standard results – Statement of convolution theorem and its applications – Solution of linear second order ordinary differential equations with constant coefficients using Laplace transform.

UNIT – III   FOURIER SERIES   12

General Fourier series – Dirichlet's conditions – Change of intervals – Odd and even functions – Half range sine and cosine series – Root mean square – Parseval's identity – Harmonic analysis.

UNIT – IV   FOURIER TRANSFORMS   12

Fourier transform pair – Properties – Fourier sine and cosine transforms pair – Properties – Transforms of simple functions – Parseval's identity.

UNIT – IV   FOURIER TRANSFORMS   12

Fourier transform pair – Properties – Fourier sine and cosine transforms pair – Properties – Transforms of simple functions – Parseval's identity.

UNIT – V   PARTIAL DIFFERENTIAL EQUATIONS   12

Formation of partial differential equations – Lagrange's partial differential equation – Clairaut's form of partial differential equations – Higher order linear partial differential equation with constant coefficients.

Theory: **45 Hours**   Tutorial: **15 Hours**   Total: **60 Hours**
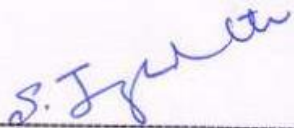
TEXT BOOKS:
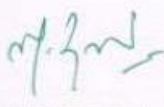
1. T. Veerarajan, "Transforms and Partial Differential Equations", McGraw Hill Publishers, 3rd Edition, 2016.
2. T. Veerarajan, "Engineering Mathematics for Semesters I & II", McGraw Hill Publishers, 1st Edition, 2019.

REFERENCE BOOKS:

1. E. Kreyszig, "Advanced Engineering Mathematics", Wiley Publishers, 10th Edition, Reprint, 2017.
2. C. Prasad and R. Garg, "Advanced Engineering Mathematics", Khanna Publishers, 1st Edition, 2018.
3. B. S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 44th Edition, 2018.
4. B. V. Ramana, "Higher Engineering Mathematics", McGraw Hill Publishers, 29th Reprint, 2017.

Prof. S. JAYABHARATHI
Head / Department of Mathematics
Sona College of Technology
Salem – 636 005

Dr. M. RENUGA
BoS - Chairperson
Science and Humanities
Sona College of Technology
Salem – 636 005

10. 05. 2019

B. E. / B. Tech. Regulations 2019

Course Code: U19PHY203C   **L T P C**
Course Name: **Physics for Electrical Engineers**   **3 1 0 4 100**

(for Electrical and Electronics Engineering)

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

CO1 Discuss the dual nature of matter and radiation and its applications.

CO2 Differentiate electrical and thermal conductivity of metals.

CO3 Elucidate the classification and theory of semiconducting materials.

CO4 Explain the basics of electron devices and their applications.

CO5 Elucidate the principle of optical fiber communication and their applications.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 2	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 3	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO – 4	3	2	-	-	-	-	-	-	-	-	2	2	-	3
CO - 5	3	2	-	-	-	-	-	-	-	-	2	2	-	3

Unit 1 Quantum Physics   **12**

Particle nature of radiation: Drawbacks of classical theory - Origin of quantum mechanics - Dual nature of matter and radiation - Particle nature of radiation - Black body radiation -Planck Hypothesis - Planck radiation formula (no derivation) – Compton effect –Explanation based on quantum theory-Expression for Compton shift (no derivation).

Wave nature of matter: de Broglie waves - Schrödinger's time independent and time dependent wave equations - Physical significance of wave function - Energy and wave function of an electron trapped in one dimensional box

Application of wave nature of particles: Electron microscope - Comparison of optical and electron microscope - Transmission electron microscope – Scanning electron microscope- Limitations of electron microscope

Unit 2 Conducting materials   12

Usage of conducting materials – basic definitions (electrical resistance-conductance-resistivity - conductivity)

Classical free electron theory of metals: Postulates of classical free electron theory – microscopic form of Ohm's law - Electrical conductivity - definition and expression for electrical conductivity - thermal conductivity – definition and expression for thermal conductivity - Wiedemann – Franz law and Lorentz number – Success and failure of classical free electron theory

Quantum free electron theory: Drawbacks of quantum free electron theory - origin of energy bands - band theory of solids (qualitative treatment only) – Fermi energy and Fermi distribution function – Effect of temperature on Fermi function – Density of energy states – carrier concentration in metals.

Unit 3 Semiconductor Physics   12

Fundamentals of semiconductors: Properties of semiconductors - Classification of semiconductors – Intrinsic and extrinsic semiconductors-Elemental and compound semiconductors

Intrinsic semiconductor: Two types of charge carriers - Energy band diagram of intrinsic semiconductors (at T= 0 K and T > 0 K) – Expression for number of electrons in conduction band-Expression for number of holes in valence band-Law of mass action and intrinsic carrier concentration - Fermi level – Variation of Fermi level with temperature – electrical conductivity – band gap determination– Draw backs of intrinsic semiconductors

Extrinsic semiconductors: Types of extrinsic semiconductors – 'n'-type and 'p'-type semiconductors – Energy band diagram of 'n' type and 'p' type semiconductors (at T= 0 K and T > 0 K) – carrier concentration of extrinsic semiconductors (Qualitative Treatment only) – variation of Fermi level with temperature and impurity concentration – Hall effect – Determination of Hall coefficient – Applications.

Unit 4 PN junction diode and optoelectronic devices   12

Theory of diode: Formation of p-n junction - p-n junction diode - p-n junction diode under forward bias - p-n junction diode under reverse bias - Half wave rectifier - full wave rectifier - bridge rectifier - Zener diode

Display devices: Photo diodes- types of photo diodes - Photo detector - PIN diode - Avalanche photo diode - Light emitting diode (LED) – Liquid Crystal Display (LCD) principle, construction

and working - Solar cell- principle – construction- working - Photo conductive cell – structure and operation, V I characteristics of photo transistor, Opto coupler, DIAC, TRIAC & CCD

Unit 5 Fiber optics   **12**

Fiber optics - Significance of optical fibers - Basic terms (reflection, refraction, refractive index, Snell's law, total internal reflection) – Derivation for acceptance angle, numerical aperture and fractional index change - Classification of fibers (based on materials, number of modes and refractive index profile)

Optical fiber communication: Block diagram of optical fiber communication - Advantages of optical fiber communication - Fiber optic sensors (Temperature and displacement sensors).

Lecture: 45, Tutorial: 15, Total: 60 Hours

Text Book:

1. M.N.Avadhanulu, 'Engineering Physics' S.Chand &Company Ltd, New Delhi (2015)
2. D. K. Bhattacharya, Poonam Tandon "Engineering Physics" Oxford University Press 2017.

References:

1. Engineering Physics, Sona College of Technology, Salem (Revised Edition 2016).
2. Physics for Electrical and Electronics Engineering, Sonaversity, Sona College of Technology, Salem (Revised Edition 2016).
3. Rajendran, V, and Marikani A, 'Materials science' TMH Publications, (2004) New Delhi.
4. Palanisamy P.K, 'Materials science', SciTech Publications (India) Pvt. Ltd., Chennai, Second Edition (2007)

U19EE201   **ELECTRIC CIRCUITS AND ELECTRON DEVICES**

L T P C
3 1 0 4

Course Outcomes: At the end of the course, the students will be able to
1. discuss the DC and AC fundamentals of electric circuits.
2. solve the complex circuits using mesh analysis, nodal analysis and network theorems.
3. analyse resonance circuits and solve problems on three phase balanced and unbalanced loads.
4. discuss the configurations and analyse the performance of BJT, UJT JFET, MOSFET and IGBT.
5. analyse the applications of electron devices.

<table>
<tr><td colspan="15">CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
<tr><td colspan="15"></td></tr>
<tr><td rowspan="2">COs</td><td colspan="14">Programme Outcomes (POs) and Programme Specific Outcome (PSOs)</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>P09</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td></tr>
<tr><td>CO1</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>1</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>1</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>1</td><td>2</td><td>1</td><td>2</td><td>1</td><td>1</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO4</td><td>3</td><td>1</td><td>2</td><td>1</td><td>3</td><td>2</td><td>2</td><td>1</td><td>2</td><td>1</td><td>2</td><td>3</td><td>3</td><td>2</td></tr>
<tr><td>CO5</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>1</td><td>2</td><td>2</td><td>2</td><td>1</td><td>1</td><td>3</td><td>3</td><td>2</td></tr>
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UNIT I - DC AND AC FUNDAMENTALS   **12**
DC fundamentals – resistance in series and parallel circuits - star – delta conversions – voltage and current divisions, source transformations - problems.
AC fundamentals – RMS and average values of sinusoidal waveform - RL, RC and RLC series circuits-problems.

UNIT II - NETWORK ANALYSIS AND THEOREMS   **12**
Mesh current and node voltage analysis - Superposition theorem -Thevenin's and Norton's theorems – Maximum power transfer theorem – Reciprocity theorem - problems (only DC networks).

UNIT III - RESONANCE AND THREE PHASE CIRCUITS   **12**
Series and parallel resonance – Frequency response – quality factor and bandwidth- three phase balanced and unbalanced systems – analysis of three phase 3-wire and 4- wire circuits with star and delta connected loads– power and power factor measurements in three phase circuits by two wattmeter method -problems.

UNIT IV - TRANSISTOR   **12**
Principle of operation of NPN and PNP transistors-transistor as an amplifier-study of CE,CB and CC configurations and characteristics - comparison - relationship between

amplification factors - operation and characteristics of UJT, JFET and MOSFET–working principle of IGBT - comparison of BJT with JFET and MOSFET.

UNIT V - ELECTRON DEVICES AND THEIR APPLICATIONS   12

Construction and characteristics of SCR and its two transistor analogy –SCR triggering methods-construction and operation of DIAC and TRIAC - comparison of SCR with DIAC and TRIAC -SCR as rectifier and inverter (single phase) - chopper – types of chopper- control strategies of chopper - cycloconverter.

TOTAL: 60 Hours

TEXT BOOKS

1. Sudhakar A and Shyam Mohan SP, "Circuits and Network Analysis and Synthesis", McGraw Hill Education (India) Private Limited, New Delhi (2015).
2. Padma S, Senthil Kumar M, Sabeenian R.S and Paramasivam M.E, "Electric Circuits and Electron Devices" Sonaversity (2008).

REFERENCES

1. Arumugam M and Premakumaran N, "Electric Circuit Theory", Khanna Publishers, 12th edition, (2017).
2. Chakrabarti A, "Circuit Theory Analysis and synthesis", Dhanpath Rai & Sons, 7th edition, New Delhi, (2018).
3. Salivahanan S, Suresh Kumar N and "Electronic Devices and Circuits", McGraw Hill Education (India) Private Limited, 4th edition, New Delhi (2016).
4. Bimbhra P.S, "Power Electronics", Khanna Publishers, 6th edition, New Delhi (2018).

U19EE202   **MEASUREMENTS AND INSTRUMENTATION**

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L T P C
3 0 0 3
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Course Outcomes: At the end of the course, the students will be able to

1. discuss the static and dynamic characteristics and define various errors.
2. derive torque equation for different types of meters.
3. calculate R, L, and C using bridges.
4. explain types of transducers storage and display devices.
5. explain data acquisition systems using transducers and sensors**.**

	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)
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	P0 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	1	3	3	3	2	2	2	1	2	3	3	2
CO 2	3	3	2	2	2	3	2	1	2	1	1	2	3	2
CO 3	3	3	2	2	2	3	2	1	2	1	1	2	3	2
CO 4	3	1	2	1	3	2	2	1	2	1	2	3	3	2
CO 5	3	1	2	1	3	2	2	1	2	1	2	3	3	2

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, and 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: torque 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 – AC bridges: Anderson, Schering, Wein - interference & screening – grounding techniques – Measurement of earth resistance.

UNIT IV - DIGITAL INSTRUMENTS AND DISPLAY DEVICES 9

Digital voltmeter: ramp, integrating and successive approximation – Digital multi- meter – 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 solar radiation and Wind velocity.

UNIT V - TRANSDUCERS AND SENSORS 9

Transducers – selection of transducers – resistive, capacitive and inductive transducers

– measurement of temperature – RTD, thermistors and thermocouples – piezoelectric transducers – digital transducers – optical encoders – Introduction to data acquisition – Sensors: Temperature, Infrared.

TOTAL: 45 Hours

TEXT BOOKS

1.   A.K.Sawhney, "A Course in Electrical & Electronic Measurements &Instrumentation", DhanpatRai and Co, 7th Edition, 2015.

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.   J. B. Gupta, "A Course in Electronic and Electrical Measurements", S. K. Kataria & Sons, Delhi, 2003.

U19PHL210	PHYSICS LABORATORY	L	T	P	C
		0	0	3	1.5

	Course Outcomes
	After successful completion of this course, the students should be able to
CO1:	Apply the principles of Optics, Thermal Physics and Elasticity to determine the Engineering properties of materials.
CO2:	Apply the principles of Optics and Electricity to determine the Engineering properties of PN junction devices.
CO3:	Determine the resistivity of the given copper turn used for house hold applications

Pre-requisite: Capable of using Screw gauge, Vernier calliper, Travelling microscope and Spectrometer

<table>
<tr><td colspan="15">CO/PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
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<tr><td>COs</td><td>PO 1</td><td>PO 2</td><td>PO 3</td><td>PO 4</td><td>PO 5</td><td>PO 6</td><td>PO 7</td><td>PO 8</td><td>PO 9</td><td>PO 10</td><td>PO 11</td><td>PO 12</td><td>PSO 1</td><td>PSO 2</td></tr>
<tr><td>CO1</td><td>3</td><td></td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td>2</td></tr>
<tr><td>CO2</td><td>3</td><td></td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td>2</td></tr>
<tr><td>CO3</td><td>3</td><td></td><td></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td><td></td><td>1</td><td></td><td></td><td>2</td></tr>
</table>

Course Assessment methods		
Direct		**Indirect**
Mean of 1st half of Experiment (10)	Quiz on 2nd half (5)	Course end survey
Quiz on 1st half (5)	Internal test II (10)	
Internal test I (10)	RTPS (10)	
Mean of 2nd half of Experiment (10)	End semester Examination (40)	

	List of Experiments
1	Determination of coefficient of viscosity of liquid by Poiseuille's method.
2	Determination of velocity of ultrasonic waves and compressibility of the given liquid using ultrasonic interferometer.
3	Determination of the thermal conductivity of a bad conductor using Lee's Disc apparatus.
4	Determination of dispersive power of the prism for various pairs of colors in the mercury spectrum using a spectrometer.
5	Determination of laser wavelength using diode laser.
6	Determination of particle size of lycopodium powder using diode laser.
7	Determination of acceptance angle and numerical aperture of an optical fibre using diode laser
8	Determination of the thickness of a thin wire by forming interference fringes using air wedge apparatus.
9	Determination of specific resistance of a given wire using Carey Foster's bridge.
10	Determination of band gap of the given semiconductor diode.
11	V-I Characteristics of PN junction diode
12	V-I Characteristics of Zener diode
13	Performance analysis of half wave rectifier.
14	Performance analysis of bridge rectifier.
	Total Hours: 45 Hrs

U19EE203   ELECTRIC CIRCUITS AND ELECTRON DEVICES LABORATORY

<div align="right">

L T P C
0 0 3 1.5

</div>

Course Outcomes: At the end of the course, the students will be able to
1. calculate electrical parameters of DC circuits using basic circuital laws and to determine the loop currents and nodal voltages of DC circuits.
2. apply various circuit theorems to solve complex DC networks.
3. analyze the performance characteristics of switching devices, converter circuits, relaxation oscillator and controlled rectifier.

<table>
<tr><td colspan="15">CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
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<tr><td>CO 1</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO 2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO 3</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
</table>

List of Experiments

1.   Verification of Ohm's Law and Kirchhoff's Laws

2.   Calculation of Mesh currents and Node voltages

3.   Verification of Superposition Theorem

4.   Verification of Thevenin's and Norton's Theorems

5.   Verification of Maximum Power Transfer Theorem

6.   Analysis of RLC series and parallel circuits

7.   Measurement of power and power factor by two wattmeter method

8.   Analysis of I/O characteristics of BJT with CE configuration

9.   Performance analysis of relaxation oscillator

10.   Performance analysis of JFET and MOSFET

11.   Performance analysis of DIAC and TRIAC

12.   Analysis of single phase controlled rectifier

<div align="right">

TOTAL : 45 Hours

</div>

U19GE201 - BASIC APTITUDE - II

L   T   P   C
0   0   2   0

Course Outcomes: At the end of the course, the students will be able to CO1
solve more elaborate problems than those in BA-I in specific areas of

quantitative aptitude.
CO2 solve problems of greater intricacy than those in BA-I in stated areas of logical reasoning.
CO3 demonstrate higher than BA-I level verbal aptitude skills in English with regard to specific topics.

List of Experiments

1. **QUANTITATIVE APTITUDE AND LOGICAL REASONING**
   Solving quantitative aptitude and logical reasoning problems with reference to the following topics:
   a. Ratio and proportion
   b. Partnership
   c. Chain rule
   d. Ages
   e. Profit, loss and discount
   f. Geometry
   g. Area and volume
   h. Data arrangement

2. **VERBAL APTITUDE**
   Demonstrating verbal aptitude skills in English with reference to the following topics:
   a. Jumbled sentences
   b. Reconstructions of sentences (PQRS)
   c. Sentence fillers two words
   d. Idioms and phrases
   e. Spotting errors
   f. Writing captions for given pictures

TOTAL : 24 Hours

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester III Regulations 2019
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
-theory		**Theory**					
1	U19EE301	Network Analysis and Synthesis	3	1	0	4	60
2	U19EE302	Analog Electronics	3	0	0	3	45
3	U19EE303	Electromagnetic Fields	3	1	0	4	60
4	U19EE304	Electrical Machines – I	3	0	0	3	45
5	U19EE305	Applied Thermodynamics	3	0	0	3	45
6	U19CS309	Object Oriented Programming in C++	3	0	0	3	45
7	U19GE302	**Mandatory Course:** Environment and Climate Science	2	0	0	0	30
-practical		**Practical**					
8	U19EE306	Analog Electronics Laboratory	0	0	2	1	30
9	U19EE307	Electrical Machines Laboratory – I	0	0	2	1	30
10	U19CS310	Object Oriented Programming in C++ Laboratory	0	0	2	1	30
11	U19GE301	Soft Skills and Aptitude-I	0	0	2	1	30
					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, Third Semester BE EEE Students and Staff, COE

U19EE301   **NETWORK ANALYSIS AND SYNTHESIS**   **3 1 0 4**

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.
- Analyse coupled circuits and design of filters.
- Synthesize RL, RC and LC networks

COs	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	1	3	1		2	2					3	2
CO2	3	2	2	3	1		1	2					3	2
CO3	3	2	2	2				1					3	2
CO4	3	3	3	3	1	2	1	1					3	3
CO5	3	3	3	3	1		1	1					3	3

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 – problems.

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

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

UNIT IV   COUPLED CIRCUITS AND FILTERS   12

Coupled circuits: Inductive coupling in series and parallel circuits – tuned circuits – single and double tuned coupled circuits – problems.

Filters: Types - Characteristics of ideal filters – low pass and high pass filters – attenuation and phase shift constants – design of constant-k and m-derived filters – problems.

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 – problems.

TEXT BOOKS:

1. Ravish R Singh, "Electrical Networks", McGraw Hill, 2011.

2. Shyam Mohan S.P., Sudhakar A, "Circuits and Network Analysis & Synthesis", Tata McGraw Hill, 5th edition, 2015.

REFERENCES BOOKS

1. Chakrabarti A, "Circuits Theory (Analysis and Synthesis)", Dhanpath Rai & Sons, 2013.

2. Arumugam M and Premkumar N, "Electric Circuit Theory", Khanna & Publishers, 2006.

3. Soni M.L and Gupta J.C, "Electrical circuit Analysis", Dhanpat Rai and Sons, Delhi, 1990.

4. Kuo F.F., "Network Analysis and Synthesis", Wiley International Edition, Second Edition, 1996.

U19EE302 **ANALOG ELECTRONICS** **3 0 0 3**

COURSE OUTCOMES
At the end of this course the student will be able to,
- Analyze the small signal model for the configurations of transistor and FET.
- Discuss and analyze the various types of large signal and feedback amplifiers.
- Design various types of multistage amplifiers and oscillators.
- Infer the DC and AC characteristics of op-amp and its effect on output and their compensation techniques.
- Elucidate and design circuits for various applications of op-amp.

	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	2		2	2			1		3	2
CO2	3	3	3	2	3		2	2			2		3	2
CO3	1	3	3	1	2		1	2			2		3	2
CO4	3	3	2	2	3		2	2			2		3	2
CO5	3	3	2	3	2		2	3			3		3	3

UNIT I   TRANSISTOR ANALYSIS   9

Transistor as an amplifier- h–parameters – forward A_i, Z_i, reverse A_v and Y_o – BJT h-model – Analysis of h-parameters for CE, CB, CC configurations – RF amplifier – Bias stability – dc load line, ac load line, operating point, stability factor, thermal runaway – Methods of transistor biasing – Bias compensation – Small signal analysis of CS amplifier.

UNIT II   LARGE SIGNAL AND FEEDBACK AMPIFIERS   9

Differential amplifier – 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 - Effect of feedback on I/O resistance- types of negative feedback amplifiers – stability of feedback amplifier.

UNIT III   MULTISTAGE AMPLIFIERS AND OSCILLATORS   9

Introduction – different coupling schemes in amplifiers – operation, advantages and disadvantages of RC coupled, transformer coupled, cascade, direct coupled and darlington amplifiers - Condition for Oscillations - RC phase shift Oscillators with transistor and FET- Hartley and Colpitts Oscillators - Wein-Bridge Oscillator - Crystal Oscillator- Frequency and Amplitude Stability Oscillators.

UNIT IV   CHARACTERISTICS OF OP-AMP   9

Block diagram of operational amplifier, packing characteristics, ideal op-amp – ideal operational 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 V   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), sample and hold circuit, differentiator, integrator, comparators & its characteristics, Schmitt trigger, peak detector, precision rectifiers.

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

TEXT BOOKS

1. S Salivahanan, N Sureshkumar and A Vallavaraj, "Electronic Devices and Circuits", Tata Mcgraw Hill, 6th reprint 2015.

2. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", New Age International Pvt. Ltd., 4th Edition ,2012.

REFERENCE BOOKS

1. David A Bell, "Electronic Devices and Circuits", Oxford University Press, Fifth edition, 2010.

2. Ramakant A.Gayakwad, "Op-amp and Linear ICs", Prentice Hall, 4th Edition, 2010.

3. J Millman, CC Halkias and SathyabrathaJit , "Electronic Devices and Circuits", Tata Mcgraw Hill, 2nd Ed, 2012.

4. Robert F. Coughlin, Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits", PHI, 2015.

U19EE303   **ELECTROMAGNETIC FIELDS**   **3 1 0 4**

COURSE OUTCOMES

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

- Describe the Electromagnetic quantities in spatial distribution of different coordinate systems.
- Describe the behavior of Electric field intensity and Electric flux density due to various charge distributions.
- Apply the principles of magnetostatics to magnetic field, boundary condition and inductance.
- Understand the concepts related to faraday's law, induced emf and Maxwell's equation.
- Illustrate the concepts of electromagnetic wave equation, wave propagation and Poynting theorem.

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)												
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CO3	3	3	3	1		1		2		1			2	1
CO4	3	3	3	2		1		3		1			2	1
CO5	3	3	3	1		1		2		1			2	1

UNIT I   **VECTOR CALCULAS**   **12**

Scalar and vector fields - Coordinate systems; cartesian, cylindrical and spherical coordinate systems - relationship between coordinate systems - types of integral related to EMF - Gradient - Curl - Divergence theorem – Stoke's theorem – simple problems.

UNIT II   **ELECTROSTATICS**   **12**

Coulombs' law - Electric field intensity, electric flux density and electric potential due to various charge distributions - Electric field intensity due to infinite line charge, charged circular ring, infinite sheet of charge - Gauss's law and applications - Electric dipole - Boundary conditions - Poisson's and Laplace's equations - Capacitance; capacitance of parallel conductors, capacitance of an isolated sphere, concentric spheres and coaxial cables – simple problems.

UNIT III   **MAGNETOSTATICS**   **12**

Lorentz law of force - Biot-savart law - Ampere's circuital law - Magnetic field intensity and 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; self and mutual inductance, inductance of solenoid and toroid, coaxial cable, two transmission lines – simple problems.

UNIT IV   ELECTRODYNAMIC FIELDS   12

Faraday's law of electromagnetic induction - Coefficient of coupling - Point form of Gauss's law - Maxwell's equation (differential and integral form) - Conduction current - Displacement current – Current densities - Equation of continuity - Energy stored in electric and magnetic fields; energy density - Relation between field theory and circuit theory – simple problems.

UNIT V   ELECTROMAGNETIC WAVES   12

Derivation of Electromagnetic wave equations - Wave equations for free space - Wave parameters; velocity, intrinsic impedance - Wave propagation in a lossless medium, wave propagation in a conducting medium, wave propagation in good dielectrics and good conductors - Skin effect - Poynting theorem – simple problems.

Lecture: 45, Tutorial: 15, Total: 60 Hrs.

TEXTBOOKS

1. Matthew N.O. Sadiku, "Principles of Electromagnetics", 5th Edition, International Version, Oxford University Press 2015.

2. W.H.HaytJ.A.Buck and M.Jallel Akhtar, "Engineering Electromagnetics", 8th Edition, McGraw Hill Education (India) Private Limited, Special Indian Edition 2014.

REFERENCEBOOKS

1. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Eighth Reprint :2015.

2. Kraus/Fleisch, "Electromagnetics with Applications", 5th Edition, McGraw Hill Education (India) Edition 2010.

3. S C Mahapatra, Sudipta Mahapatra, "Principles of Electromagnetics", Mc Graw Hill Education (India) Private Limited, New Delhi,2nd Edition 2015.

4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education (India) Private Limited, second reprint 2015.

U19EE304   **ELECTRICAL MACHINES – I**   **3 0 0 3**

COURSE OUTCOMES:

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

- Explain the fundamentals of energy conversion and single-phase transformer.
- Classify different types of polyphase connections of transformer and find the efficiency of transformer.
- Explain the constructional details and principle of operation of DC generator and analyse its performance.
- Explain the constructional details and principle of operation of DC motor and analyse its performance.
- Calculate the efficiency of DC machines using direct and indirect testing.

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<tr><td>CO2</td><td>3</td><td>3</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td></td><td>1</td><td></td><td></td><td>1</td><td>3</td><td>1</td></tr>
<tr><td>CO3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>1</td><td>2</td><td>2</td><td></td><td>1</td><td></td><td></td><td>1</td><td>3</td><td>1</td></tr>
<tr><td>CO4</td><td>3</td><td>3</td><td>3</td><td>3</td><td>1</td><td>2</td><td>2</td><td></td><td>1</td><td></td><td></td><td>1</td><td>3</td><td>2</td></tr>
<tr><td>CO5</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td></td><td>1</td><td></td><td></td><td>1</td><td>3</td><td>1</td></tr>
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UNIT I   MAGNETIC CIRCUITS AND SINGLE PHASE TRANSFORMER   9

Principles of Electromechanical energy conversion –. Single Phase Transformer – principle of operation – construction – classification of transformers –EMF equation – transformation ratio – transformer on no-load and load – phasor diagrams – equivalent circuit – voltage regulation – auto transformer – applications – simple problems.

UNIT II   THREE PHASE TRANSFORMER AND TESTING   9

Three-phase transformers – principle – construction – three phase transformer connections – star, zig-zag, open-delta, Scott connection– three-phase to single-phase conversion – parallel operation – testing of transformers – polarity test, load test – phasing out test – Sumpner's test – condition for maximum efficiency, all day efficiency - applications – simple problems.

UNIT III   DC GENERATORS   9

Principle of operation, constructional details, armature windings, EMF equation- voltage build up process-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 –types of motors - torque equation – electrical and mechanical characteristics of DC shunt, series and compound motors – power flow – starting and braking of DC Shunt motors – starting and braking of DC Series motors - introduction to soft starter - speed control – applications – simple problems.

UNIT V   TESTING OF DC MACHINES   9

Losses and efficiency in DC machines – condition for maximum efficiency – testing of DC machines – brake test, Swinburne's test and Hopkinson's test – Field's test - separation of losses – simple problems.

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

TEXT BOOKS

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

REFERENCE BOOKS

1. Samarajit Ghosh, "Electrical Machines", Pearson Education, second edition, 2012.
2. Stephen J Chapman, "Electric Machinery Fundamentals", Tata McGraw-Hill Education Private Ltd, Fifth Edition, 2012.
3. M.Ramamoorthy, O. Chandra Sekhar, "Electrical Machines", PHI Learning Pvt.Ltd., 2018.
4. S.K.Sahdev, " Electrical Machines", Cambridge University Press,2018.

U19EE305　　　　　　**APPLIED THERMODYNAMICS**　　　**3 0 0 3**

COURSE OUTCOMES

At the end of each unit, the students will be able to -

- Discuss the thermodynamic properties of system and apply zeroth and First Law of Thermodynamics to solve engineering problems.
- Determine the thermal efficiency of steam power plant and discuss the various components of thermal power plant
- Explain the types of Refrigeration system and calculate the cooling, heating and humidifier capacities for various air-conditioning components by using psychrometric charts.
- Analyze the performances of hydraulic turbines.
- Evaluate the performance of centrifugal pumps and identify the various types of pumps and compressor for specific application.

<table>
<tr><td colspan="14">CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
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<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>P09</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td></tr>
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<tr><td>CO2</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>2</td><td>3</td><td>1</td><td>3</td><td>2</td><td>3</td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>CO3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>1</td><td>3</td><td>1</td><td>2</td><td>2</td><td>2</td><td>2</td></tr>
<tr><td>CO4</td><td>3</td><td>3</td><td>2</td><td>3</td><td>2</td><td>2</td><td>3</td><td>1</td><td>3</td><td>2</td><td>3</td><td>1</td><td>3</td><td>2</td></tr>
<tr><td>CO5</td><td>3</td><td>2</td><td>3</td><td>3</td><td>2</td><td>2</td><td>2</td><td>1</td><td>3</td><td>1</td><td>3</td><td>2</td><td>2</td><td>2</td></tr>
</table>

UNIT I　　　**FUNDAMENTALS OF THERMODYNAMICS**　　　　　　**9**

Introduction to Thermodynamics – Concept of a System – Types of Systems – Thermodynamic Equilibrium – Properties - State - Process and Cycle – Zeroth Law – Energy Interactions – Heat and Work – Types of Work – First Law: Cycle and Process – Heat and work Interactions in a Closed System for Various Processes – Limitations of First Law - Non-flow and flow processes.

UNIT II　　　**STEAM POWER PLANT AND ITS COMPONENTS**　　　9

Thermal Power Plant Layout – Four Circuits – Rankine Cycle – Steam properties- quality of steam - simple problems. Boilers: -Classification- Fire Tube vs Water Tube boilers-Babcock & Wilcox – Cochran Boilers. Steam Turbines: Impulse and. Reaction Turbines –Condensers: Types – Jet & Surface Condensers. Cooling Towers - Dust collector – Draught system.

UNIT III　　　**REFRIGERATION SYSTEM AND AIR CONDITIONING**　　　**9**

Refrigeration – ton of refrigeration - Vapour compression refrigeration system - cycle, p-h chart, Vapour absorption system- comparison- properties of refrigerants.

Air conditioning - types of Air conditioning system and working principles- - Study on psychrometric charts, psychrometric processes - Properties of Air (DBT, %RH, WB, DPT, and enthalpy) - simple Problems.

UNIT IV   HYDRAULIC TURBINES   9

Hydraulic turbines - classification and working principle.Pelton wheel turbine - Francis turbine -Kaplan turbine - Velocity triangle - work done – Efficiencies - Performance calculations.

UNIT V   PUMPS & COMPRESSOR   9

Centrifugal pumps– working principle - Velocity triangle - work done- Efficiencies- Performance calculations. Reciprocating pump- working principle – Comparison

Compressor - Classification- Applications - Reciprocating compressor and Rotary Compressor– working principle – Comparison.

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

TEXT BOOKS

1. R.K.Rajput, "Thermal Engineering" ,Laxmi Publications, New Delhi, Sixth edition, 2005.
2. Bansal, R.K., Fluid Mechanics and Hydraulics Machines, (9th edition), Laxmi publications (P) Ltd,New Delhi, 2017.
3.

REFERENCE BOOKS

1. Sarkar B.K., "Thermal Engineering", Tata McGraw-Hill, New Delhi New Delhi, 2001
2. Arora C.P., "Refrigeration and Air conditioning", Tata McGraw-Hill, New Delhi, 2000.
3. Rudramoorthy R, "Thermal Engineering", Tata McGraw Hill Book Company, New Delhi, 2003
4. P. L. Ballaney, "Thermal Engineering: Engineering Thermodynamics and Energy Conversion Techniques", Khanna Publishers, 5th Edition, 2010.

U19CS309   **OBJECT ORIENTED PROGRAMMING IN C++**   **3 0 0 3**

COURSE OUTCOMES

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

- Explain fundamental programming concepts such as variables, conditional statements, looping constructs.
- Apply derived data types and methods (procedures), inline function, friend function in applications.
- Describe how the class mechanism supports encapsulation and information hiding.
- Apply operator overloading and inheritance in solving real time problems.
- Write C++ programs for applications using files and exceptions.

<table>
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</table>

UNIT I   INTRODUCTION TO OOPS AND C++   9

Introduction to Object Oriented Programming and C++: Object oriented concepts and its characteristics - History of C++ - Applications of C++ - Structure of C++ - Tokens – Keywords – Identifiers - Basic data types - Input and output statements - C++ Operators and control statements.

UNIT II   DERIVED DATA TYPES AND FUNCTIONS   9

Derived data types: Arrays – Structures - Unions - Type casting - Symbolic constants - Scope resolution operator -Functions: Function Prototyping - Function components - Passing parameters – Call by value - Call by reference - Inline function - Default arguments - Overloaded function- Introduction to friend function.

UNIT III   CLASSES AND OBJECTS   9

Classes and Objects: Class specification - Member function definition - Access qualifiers - Instance creation - Static data members and member functions - Array of objects - Objects as arguments - Returning objects – Constructors - Parameterized Constructors - Overloaded Constructors - Constructors with default arguments - Copy constructors – Destructors.

UNIT IV   OPERATOR OVERLOADING AND INHERITANCE   9

Operator Overloading - Operator function – Overloading unary and binary operator – Inheritance Introduction – Types of Inheritance - Constructors in derived class - Abstract classes - Runtime Polymorphism– Array of pointers to base class – Virtual functions - Pure virtual functions – Virtual Destructors.

Streams: Streams in C++ - Stream classes - Formatted and unformatted data – Manipulators - File streams - File pointer and manipulation - File open and close - Sequential and random access - Name Space.

Exception Handling: Principle of exception handling - Exception handling mechanism - Multiple catch statements - Nested try statements.

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

TEXT BOOK

1. Robert Lafore, "Object-Oriented Programming in C++" Pearson Education, 4 Edition, 2008.
2. K R Venugopal, RajkumarBuyya "Mastering C++" Tata McGraw Hill, New Delhi, Second edition 2015.

REFERENCES

1. H. M. Deitel, P. J. Deitel, " C++ How to Program", Fifth Edition, Deitel& Associates, Inc.
2. Nicholas A. Solter, Scott J. Kleper, "Professional C++", 3rd Edition, Wiley Publishing,
3. Ira Pohl, "Object Oriented Programming using C++", Pearson Education, Second Edition Reprint 2004.
4. S. B. Lippman, Josee Lajoie, Barbara E. Moo, "C++ Primer", Fourth Edition, Pearson Education, 2005.
5. B. Stroustrup, "The C++ Programming language", 3rd edition, Pearson Education, 2004.
6. E. Balaguruswamy, "Object-Oriented Programming with C++" Tata McGraw Hill, New Delhi, Sixth edition 2015.
7. B. Stroustrup, "The C++ Programming language", 3rd edition, Pearson Education, 2004.
8. E. Balaguruswamy, "Object-Oriented Programming with C++" Tata McGraw Hill, New Delhi, Sixth edition 2015.

COURSE OUTCOMES:

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

- Design different amplifier circuits and verify their output waveforms.

- Verify the output waveforms of various types of oscillators.

- Construct circuits for various applications using op-amp and verify their output waveforms.

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	2	1	1				2		3	3
CO2	3	3	3	3	3	1	1				2		3	3
CO3	3	3	3	3	3	1	1				2		3	3

LIST OF EXPERIMENTS

1. Design the differential Amplifier

2. Verify the output of feedback Amplifier

3. Verify the output waveforms of Hartley and Colpitts Oscillator

4. Verify the output waveforms of Phase shift and Wein-bridge Oscillator.

5. Design of inverting and non-inverting amplifiers.

6. Design of instrumentation amplifier using op-amp.

7. Design of integrator and differentiator (IC741).

8. Designs of Schmitt trigger using op-amp.

9. Design of precision rectifiers using op-amp.

10. Design of adder and subtractor.

11. Design of clipper and clamper circuits using op-amp.

Total: 30 Hours

COURSE OUTCOMES:

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

- Analyse the characteristics and determine the efficiency of DC machines.
- Pre-determine the losses on no-load and determine the efficiency and regulation of transformer.
- Control the speed of shunt motor to above and below rated speed using rheostat.

	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	1		1		1			1	3	1
CO2	3	3	2	2	1		1		1			1	3	1
CO3	3	3	2	2	1		1		1			1	3	1

List of Experiments

1. Analyse the open circuit and load characteristics of separately excited DC shunt generator.

2. Analyse the load characteristics of 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. Speed control on a DC shunt motor by field and armature control method.

7. Analyse the characteristics of DC motor by Swinburne's test and Hopkinson's test on DC motor-generator set.

8. Analyse the load characteristic of single-phase transformer.

9. Predetermine the efficiency of transformer by Sumpner's test and open circuit and short circuit tests.

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: 30 Hours

U19CS310   OBJECT ORIENTED PROGRAMMING IN C++ LAB   0 0 2 1

COURSE OUTCOMES

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

- Apply the control structures and functions in C++ to solve problems.
- Develop applications using object oriented concepts.
- Demonstrate the concept of file and exception handling mechanism.

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	3	3	1	1		2	3	3			3	2	3
CO2	3	2	3	2	2		3	3	3			3	2	3
CO3	3	3	3	3	3		3	3	3			3	2	3

LIST OF EXPERIMENTS

1. Simple C++ programs to implement various control structures
   a. if statement
   b. switch case statement and do while loop
   c. for loop
   d. while loop
2. Programs to implement single and multi-dimensional arrays.
3. Programs to implement Structures.
4. Programs to understand Functions
   a. Built-in and user defined functions
   b. Functions with default arguments
   c. Inline functions
   d. Overloaded Functions
5. Programs to understand different function call mechanism.
   a. call by reference
   b. call by value
6. Programs to understand friend function & friend class.
   a. friend function
   b. friend class
7. Programs to understand constructors, destructors and this pointer.
8. Programs to overload unary & binary operators as member function & non-member function.
   a. unary operator as member function
   b. binary operator as non-member function
9. Programs to implement inheritance and it types.
10. Programs to implement run-time polymorphism.
11. Programs to demonstrate file manipulation.
12. Programs to apply exception handling.

Semester-III	U19 GE301- 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 in stated areas of quantitative aptitude and logical reasoning
3. Demonstrate higher 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. **Vedic Maths:** Fast arithmetic, multiplications technique, Criss cross, Base technique, Square root, Cube root, Surds, Indices, Simplification. b. **Numbers:** Types, Power cycle, Divisibility, Prime factors & multiples, HCF & LCM, Remainder theorem, Unit digit, highest power. c. **Averages:** Basics of averages and weighted average. d. **Percentages:** Basics of percentage and Successive percentages. e. **Ratio and proportion:** Basics of R &P, Alligations, Mixture and Partnership. f. **Profit ,Loss and Discount:** Basic & Advanced PLD g. **Data Interpretation:** Tables, Bar diagram, Venn diagram, Line graphs, Pie charts, Caselets, Mixed varieties, Network diagram and other forms of data interpretation. h. **Syllogism:** Six set syllogism using Venn diagram and tick and cross method
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 g. Error spotting

S-Amt

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

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Sona College of Technology, Salem   **Department of Sciences (Chemistry)**

SEMESTER – III

MANDATORY COURSE

U19GE302 - ENVIRONMENT AND CLIMATE SCIENCE

(Common for CSE, CIVIL, EEE, MECH)

Course Outcomes:

L	T	P	C
2	0	0	0

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

1. state the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water and food resources.
2. explain the concepts of an ecosystem and provide an overview of biodiversity and its conservation.
3. explain environmental based pollution their causes, effects and their remedial measures
4. discuss their causes, effects and the control measures of Global Warming, Acid Rain, Ozone Layer Depletion
5. describe the effect of climate change due to pollution

UNIT I   INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES   6

Definition, Scope and Importance Forest Resources:- Use and over - exploitation, deforestation, Case Studies, Water Resources:- Use and Over-Utilization of Surface and ground water , Floods, Drought, Food Resources- Effects of Modern Agriculture, Fertilizer- Pesticide Problems–Role of an Individual in Conservation of Natural Resources.

UNIT II   ECOSYSTEMS AND BIODIVERSITY   6

Structure and Function of an Ecosystem– Energy Flow in the Ecosystem -Food Chains, Food Webs and Ecological Pyramids.

Introduction to Biodiversity –Value of Biodiversity: Consumptive Use, Productive Use, Social, Ethical, Aesthetic and Option Values –India as a Mega-Diversity Nation — 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   6

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, Solid Waste Management- Effects and Control Measures of Acid Rain,– Role of an Individual in Prevention of Pollution..

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30.07.2021   Regulations-2019

UNIT IV   CLIMATE CHANGE ON THE ENVIRONMENT   6

Sustainable Development- - Climate Change- Causes and effects of Global Warming - Effect of global warming in food supply, plants, sea, coral reef, forest, agriculture, economy - Kyoto Protocol in reduction of greenhouse gases - Ozone Layer Depletion - mechanism, effects and control measures- Montreal Protocol to protect ozone layer depletion - Rain Water Harvesting - .Effect of climate change due to air pollution Case study - CNG vehicles in Delhi

UNIT V   EFFECT OF CLIMATE CHANGE ON POLLUTION   6

Fungal diseases in forests and agricultural crops due to climatic fluctuations - Growing energy needs - effect of climate change due to non-renewable energy resources. Renewable energy resources in the prevention of climatic changes- Effect of climatic changes in ground water table, garments, monuments, buildings, consumption of energy, agriculture and in electric power sector - Carbon credit - carbon footprint - disaster management -Role of an individual to reduce climate change.
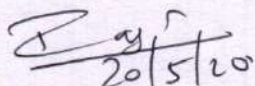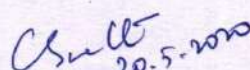
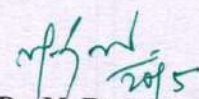**TOTAL: 30 HOURS**

Text Books:

1. Miller, T.G. Jr., "Environmental Science", Wadsworth Pub. Co. 2018
2. Anubha Kaushik and Kaushik, "Environmental Science and Engineering" New Age International Publication, 4th Multicolour Edition, New Delhi, 2014.

References:

1. S. Radjarejesri et al., "Environmental Science" Sonaversity, Sona College of Technology, Salem, 2018.
2. Masters, G.M., "Introduction to Environmental Engineering and Science", Pearson Education Pvt., Ltd., 2nd Edition, 2004.
3. Erach, B., "The Biodiversity of India", Mapin Publishing P.Ltd.,Ahmedabad, India.
4. Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad – 500029.

Dr. M. Raja
Course Coordinator / Sciences

Dr. C. Shanthi
HOD / Sciences

Dr. M. Renuga
Chairperson BOS,
Science and Humanities

20.05.2020

B.E. / B.Tech. Regulations 2019

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	U19MAT401B	Probability and Statistical Methods	3	1	0	4	60
2	U19EE401	Signals and Systems	2	1	0	3	45
3	U19EE402	Electrical Machines – II	3	0	0	3	45
4	U19EE403	Power Electronics and Drives	3	0	0	3	45
5	U19EE404	Digital Electronics and Microcontroller	3	0	0	3	45
6	U19CS408	Data Structures	3	0	2	4	75
7	U19GE403	**Mandatory Course** - Essence of Indian Traditional Knowledge	2	0	0	0	30
		Practical					
8	U19EE405	Electrical Machines Laboratory – II	0	0	2	1	30
9	U19EE406	Power Electronics and Drives Laboratory	0	0	2	1	30
10	U19EE407	Digital Electronics and Microcontroller Laboratory	0	0	3	1.5	45
11	U19GE401	Soft Skills and Aptitude - II	0	0	2	1	30
					Total Credits	24.5	

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, Fourth Semester BE EEE Students and Staff, COE

B. E / ELECTRICAL AND ELECTRONICS ENGINEERING

SEMESTER – IV	PROBABILITY AND STATISTICAL METHODS	L	T	P	C
U19MAT401B		3	1	0	4

COURSE OUTCOMES

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

1. apply the concepts of measures of central tendency, dispersion, correlation to the given data and analyze the results.
2. apply the concepts of random variables and their properties to generate the moments.
3. fit the suitable distribution and its properties to the real world problems and interpret the results.
4. apply the concepts of joint probability distribution and its properties to find the covariance.
5. test the hypothesis of the population using sample information.

CO / PO, PSO Mapping
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CO4	3	2		3	2						2	2	3	3
CO5	3	2		3	2						2	2	3	3

UNIT – I   BASIC STATISTICS   12

Measures of central tendency (simple arithmetic mean, median, mode) – quartile's – measures of dispersion (range, inter-quartile range, quartile deviation, mean deviation, standard deviation, coefficient of variation) – simple correlation – curve fitting (straight line and parabola).

UNIT – II   RANDOM VARIABLES   12

Discrete and continuous random variables – probability mass function, probability density function, moments, moment generating function and their properties.

UNIT – III   THEORETICAL DISTRIBUTIONS   12

Binomial, Poisson, geometric, uniform, exponential and normal distributions and their properties – applications.

UNIT – IV   TWO DIMENSIONAL RANDOM VARIABLES   12

Joint distributions, marginal and conditional distributions – covariance – correlation – central limit theorem.

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UNIT – V   TESTING OF HYPOTHESIS   12

Sampling distributions – testing of hypothesis for proportion, mean, standard deviation and differences using normal distribution– t-test for single mean and difference between means - χ^2- tests for independence of attributes and goodness of fit and F-test for equality of two variances.

Theory: **45 Hours**   Tutorial: **15 Hours**   Total: **60 Hours**
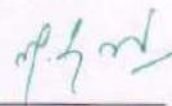
TEXT BOOKS:

1. S. C. Gupta and V. K. Kapoor, "Fundamentals of Mathematical Statistics", Sultan Chand and Sons Publishers, 11th Edition, Reprint, 2019.
2. T. Veerarajan, "Probability, Statistics and Random Processes with Queueing Theory and Queueing Networks", McGraw Hill Publishers, 4th Edition, 7th Reprint, 2018.

REFERENCE BOOKS:

1. R. A. Johnson and C. B. Gupta, "Miller and Freund's, Probability and Statistics for Engineers", Pearson Publishers, 9th Edition, 2018.
2. S. Ross, "A First Course in Probability", Pearson Publishers, 9th Edition, 2019.
3. P. G. Hoel, S. C. Port and C. J. Stone, "Introduction to Probability Theory", Universal Book Stall Publishers, Reprint, 2003.
4. W. Feller, "An Introduction to Probability Theory and Its Applications – Volume – I", Wiley Publishers, 3rd Edition, 2008.

Prof. S. JAYABHARATHI
Head / Department of Mathematics
Sona College of Technology
Salem – 636 005

Dr. M. RENUGA
BoS - Chairperson
Science and Humanities
Sona College of Technology
Salem – 636 005

13. 01. 2021

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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.
- Analyse discrete transforms properties

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)												
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CO5	3	3	2	3	3							3	3	3

UNIT I   CLASSIFICATION OF SIGNALS AND SYSTEMS   9

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 systems.

UNIT II   ANALYSIS OF CONTINUOUS TIME SIGNALS AND LINEAR TIME INVARIENT (LTIV) SYSTEMS   9

Fourier and Laplace transforms in CT Signal analysis – Fourier and Laplace transforms in analysis of CT systems – Dirichlet's Conditions - Properties of Fourier and Laplace Transform s - Initial Value, Final Value and Parseval's Theorems.

UNIT III   ANALYSIS OF DISCRETE TIME SIGNALS   9

Baseband sampling – Sampling Theorem for Low pass Signals - under sampling - Nyquist Rate and Nyquist Interval - Discrete Time Fourier Transform (DTFT) – properties of DTFT – Z transform – properties of Z transform.

UNIT IV   LINEAR TIME INVARIANT DISCRETE TIME SYSTEMS   9

Difference equations – Block diagram representation - Direct form I and Direct Form II structures – impulse response – convolution sum – discrete Fourier and Z transform analysis – Magnitude / Phase Transfer Function using Fourier Transform – Pole-Zero Plots.

UNIT V   DISCRETE TRANSFORMS   9

Discrete Fourier Transform(DFT) – definition – properties, computation of Discrete Fourier Transform(DFT) using Fast Fourier Transform(FFT) algorithm – Decimation in Time (DIT) domain and Decimation in Frequency(DIF) domain – Fast Fourier Transform(FFT) using radix-2 – Butterfly structure – computation of Inverse Discrete Fourier Transform(IDFT) using DFT- Architecture of TMS320C54X Processor.

Lecture: 30; Tutorial:15; Total: 45 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, RakeshRanjan, "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.RonaldFannin,"Signals &Systems", Pearson Education, Fourth Edition, 2002.

U19EE402   **ELECTRICAL MACHINES-II**   **3 0 0 3**

COURSE OUTCOMES
At the end of the course student should be able to,
1. Illustrate the construction and working of alternators and apply various methods to calculate voltage regulation.
2. Explain the operation and derive the power equations of synchronous motor.
3. Explain the construction and operation of three phase induction motor.
4. Calculate the performance characteristics of induction motor using circle diagram and explain various starting methods and speed control methods of three phase induction motor.
5. Construct the equivalent circuit of single phase induction motor and explain the fundamentals of special machines.

	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
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CO4	3	3	3	3	2					2	2	3	3	3
CO5	3	3	3	3	2					2	2	3	3	3

UNIT I   ALTERNATOR   9
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   SYNCHRONOUSMOTOR   9
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   THREEPHASE INDUCTION MOTOR   9
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, STARTERSAND SPEED CONTROL OF THREE PHASE INDUCTION MOTOR   9
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   9
Principle of operation – double revolving field theory – types of single phase induction motor – equivalent circuit – performance calculation – no load and blocked rotor test – Basics of BLDC Motor, stepper motor and Universal motor – applications.

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

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.

U19EE403   **POWER ELECTRONICS AND DRIVES**   **3 0 0 3**

COURSE OUTCOMES
At the end of this course the students will be able to,
1. Illustrate the operation of single phase and three phase controlled converters and analyze the operation of choppers with relevant mode waveforms.
2. 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.
3. Explain operation of single phase and three phase AC voltage regulators with its sequence control techniques and summarize the operation of cyclo converters.
4. Describe the steady state operation and transient dynamics of a motor load system.
5. Analyze the operation of the converter fed, inverter fed and chopper fed DC & AC drives.

<table>
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UNIT I   PHASE-CONTROLLED CONVERTERS AND CHOPPERS   9
Single phase converter - half controlled bridge converter and full controlled bridge converter with R Load – analysis 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 Load.
DC Choppers: Principle of step up, step down chopper and Chopper operation – Control strategies – Classification & operation of choppers class (A, B, C, D, E)

UNIT II   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 – Voltage control of Single phase inverters – harmonic reduction techniques and filters.

UNIT III   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.

UNIT IV   INTRODUCTION TO 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 V   SOLID STATE CONTROL OF DC & AC DRIVES   9

DC DRIVES: Single-phase and three-phase converter fed drives – continuous and discontinuous conduction modes – chopper fed drives.

AC DRIVES: Induction motor drives – stator control – stator voltage and frequency control –Cyclo-converter fed drives.

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. Gopal K Dubey, "Fundamentals of Electric Drive", Narosa Publications, II Edition, 2002**.**

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. P.S.Bimbra "Power Electronics" Khanna Publishers, third Edition 2003.

4. Bimal K.Bose, "Modern Power Electronics and AC Drives", Prentice Hall of India, 2005.

U19EE404   DIGITAL ELECTRONICS AND MICROCONTROLLER   3 0 0 3

COURSE OUTCOMES
At the end of this course the students will be able to
1. simplify switching functions and understand logic families.
2. design combinational logic circuits using gates and MSI devices.
3. analyse and design sequential logic circuits and counters using Flip-flops.
4. explain the architecture and features of microcontroller and arm processor.
5. write assembly language programs and apply in electrical appliances.

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)													
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UNIT I   BOOLEAN ALGEBRA AND LOGIC FAMILIES   9
Introduction to digital logic and number systems – Binary codes: Gray and BCD – Logic gates – Boolean algebra: Laws, theorems and minimization of switching functions – Simplification using Karnaugh map (upto five variables).
Logic families: terminologies, types, TTL and CMOS gates – comparison.

UNIT II   COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS   9
Design of adder, subtractor (half and full), 4-bit binary adder / subtractor and comparator (single bit) – Encoder, Decoder, Demultiplexer and Multiplexer – Realization of combinational circuits using decoders and multiplexers.
Sequential logic: SR latch – Level and edge triggering – Flip-Flops (FF): SR, JK, D and T - conversion between flip flops – Shift registers.

UNIT III   SYNCHRONOUS SEQUENTIAL LOGIC CIRCUITS   9
Analysis and design of synchronous sequential circuits – Moore and Mealy models – State diagram, state table, state reduction and state assignment.
Design of synchronous and asynchronous counters: Up, down and modulo counters – Sequence detectors.

UNIT IV   MICROPROCESSOR AND MICROCONTROLLER   9
Over view of microprocessor: Terminologies, functional block diagram, applications–Introduction to Microcontroller – Microprocessor vs Microcontroller – 8051 Microcontroller: Architecture, memory organization, port operation, counters and timers, serial communication, interrupts – Introduction to ARM Processor: features, simple architecture of ARM 7 processor.

UNIT V   8051 PROGRAMMING AND APPLICATIONS   9
8051 instruction set and addressing modes – simple programming –Temperature sensor interfacing with 8051.
Applications: waveform generation, speed control of stepper motor, DC motor and traffic light control.

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

TEXT BOOKS:

1. Morris Mano M and Michael D. Ciletti, "Digital Design", Pearson Education, 6th edition, 2018.

2. Krishna Kant, "Microprocessors and Microcontrollers", PHI Publisher, 2013.

REFERENCE BOOKS:

1. Anand Kumar A, "Fundamentals of Digital Circuits", PHI Publishers, 4th edition, 2016.

2. Padmanabhan T.R., "Introduction to Microcontrollers and their Applications", Narosa Publishing House, 2012

3. Nagoor Kani A, "Microprocessors and Microcontrollers", McGraw Hill Education, 2020.

4. Senthil Kumar N., Saravanan M. & Jeevananthan S., "Microprocessors and Microcontrollers", Oxford Publication, 2nd edition 2016.

U19CS408   **DATA STRUCTURES**   **3 0 2 4**

COURSE OUTCOMES:

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

1. Implement abstract data types for linear data structures
2. Solve real world problems using stack and queue linear data structures
3. Apply various non-linear tree data structures in real time applications
4. Design algorithms to solve common graph problems
5. Analyze various searching, sorting and hashing techniques

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)													
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CO5	3	3	3	3	3			3	3			3	2	2

UNIT I   LINEAR DATA STRUCTURES – LIST   15

Abstract Data Types (ADTs) – List ADT – Array-based implementation – Linked list implementation - Singly linked lists - Circularly linked lists - Doubly-linked lists – Applications of lists

List of Experiments:

- *Implementation of Lists*

UNIT II   LINEAR DATA STRUCTURES – STACKS, QUEUES   15

Stack ADT – Operations– Evaluating arithmetic expressions - Conversion of Infix to postfix expression – Queue ADT – Operations – Circular Queue – Double ended queue – Applications of Stacks and queues.

List of Experiments:

- *Implementation of Stacks*
- *Implementation of Queues*

UNIT III   NON-LINEAR DATA STRUCTURES – TREES   15

Trees – Traversals – Binary Trees – Expression trees – Applications of trees – Binary search trees - AVL Trees – B-Tree – Heap – Applications of heap -Tries.

List of Experiments:

- *Implementation of Binary Search Trees*
- *Implementation of AVL Trees*
- *Implementation of Heap*

UNIT IV   NON-LINEAR DATA STRUCTURES – GRAPHS   15

Graphs - Representation of graph – Graph traversals – Breadth-first traversal – Depth-first traversal – Minimum Spanning Trees: Prim's algorithm, Kruskal's algorithm – Shortest path algorithms: Dijkstra's algorithm - Applications of Graphs: Topological Sort.

List of Experiments:

- *Implementation of graphs using BFS and DFS.*
- *Implementation of Prim's algorithm.*
- *Implementation of Kruskal's algorithm*
- *Implementation of Dijkstra's algorithm*

UNIT V   SEARCHING, SORTING AND HASHING TECHNIQUES   15

Searching - Linear Search – Binary Search, Sorting – Bubble sort– Insertion sort – Merge sort, Hashing - Hash Functions – Separate Chaining – Open Addressing – Rehashing – Extendible Hashing.

List of Experiments:

- *Implementation of Hashing and Collision Resolution Technique*
- *Implementation of Searching Techniques*
- *Implementation of Sorting Techniques*

Lecture: 45, Practical: 30, TOTAL: 75 Hours

TEXT BOOKS

1. Mark Allen Weiss, "Data structures and Algorithm Analysis in C", Pearson Education, New Delhi, Second Edition, 2012.

REFERENCES

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest , Clifford Stein, "Introduction to Algorithms" ,3rd Edition, MIT Press, 2010.

2. Jean Paul Tremblay and Sorenson, "An Introduction to Data Structures with Applications", McGraw Hill Publishing Company, New Delhi, Second Edition, 2007.

3. Yedidyah Langsam, Moshe J Augenstein and Aaron M Tanenbaum, "Data Structures using C and C++", Prentice Hall of India/ Pearson Education, New Delhi, 2006.

4. Ellis Horowitz, Sartaj Sahni, Susan Anderson-Freed, "Fundamentals of Data Structures in C", Silicon Press, New Jersey, Second Edition, 2005.

U19GE403   ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE   2 0 0 0
(Mandatory Course)

COURSE OUTCOMES:
At the end of the course, the students will be able to,
1. understand, connect up and explain basics of Indian traditional knowledge in modem scientific perspective.
2. show an ability to comment critically on curriculum proposals that aim to promote science citizenship/scientific literacy
3. communicate using common medical and psychological terminology, including the skill to discuss commonly used medications, supplements, and surgical procedures
4. use effective oral and written language skills to communicate scientific data and ideas
5. describe the fundamentals of yoga and its importance.

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Unit - I   6
- Introduction to Vedas
- Traditional methodology of Veda — Sat Angas
- Types of Vedas and their application
- Sub Veda — Ayurveda - their modern day application

Unit - II   6
- Basics of Applied Vedic Science
- Modern day application of Vedas and procedure
- Ancient Indian Scientific thoughts
- Introduction to the Vedic language "Sanskrit"

UNIT - III - Modern science   6
- Introduction — modern science
- Objectives — modern science
- Architecture in ancient India

UNIT - IV Technology   6
- India's contribution to science and technology (from ancient to modern)
- Nobel laureates of Indian origin and their contribution
- India in space
- Latest achievement from Jan — 2017

UNIT - V- Yoga and Holistic Health Care   6
- Fundamentals of yoga and holistic health
- Human biology
- Diet and nutrition
- Life management
- Contemporary yogic models — case study

Total: 30 HOURS

REFERENCES

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

3. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.

4. Roshan Dalai The Vedas: An Introduction to Hinduism's Sacred Texts, Penguin Books 2014. ISBN 13: 9780143066385

5. Raja Ram Mohan Roy, Vedic Physics, Mount Meru Publication ISBN : 9781988207049

U19EE405   **ELECTRICAL MACHINES LABORATORY–II**   **0 0 2 1**

COURSE OUTCOMES:

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

1. Determine the regulation of three-phase alternator using EMF, MMF, ZPF, slip test, inductive and capacitive load methods.

2. Analyse the V and inverted V curves of three-phase synchronous motor.

3. Draw the performance characteristics and equivalent circuit of single-phase and three-phase induction motor.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
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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. Plotting V and inverted V curve 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 analysis of three-phase alternator.

12. Regulation of three-phase alternator using inductive load and capacitive load.

13. Performance calculation of BLDC motor.

Total: 30 Hours

U19EE406   POWER ELECTRONICS AND DRIVES LABORATORY   0 0 2 1

COURSE OUTCOME

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

1. Design various configurations of converters to fed R and RL & RLE loads.

2. Verify the operation of step down and step up choppers, commutated choppers, single phase and three phase PWM inverters, cycloconverter and AC voltage regulators.

3. Simulate AC and DC drives using power electronics modules and the performance characteristics of AC, DC and special drives

COs	\multicolumn{14}{c}{CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak}

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LIST OF EXPERIMENTS

1. Design of single phase half controlled & fully controlled converter using R, RL & RLE Loads.

2. Design of three phase half controlled & fully controlled converter using R, RL & RLE Loads

3. Design of step down and step up MOSFET based choppers.

4. Construct and verify the four quadrant operation of chopper.

5. Design IGBT based single-phase PWM inverter.

6. Design IGBT based three-phase PWM inverter(120 and 180 degree)

7. Design of single phase cycloconverter.

8. Construct single phase and three phase AC voltage regulators and verify its operation.

9. Design and Simulation of closed loop control of converter fed DC motor.

10. Design and Simulation of closed loop control of chopper fed DC motor.

11. Design and Simulation of VSI fed 3 phase induction motor.

12. Speed control of 3 phase induction motor using PWM inverter

Total: 30 Hours.

U19EE407   DIGITAL ELECTRONICS AND MICROCONTROLLER LABORATORY   0 0 3 1.5

COURSE OUTCOME

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

1. Implement the Boolean functions using logic gates and digital ICs.

2. Design and implement counters and shift registers.

3. Write and implement simple programs using microcontroller.

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</table>

LIST OF EXPERIMENTS

1. Implementation of Boolean functions using logic gates.

2. Implementation of adder and subtractor circuits using logic gates.

3. Implementation of combinational circuits using Decoder and Multiplexer.

4. Design and implementation of synchronous counters using flip-flop.

5. Design and implementation of asynchronous counters using flip-flop.

6. Design and implementation of shift registers.

7. Simple arithmetic operations using 8051 microcontroller.

8. Simple array operations using 8051 microcontroller.

9. Interfacing and Programming of DC Motor Speed Control

10. Interfacing and Programming of Temperature Indicator

11. Interfacing and Programming of Water tank level control

12. Measurement and data acquisition of temperature using NI CIRO

Total: 45 Hours

Semester – IV	U19GE401-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. Equations: Basics of equations , Linear, Quadratic Equations of Higher Degree and Problem on ages. b. Logarithms, Inequalities and Modulus c. Sequence and Series: Arithmetic Progression, Geometric Progression, Harmonic Progression, and Special Series. d. Time and Work: Pipes & Cistern and Work Equivalence. e. Time, Speed and Distance: Average Speed, Relative Speed, Boats & Streams, Races and Circular tracks and Escalators. f. Arithmetic and Critical Reasoning: Arrangement, Sequencing, Scheduling, Network Diagram, Binary Logic, and Logical Connection. g. Binary Number System.- Binary to decimal, Octal, Hexadecimal
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

Dr.S.Anita

Head/Training

SEMESTER – IV

MANDATORY COURSE

U19GE403 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

(Common for EEE, CIVIL, MECH and CSE)

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L  T  P  C
2  0  0  0
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Course Outcomes

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

1. understand, connect up and explain basics of Indian traditional knowledge in modern scientific perspective.
2. show an ability to comment critically on curriculum proposals that aim to promote science citizenship/scientific literacy
3. communicate using common medical and psychological terminology, including the skill to discuss commonly used medications, supplements, and surgical procedures
4. use effective oral and written language skills to communicate scientific data and ideas
5. describe the fundamentals of yoga and its importance

Unit I

- Introduction to Vedas   6
- Traditional methodology of Veda – Sat Angas
- Types of Vedas and their application
- Sub Veda – Ayurveda - their modern day application

Unit II

- Basics of Applied Vedic Science   6
- Modern day application of Vedas and procedure
- Ancient Indian Scientific thoughts
- Introduction to the Vedic language "Sanskrit"

UNIT – III- Modern science   6

- Introduction – modern science
- Objectives – modern science
- Architecture in ancient India

UNIT – IV Technology

- India's contribution to science and technology (from ancient to modern)   6
- Nobel laureates of Indian origin and their contribution
- India in space
- Latest achievement from Jan – 2017

23.01.2021   B.E. / B.Tech. Regulations 2019
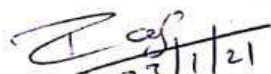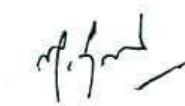
UNIT – V- Yoga and Holistic Health Care   6

- Fundamentals of yoga and holistic health
- Human biology
- Diet and nutrition
- Life management
- Contemporary yogic models – case study

References

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014
2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan
3. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, Vidyanidhi Prakasham, Delhi, 2016.
4. Roshan Dalal The Vedas: An Introduction to Hinduism's Sacred Texts, Penguin Books 2014. ISBN 13: 9780143066385
5. Raja Ram Mohan Roy, Vedic Physics, Mount Meru Publication ISBN : 9781988207049

Total: 30 HOURS

Dr. M. Raja
Course Coordinator / Sciences

Dr. C. Shanthi
HOD / Sciences

Dr. M. Renuga
Chairperson BOS,
Science and Humanities

23.01.2021   B.E. / B.Tech. Regulations 2019

10.12.2021   Regulations-2019

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
Theory							
1	U19EE501	Generation, Transmission and Distribution Systems	2	1	0	3	45
2	U19EE502	Control Systems	2	1	0	3	45
3	U19EE503	Embedded Systems and IoT	3	0	0	3	45
4	U19EE504	Electrical Machine Design	2	1	0	3	45
5	U19EE505	Total Quality Management in Electrical Industries	3	0	0	3	45
6	noc22_cs95	**NPTEL** - Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3	45
Practical							
7	U19EE506	Instrumentation and Control Laboratory	0	0	2	1	30
8	U19EE507	Embedded Systems and IoT Laboratory	0	0	2	1	30
9	U19GE501	Soft Skills and Aptitude – III	0	0	2	1	30
					Total Credits	**21**	

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, Fifth Semester BE EEE Students and Staff, COE

U19EE501 GENERATION, TRANSMISSION AND DISTRIBUTION SYSTEMS 2 1 0 3

COURSE OUTCOMES
At the end of the course student should be able to,
1. Explain the structure of power system and operation of power plants using different sources of electrical energy.
2. Develop expressions for the computation of various transmission line parameters and its application in variousnetworks.
3. Analyse the types of transmission lines by calculating the transmission line efficiency, regulation and sag.
4. Analyse the voltage distribution in insulator strings, its improvement and also the various parameter inunderground cables.
5. Explain the operation of various distribution systems and the principle of operation of various FACTS devices.

| COs | \multicolumn{14}{c}{CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak} |

COs	\multicolumn{14}{c}{Programme Outcomes (POs) and Programme Specific Outcome (PSOs)}
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CO1	2		3	2		2	1	2	1	1	3	2	3	3
CO2	2	3	3	3	2	2	3	3	1		3		3	3
CO3	2	3	3	3	2	2	3	3	1		3		3	3
CO4	2	3	3	3	2	2	3	3	1		3		3	3
CO5	2	1	3	2	1	2	3	3	2	2	3	2	3	3

UNIT I   POWER GENERATION AND ECONOMICS   9
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) – economic aspects.
Power plants: construction and working principle of steam, hydroelectric, nuclear, solar and wind power plants.

UNIT II   TRANSMISSION LINE PARAMETERS   9
Transmission line conductors – solid, stranded and bundled conductors – parameters of single and three-phase transmission lines – 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.

UNIT III   ANALYSIS OF TRANSMISSION LINES   9
Classification of overhead lines: important terms, calculation of transmission efficiency and voltage regulation of shortline, 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, unequalsupports and effect of wind and ice).

UNIT IV INSULATORS AND CABLES 9

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. Introduction to Protection for Transmission lines and cable.

UNIT V INTRODUCTION TO MODERN TRANSMISSION SYSTEMS 9

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-3 phase 4 wire system and single phase 2 wire distribution-
FACTS: principle of operation of SVC, TCSC, STATCOM, UPFC– merits &demerits of FACTS technology.

Lecture: 30; Tutorial: 15; Total: 45 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, 2008.

REFERENCES:

1. M.L. Soni, P. V. Gupta, Bhatnagar, A. 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.

U19EE502   **CONTROL SYSTEMS**   **2 1 0 3**

COURSE OUTCOMES:
At the end of the course student should be able to,
1. develop mathematical model of electrical, mechanical systems and derive the transfer functions.
2. perform time-domain analysis of the system to predict the system's behaviour.
3. determine the stability of LTI systems using Routh criterion and root locus technique.
4. analyse the frequency response and stability of LTI systems.
5. obtain state model from transfer function and solve the state equations.

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)													
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CO3	3	3	3	3	3	-	-	-	-	-	1	2	3	2
CO4	3	3	3	3	3	-	-	-	-	-	1	2	3	2
CO5	3	3	3	3	3	-	-	-	-	-	1	3	3	3

UNIT I   SYSTEMS AND REPRESENTATION   9
Introduction – classification of control systems – open loop and closed loop systems – transfer functions – Electrical and mechanical (translational and rotational) systems – electrical analogous of mechanical systems – block diagram reduction – Mason's gain formula.

UNIT II   TIME DOMAIN ANALYSIS   9
Standard test signals – time response of first order systems – step response of second order systems – time domain specifications – steady state error – static and dynamic error coefficients – Introduction to controllers: P, PD, PI and PID.

UNIT III   STABILITY ANALYSIS AND COMPENSATORS   9
Concept of stability – conditions for stability – Routh stability criterion – root locus – effect of addition of poles and zeros – relative stability. Compensation – physical realization of basic compensators (lead, lag and lead-lag).

UNIT IV   FREQUENCY DOMAIN ANALYSIS AND STABILITY   9
Frequency response – frequency domain specifications – correlation between time and frequency response – Bode plot – determination of transfer function from log-magnitude plot – polar plot – Nyquist stability criterion.

UNIT V   STATE SPACE ANALYSIS OF LINEAR CONTINUOUS-TIME SYSTEM   9
Basic concepts – state model – state space representation using physical variables and phase variables – transfer function from state model – solution of state equations – state transition matrix – controllability and observability – Kalman and Gilbert tests.

Lecture: 30; Tutorial: 15; Total: 45 Hours

TEXTBOOKS:

1. I.J.Nagrath and M.Gopal, "Control Systems Engineering", VI Edition, New Age International Ltd, Publishers, 2018.

2. F.Golnaraghi, B.C.Kuo, "Automatic Control Systems", X edition, McGraw Hill education, 2018.

REFERENCES:

1. Katsuhiko Ogata, "Modern Control Engineering", V edition, Pearson education, 2015.

2. R.C. Dorf and R.H. Bishop, "Modern Control Systems", XII edition, Pearson education, 2017.

3. J.Distefano, A.Stubberu, et al. "Schaum's Outline: Control Systems", McGraw Hill, 2017.

4. S. Padma et al., "Control Systems", Sonaversity, 2015.

U19EE503   **EMBEDDED SYSTEMS AND IoT**   **3 0 0 3**

COURSE OUTCOMES
At the end of this course the students will be able to,
1. Explain the architectural features of embedded system.
2. Describe the communication interfaces of embedded systems network and embedded IDE.
3. Define Internet of things and its enabling technologies.
4. Apply the sensors and actuators for suitable applications.
5. Design case studies based on Python Raspberry Pi.

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UNIT I   INTRODUCTION 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   BUSES FOR DEVICES NETWORK & EMBEDDED SYSTEM DEVELOPMENT ENVIRONMENT 9

Serial communication using I^2C, SPI, CAN, USB buses - Parallel communication using ISA, PCI, PCI/X buses, arm bus – internet enabled systems-Network protocols.

IDE, Compiler, Linker - Types of File Generated on Cross Compilation-Simulator, Emulator and Debugging.

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, IoT Levels and Templates - Domain specific IoTs - IoT Architectural view- IOB.

UNIT IV   ELEMENTS OF IoT   9

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

UNIT V   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, 2017.

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..

U19EE504   **ELECTRICAL MACHINE DESIGN**   **2 1 0 3**

COURSE OUTCOMES:
At the end of this course the students will be able to,
1. Explain the design basics of magnetic circuit and loadings of an electrical machine.
2. Calculate the design parameters of DC machine.
3. Calculate the design parameters of squirrel cage and slip ring three-phase induction motors.
4. Calculate the design parameters of turbo alternators and salient pole synchronous machines.
5. Calculate the parameters of transformer dimensions and design its cooling tank.

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</table>

UNIT I   MAGNETIC CIRCUIT DESIGN PRINCIPLES   9

Considerations, factors, limitations and principles of design – fundamentals of magnetic circuits – comparison of magnetic and electric circuits – MMF for airgap and teeth – net length of iron – real and apparent flux densities – Total and specific loadings – factors affecting size of rotating machines – choice of specific magnetic and electric loadings.

UNIT II   DESIGN OF DC MACHINES   9

Output equation – main dimensions: separation of D and L – choice of number of poles – core length, armature diameter – pole proportions – Armature design: number of armature coils, and slots – Pole design – design of shunt field winding – design of commutator and brushes.

UNIT III   DESIGN OF THREE PHASE INDUCTION MOTORS   9

Output equation – main dimensions: separation of D and L – Stator design: winding, number of slots, area of slots – Squirrel cage rotor design: bars, slots and end rings – Wound rotor design: turns and area of conductors.

UNIT IV   DESIGN OF SYNCHRONOUS MACHINES   9

Output equation – runaway speed – main dimensions: separation of D and L – Short circuit ratio – design of armature and rotor of salient pole machines – design of damper winding – design of field winding – design of stator and rotor of turbo alternators.

UNIT V   DESIGN OF TRANSFORMERS   9

Classification – output equations – volt per turn – optimum designs – design of core, windings, and yoke – window dimensions – overall dimensions – temperature rise – design of tank with cooling tubes.

Lecture: 30, Tutorial: 15, Total: 45 Hours.

TEXTBOOKS:

1. Sawhney A.K. & Chakrabarti A, "A Course in Electrical Machine Design", Dhanpat Rai & Co., VI Edition, 2016.
2. Deshpande MV, "Design and Testing of Electrical Machines", PHI learning, III edition, 2010.

REFERENCES:

1. A. Nagoor Kani, "Electrical Machine Design", RBA publications, II edition, 2014.
2. Agarwal R.K., "Principles of Electrical Machine Design", S.K.Kataria and Sons, V edition, 2014.
3. Sen S.K., "Principle of Electrical Machine Design with C++", Oxford & IBH Publishing, III edition, 2014.
4. KM Vishnu Murthy, "Computer-Aided Design of Electrical Machines", BS publications, 2015.

U19EE505   TOTAL QUALITY MANAGEMENT IN ELECTRICAL INDUSTRIES   3 0 0 3

COURSE OUTCOMES

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

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

CO / PO, PSO Mapping														
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
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CO3	1	2	3	2	-	3	2	3	3	1	3	3	1	1
CO4	1	2	3	2	-	3	2	3	3	1	3	3	1	1
CO5	1	2	3	2	-	3	2	3	3	1	3	3	1	1

UNIT I   EVOLUTION OF QUALITY   9

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   9

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   9

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   9

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   9

Six sigma − lean manufacturing − lean six sigma − theory of constraints − agile manufacturing − Advanced product quality planning (APQP) in automotive industry.

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. James R.Evans& William M.Lidsay, "The Management and Control of Quality", Eighth Edition, South – Western (Thomson Learning), 2011.

3. Dr. V. Jayakumar and Dr. R. Raju, "Total Quality Management" , Lakshmi Publications, third revised edition, 2016.

4. https://www.iso.org/popular-standards.html

PROF. SUDIP MISRA
Department of Computer Science and Engineering
IIT Kharagpur

ABOUT THE COURSE :
Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle.This course has been organized into the following modules:

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

PRE-REQUISITES: Basic knowledge of computer and internet

INDUSTRY SUPPORT: All Industrial Sectors

ABOUT INSTRUCTOR:
Dr. Sudip Misra is a Professor in the Department of Computer Science and Engineering at the Indian Institute of Technology Kharagpur. Prior to this he was associated with Cornell University (USA), Yale University (USA), Nortel Networks (Canada) and the Government of Ontario (Canada). He received his Ph.D. degree in Computer Science from Carleton University, in Ottawa, Canada. He has several years of experience working in the academia, government, and the private sectors in research, teaching, consulting, project management, architecture, software design and product engineering roles.His current research interests include Wireless Ad Hoc and Sensor Networks, Internet of Things (IoT), Computer Networks, Learning Systems, and algorithm design for emerging communication networks. Dr. Misra is the author of over 260 scholarly research papers, including 140+ reputed journal papers. He has won seven research paper awards in different conferences. Recently, he and his students won Samsung Innovation Award and the IEEE ComSoc Student Competition. He was awarded the fellow of NASI. He was also awarded the IEEE ComSoc Asia Pacific Outstanding Young Researcher Award at IEEE GLOBECOM 2012, Anaheim, California, USA. He was also the recipient of several academic awards and fellowships such as the Young Scientist Award (National Academy of Sciences, India), Young Systems Scientist Award (Systems Society of India), Young Engineers Award (Institution of Engineers, India), (Canadian) Governor General's Academic Gold Medal at Carleton University, the University Outstanding Graduate Student Award in the Doctoral level at Carleton University and the National Academy of Sciences, India - Swarna Jayanti Puraskar (Golden Jubilee Award).Dr. Misra was also awarded the Canadian Government's prestigious NSERC Post-Doctoral Fellowship and the Humboldt Research Fellowship in Germany. Dr. Misra has been serving the editorial boards of distinguished journals such as the Transactions on Vehicular Technology, Transactions on Mobile Computing, International Journal of Communication Systems (Wiley) and the IET Wireless Sensor Systems (UK). In the past, he served as the Associate Editor/Editorial Board Member of the Telecommunication Systems Journal (Springer), Security and Communication Networks Journal (Wiley), and the EURASIP Journal of Wireless Communications and Networking, IET Communications Journal, and the Computers and Electrical Engineering Journal (Elsevier).Dr. Misra has published 10 books in the areas of wireless ad hoc networks, wireless sensor networks, wireless mesh networks, communication networks and distributed systems, network reliability and fault tolerance, and information and coding theory, published by reputed publishers such as Cambridge University Press, Springer, Wiley, and World Scientific.

Course layout

Week 1 : Introduction: Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II.

Week 2 : Industry 4.0: Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories

Week 3 : Industry 4.0: Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artifical Intelligence, Big Data and Advanced Analysis

Week 4 : Cybersecurity in Industry 4.0, Basics of Industrial IoT: Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.

Week 5 : IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.

Week 6 : Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.

Week 7 : Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.

Week 8 : Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.

Week 9 : Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.

Week 10 : Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.

Week 11 : Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.

Week 12 : Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies :
Case study - I : Milk Processing and Packaging Industries
Case study - II: Manufacturing Industries - Part I
Case study - III : Manufacturing Industries - Part II
Case study - IV : Student Projects - Part I
Case study - V : Student Projects - Part II
Case study - VI : Virtual Reality Lab
Case study - VII : Steel Technology Lab

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

Total: 45 Hours

U19EE506   **INSTRUMENTATION AND CONTROL LABORATORY**   **0 0 2 1**

COURSE OUTCOMES:

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

1. Measure electrical parameters using suitable circuit arrangement.
2. Determine the transfer function of servomotors and analyse time response.
3. Evaluate response and stability of a linear system.

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	1	2	3	3	3
CO2	3	3	3	3	3	-	-	-	3	1	2	3	3	3
CO3	3	3	3	3	3	-	-	-	3	1	2	3	3	3

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

LIST OF EXPERIMENTS

Instrumentation

1. Measurement of low and medium resistances using suitable bridges.

2. Measurement of inductances and capacitances using suitable bridges.

3. Measurement of single-phase power using current and potential transformers.

4. Determination of characteristics of displacement, pressure, and temperature transducers.

Control Systems

5. Determination of characteristics of DC position control system and AC synchro.

6. Determination of transfer function of armature-controlled and field-controlled DC servomotor.

7. Determination of transfer function of separately excited DC generator.

8. Design and analysis of P, PI and PID controllers.

9. Step response analysis of first and second order systems.

10. Stability analysis of linear time invariant systems (Root locus, Bode, and Nyquist plots).

11. Determination of state space representation of the given transfer function and vice versa.

12. Test of controllability and observability in linear continuous time domain state model.

Total: 30 Hours

U19EE507   **EMBEDDED SYSTEMS AND IOT LABORATORY**   **0 0 2 1**

COURSE OUTCOMES

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

1. Design an embedded system to get input from various sensor modules, monitor and display in the LED display.

2. Deploy an IoT application using Arduino/Raspberry Pi and appropriate sensor and actuator for monitoring.

3. Design an industrial based IoT system by interfacing analog and digital sensors with embedded controllers using LoRaWAN communication protocol.

COs	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
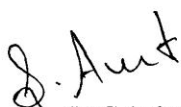
The interfacing, programming and simulation of the following experiments are done with Arduino board& IDE/Raspberry Pi/Python.

List of experiments:

1. LED blinking, push button / slide switch based led/buzzer control.

2. Integrating OLED display with Raspberry Pi to display "Hello World".

3. Monitoring temperature & humidity of environment using SHT31 temperature sensor in IOT cloud platform and display it in OLED display.

4. Monitoring accelerometer, gyroscope value using ADXL345 sensor and monitor no movement alert in IOT cloud platform and display it in OLED display.

5. Monitoring soil moisture data and control the contactor/starter of the motor to ON/OFF using IOT cloud platform.

6. Monitoring motion detection using PIR sensor and control the relay for light ON/OFF & update the status change to IOT cloud platform.

7. Monitoring water level of a tank using ultrasonic sensor and control contactor/starter of the motor from IOT cloud platform.

8. Control Rotation of 180 Degree Servo Motor from IOT Cloud Platform.

9. Monitoring temperature & humidity of environment using SHT31 temperature sensor in IOT cloud platform using LoRaWAN communication.

10. Electrical appliances control using LoRaWAN communication

Total: 30 Hours

Semester –V	U19GE501 : 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. Display effective language knowledge to construct sentences with subject verb agreement and select the best alternative for the underlined parts of the sentences, and fill in the blanks in the given passages with suitable forms of words and their synonyms.

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 interviews h. Mock GDs
2.QUANTITATIVE APTITUDE AND LOGICAL REASONING	**Solving problems with reference to the following topics :** a. **Geometry:** 2D, 3D, Coordinate Geometry, and Height & Distance. b. **Permutation&Combinations:** Principles of counting, Circular Arrangements and Derangements. c. **Probability:** Addition & Multiplication Theorems, Conditional Probability and Bayes Theorem. d. **Statistics** : Mean Median, Mode, Range and Standard Deviation. e. **Interest Calculation** :Simple Interest and Compound Interest f. **Crypto arithmetic:** Addition and Multiplication based problem. g. **Logical Reasoning :**Blood Relations, Directions Test, Series, Odd man out, Analogy, Coding & Decoding, Problems and Input – Output Reasoning. h. Statement & Assumptions, Statements & Arguments, Inference. i. **Company Specific Pattern :**Infosys and TCS company specific problems
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

Dr.S.Anita

Head/Training

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 VI Regulations 2019
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	U19EE601	Power System Analysis	3	1	0	4	60
2	U19EE602	Power System Protection and Switchgear	3	0	0	3	45
3	U19EE603	Special Electrical Machines and their Controllers	3	0	0	3	45
4	U19EE918	**Professional Elective** - Renewable Energy Sources	3	0	0	3	45
	U19EE928	**Professional Elective** - Electric Vehicle Technology					
5	U19EE929	**Professional Elective** - Electrical System Design	1	0	4	3	75
6	U19CS1002	**Open Elective** - Cloud Computing	3	0	0	3	45
	U19EC1007	**Open Elective** - CMOS VLSI Design					
	U19CE1003	**Open Elective** - Energy Efficiency and Green Building					
	U19MC1004	**Open Elective** - Fundamentals of Robotics					
	U19BM1001	**Open Elective** - Hospital Management					
	U19EC1006	**Open Elective** - Mobile Technology and its Applications					
	U19CE1002	**Open Elective** - Municipal Solid Waste Management					
	U19IT1001	**Open Elective** - Problem Solving Techniques using Java Programming					
	U19ME1004	**Open Elective** - Renewable Energy Sources					
	U19MC1003	**Open Elective** - Smart Automation					
		Practical					
7	U19EE604	Mini Project	0	0	6	3	90
8	U19ENG601	Communication Skills Laboratory	0	0	2	1	30
9	U19GE601	Soft Skills and Aptitude - IV	0	0	2	1	30
					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, Sixth Semester BE EEE Students and Staff, COE

06.01.2023   **Regulations-2019**

U19EE601   **POWER SYSTEM ANALYSIS**   **3 1 0 4**

COURSE OUTCOMES:

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

1. Model the various power system components and formation of Y-bus matrix.

2. Solve the power flow equation for power system networks using iterative techniques.

3. Analyze the symmetrical faults for the power system networks using bus impedance matrix formulation.

4. Analyze the unsymmetrical faults for the power system networks using symmetrical components.

5. Model the power system for stability analysis using iterative methods.

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
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CO3	3	3	3	3	2	2	2	2	1	3	2	3	3	3
CO4	3	3	3	3	2	2	2	2	1	3	2	3	3	3
CO5	3	3	3	3	2	2	2	2	1	3	2	3	3	3

UNIT I   POWER SYSTEM MODELLING   12
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, Y-bus formulation by direct inspection and singular transformation methods.

UNIT II   POWER FLOW ANALYSIS   12
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: 45, Tutorial: 15, TOTAL: 60 Hours

TEXT BOOKS:

1. Nagrath.I.J, Kothari.D.P, "Modern Power System Analysis", Tata McGraw Hill, 3rd Ed., 2003.

2. P. Venkatesh, B.V.Manikandan, S. Charles Raja, A. Srinivasan, "Electrical Power Systems", 2nd Edition, PHI Publications, 2017.

REFERENCES:

1. Hadi Saadat, "Power System Analysis", Tata McGraw Hill Pub Co. Ltd., New Delhi, 2002.

2. Gupta, J.B., "A Course in Electrical Power", S.K.Kataria and Sons, 2009.

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

U19EE602   **POWER SYSTEM PROTECTION AND SWITCHGEAR   3 0 0 3**

COURSE OUTCOMES:
At the end of this course, the students will be able to,
1. Discuss the need for protection and classify relays.
2. Identify, apply, and calculate settings for overcurrent, directional overcurrent, distance and differential protection relays.
3. Discuss protection schemes of generator, transformer, bus bars and transmission lines.
4. Describe the method of circuit breaking and types of circuit breakers.
5. Illustrate the causes and methods of protection against over voltages and insulation co-ordination in power system.

<table>
<tr><td colspan="15">CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
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<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>P09</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td></tr>
<tr><td>CO1</td><td>2</td><td>2</td><td>1</td><td></td><td></td><td>3</td><td>3</td><td>1</td><td></td><td>2</td><td></td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>CO2</td><td>2</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>3</td><td>1</td><td>1</td><td>2</td><td></td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>CO3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>3</td><td>1</td><td></td><td>2</td><td>1</td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>CO4</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td><td>3</td><td>3</td><td>1</td><td></td><td>2</td><td></td><td>2</td><td>3</td><td>3</td></tr>
<tr><td>CO5</td><td>2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td></td><td>2</td><td>1</td><td>2</td><td>3</td><td>3</td></tr>
</table>

UNIT I   INTRODUCTION   9
Need for protection – Nature and causes of faults – Types of Faults – Zones of Protection – Primary and Back-up protection - essential qualities of Protection – classification of protective relays – classification of Protective schemes – Instrumentation transformers.
Electromechanical Relays – types -   Static relays- Comparators - Numerical Relays

UNIT II   PROTECTIONAL RELAYS   9
Overcurrent Relays: Characteristics – Current setting, Time setting – Protective schemes – Directional relay – Earth Fault relay. Distance Relay: Impedance relay – Reactance relay – MHO relay –Quadrilateral relay. Differential Relays: Types – simple differential relay, Percentage differential relay, balanced voltage differential relay. Under frequency relays – Negative sequence relays.

UNIT III   APPARATUS PROTECTION   9
Apparatus protection – generator and transformer protection – protection of bus bars, transmission lines, CTs & PTs and their application in protective schemes.

UNIT IV   CIRCUIT BREAKER   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.

Types of circuit breakers: air circuit breakers, oil circuit breakers, SF6 circuit breakers and vacuum circuit breakers – comparison of circuit breakers, Rating and selection of circuit breakers. Introduction to Isolators and Gas Insulated Substation.

UNIT V   PROTECTION AGAINST OVER VOLTAGES   9

Causes of over voltages – Lightning phenomena – overvoltage protection due to lightning and switching - 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. Badri Ram and B.H.Vishwakarma, "Power System Protection and Switchgear", Tata McGraw Hill Education Pvt. Ltd, 2017.

2. Ravindranath.B and Chander.N, "Power System Protection and Switchgear", New Age international Publishers, 2011.

REFERENCES:

1. Chakrabarti.A, Soni.M.L, Bhatnagar.U.S., & Gupta.P.V, "A text book on Power System Engineering", Dhanpat rai & 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.

U19EE603 SPECIAL ELECTRICAL MACHINES AND THEIR CONTROLLERS 3 0 0 3

COURSE OUTCOMES:
At the end of this course, students will be able to
1. Categorize the stepping motors, analyse its performance characteristics for given excitation mode and develop the drive circuit.
2. Explain the operating principle and control techniques for Switched Reluctance Motor.
3. Explain the operating principle and control techniques for Permanent Magnet Brushless DC motor.
4. Explain the operating principle and analyse the characteristics of Permanent Magnet Synchronous Motor.
5. Explain the construction, operating principle and application of Synchronous Reluctance and Linear Induction motor.

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<tr><td>CO3</td><td>3</td><td>3</td><td>3</td><td>-</td><td>2</td><td>2</td><td>2</td><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td><td>3</td><td>2</td></tr>
<tr><td>CO4</td><td>3</td><td>3</td><td>3</td><td>-</td><td>2</td><td>2</td><td>2</td><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td><td>3</td><td>2</td></tr>
<tr><td>CO5</td><td>3</td><td>3</td><td>3</td><td>-</td><td>2</td><td>2</td><td>2</td><td>-</td><td>-</td><td>-</td><td>2</td><td>2</td><td>3</td><td>2</td></tr>
</table>

UNIT I   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 II   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 III   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 IV   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.

UNIT V   SYNCHRONOUS RELUCTANCE MOTOR   9

SynRM: Constructional features – Axial and Radial Type - Operating principle – Variable reluctance – Voltage and Torque equation - Performance characteristics – advantages - Linear Induction motor: Construction and operating principle - Application.

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.

U19EE604   **MINI PROJECT**   **0 0 6 3**

The mini project is introduced to develop practical skills to solve real time problems related to the industry in the field of electrical and electronics engineering. This course will also develop investigative, research, report writing skills and work in team; it provides an opportunity to learn a chosen topic in considerable depth.

COURSE OUTCOMES:

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

1. Utilize core engineering knowledge to identify an issue related to society, environment, engineering and technology.
2. Formulate, analyze and develop a prototype for the identified problem.
3. Evaluate the solution and compile the report for oral presentation.

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	2	3	1	3	3	3	3
CO2	1	3	3	3	3	2	3	3	3	2	3	3	3	3
CO3	3	3	2	1	3	2	2	2	3	3	3	3	3	3

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

Description:

- Project work should be done batch wise with the strength of maximum four members per team.

- Identify the thrust area and choose the title of the project.

- All must be present for all the three project reviews as per the schedule.

- Develop an innovative prototype or simulation model.

- Prepare a comprehensive project report for final viva-voce examination

Total: 90 Hours

U19EE918   **RENEWABLE ENERGY SOURCES**   **3 0 0 3**

COURSE OUTCOMES

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

1. Describe the global power demand scenario and the prospects of renewable energy sources in meeting this demand
2. Explain the principle of operation and the applications of solar thermal and electrical systems.
3. Illustrate the power generation technologies of wind energy conversion system and biomass energy system
4. Describe the principle of operation and prospects of power generation from geo-thermal, tidal, wave energy and ocean thermal energy systems.
5. Outline the emerging energy generation systems like MHD, thermal hybrid and fuel cell applications.

<table>
<tr><td colspan="14">CO / PO, PSO Mapping
(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak</td></tr>
<tr><td colspan="14"></td></tr>
<tr><td rowspan="2">COs</td><td colspan="13">Programme Outcomes (POs) and Programme Specific Outcome (PSOs)</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>P09</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td></tr>
<tr><td>CO1</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO2</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO4</td><td>3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO5</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td>3</td><td></td><td></td><td></td><td></td><td>3</td><td>3</td><td>3</td></tr>
</table>

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-

Solar thermal: applications- cooking, distillation, water heating, greenhouse, power generation- Solar Photovoltaic: Principles and applications- solar pumping, solar power generation.

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.

U19EE928   **ELECTRIC VEHICLE TECHNOLOGY**   **3 0 0 3**

COURSE OUTCOMES
At the end of this course the students will be able to,
1. Explain the need for electric and hybrid vehicles fundamentals.
2. Discuss the various types of motor control design features of Electric vehicle.
3. Describe the energy sources of types of batteries and Battery Management System (BMS).
4. Illustrate the design of various considerations of electric vehicle.
5. Explain the hybrid design vehicle technology and fuel cells.

	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	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	1	3	3	3	3	3	1	3	3	3	2
CO2	3	1	2	1	3	3	3	3	3	1	3	3	3	2
CO3	3	3	3	3	3	3	3	2	3	1	3	3	3	2
CO4	3	3	3	3	3	2	3	2	3	1	3	3	3	2
CO5	3	1	2	1	3	3	3	3	3	1	3	3	3	2

UNIT I   INTRODUCTION   9
Need for electric and hybrid vehicles, Electric vehicle layouts, Components of electric vehicle. Cost and emissions, End of life, Comparative study of electric and hybrid vehicles, Limitations of electric vehicles, Study on efficiency of electrical vehicles, Comparison of ICE and EV efficiencies and Cost of ownership over specific distance, Electric vehicle terminology, Petroleum resources, Global warming.

UNIT II   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 – DC and AC motor speed controllers, *Field Oriented Control (FOC) control and flux weakening introduction, different types of magnets and performance,* Power rating design, Electric drive trains, Selection and sizing of motor.

UNIT III   ENERGY SOURCES AND BATTERY MANAGEMENT SYSTEM (BMS)   9
Energy Sources: Battery parameters – Power requirement of electric vehicles – Different types of batteries cell types (Lead Acid / Li / NiMH) Battery charging and discharging calculation, Battery Current Rating, hazards arising from batteries and other safety standards, Disposal of used batteries, Solar, wind.
Battery Management System (BMS): Need of BMS, Rule based control and optimization based control, Software-based high level supervisory control.

UNIT IV   STRUCTURE OF ELECTRIC VEHICLES   9
Aerodynamic – Rolling resistance – Transmission efficiency – Grading Resistance – Vehicle mass – Electric vehicle chassis and Body design considerations – Heating and cooling systems – Controllers – Power steering – Power, Torque RPM of motor Calculation from Vehicle Performance, Whr/km Calculation.

UNIT V   HYBRID VEHICLES AND FUEL CELL   9

Hybrid electric vehicles classification: Micro, Mild, Full – EV Layout.

Architecture: Series, Parallel and Series-Parallel, Advantages and Disadvantages, Hybrid-Propulsion systems and components – Regenerative braking – Economy.

Fuel cell: Introduction, Technologies and Types, Obstacles, Operation principles, Potential and I-V curve.

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

TEXT BOOKS

1. Wei Liu, "Hybrid Electric Vehicle System Modelling and Control", Second Edition, John Wiley & Sons, Inc., 2017.

2. Tom Denton, "Electric and Hybrid Vehicles", CRC Press, Second Edition, 2020.

REFERENCES

1. Simona , "Hybrid Electric Vehicles", First Edition, Springer India , 2019

2. Mehrdad Ehsani, Yimin Gao, Stefano Longo and Kambiz Ebrahimi , "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles", Third Edition, CRC Press,2018.

3. Teresa Donateo, "Hybrid Electric Vehicles", First Edition, Intech Open Limited ,2017

4. Gianfranco Pistoia, "Electric and Hybrid Vehicles Power Sources, Models, Sustainability, Infrastructure and the Market", Elsevier Publications, 2010.

COURSE OUTCOMES

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

1. Analyse the behaviour of various distribution system components and illumination schemes.
2. Calculate panel load scheduling for a building and implement with Revit architecture.
3. Evaluate heating/cooling load calculations for a building and implement with Revit architecture.

	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	2	3	3	2	2		2	3	3	2	2
CO2	3	2	3	2	3	3	2	2		2	3	3	2	2
CO3	3	2	3	2	3	3	2	2		2	3	3	2	2

THEORY COMPONENTS: **15**

Fundamental components of Revit architecture – Preparation of structural file for electrical designing – Generating single line diagram – Lighting design and lighting scheme calculations – power circuit components and design – load calculations - panel scheduling – tagging of components – electrical system coordination in Revit architecture – heating/cooling load calculations in Revit architecture.

PRACTICAL COMPONENTS: **60**

1. Create Revit models by linking and setting up the architecture and structural file.
2. Develop copy/monitor levels for an electrical layout.
3. Generate visibility graphics settings for designing an electrical design layout.
4. Construct space for an electrical system model in Revit architecture.
5. Generate single line diagram for building..
6. Design lighting circuits for a building.
7. Design power circuits for a building.
8. Develop distribution system for an electrical load.
9. Calculate panel load scheduling for an electrical system layout.
10. Implement addition and modification of tags for a given layout.
11. Verify coordination of electrical system design with HVAC/plumbing.
12. Calculate Heating/Cooling Load for a Room using Revit Architecture.

Lecture: 15, Tutorial: 00, Practical: 60, Total: 75 Hours

TEXT BOOK

1. M.L. Soni, Gupta, Bhatnagar, Chakrabarthy, "A Text book on Power Systems Engineering", Dhanpat Rai & Sons, 2007.
2. J.B.Gupta, "Utilization of Electric Power and Electric Traction", S.K.Kataria & Sons, 2012.

REFERENCE BOOKS

1. V.K.Metha, Rohit Metha, "Principles of Electrical Engineering and Electronics", Second edition, S.Chand Publication, 2015.
2. B.L. Theraja and A. K. Theraja, "A Text Book of Electrical Technology", S.Chand Publication, Vol 2, 2014.
3. AUTOCAD reference manual.
4. Revit architecture reference manual.

Course Outcome: At the end of the course, the students will be able to
1. Communicate confidently and appropriately in professional environment
2. Demonstrate active interpersonal skill knowledge to excel in their career
3. Use language efficiently to write winning proposals and effective reports, and to face interviews, participate in group discussions and present speeches.

	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	2	2
CO2	-	-	-	-	3	2	2	-	3	3	-	3	2	2
CO3	-	-	-	-	3	2	2	-	3	3	-	3	2	2

1. **Listening Comprehension**: listening to audio files and sequencing of sentences – Filling in the blanks – Listening comprehension.

2. **Reading Comprehension**: Filling in the blanks – Cloze exercises – Vocabulary building – Reading and answering questions.

3. **Speaking:** Correct Pronunciation – Common errors in spoken English.

   Conversations: Face to Face Conversation – Telephone conversation – Role play activities (Students take on roles and engage in conversation)

4. Making presentations: introducing oneself – introducing a topic – answering questions – individual presentation practice

5. Creating effective PPTs – presenting the visuals effectively

6. Using appropriate body language in professional contexts – gestures, facial expressions, etc.

7. Preparing job applications - writing covering letter and résumé

8. Applying for jobs online - email etiquette

9. Participating in group discussions – understanding group dynamics - brainstorming the topic – mock GD

10. Training in soft skills - persuasive skills – people skills - questioning and clarifying skills

11. Writing Project proposals: collecting, analyzing and interpreting data / drafting the final report

12. Attending job interviews – answering questions confidently

13. Interview etiquette – dress code – body language – mock interview

TOTAL: 30 Hours

Dr. M.RENUGA,
Professor & Head,
Department of Humanities & Languages,
Sona College of Technology,
SALEM - 636 00..

REFERENCE BOOKS:

1. English and Soft Skills, Dhanavel, S.P. Hyderabad: Orient Black Swan Ltd. 2010.
2. How to Prepare for Group Discussion and Interview, Corneilssen, Joep. New Delhi: Tata-McGraw-Hill, 2009.
3. Group Discussion and Team Building D'Abreo, Desmond A. Mumbai: Better yourself books, 2004.
4. The ACE of Soft Skills, Ramesh, Gopalswamy, and Mahadevan Ramesh. New Delhi: Pearson, 2010.
5. Corporate Soft Skills, Gulati, Sarvesh. New Delhi: Rupa and Co. 2006.
6. Presentation Skills for Students, Van Emden, Joan, and Lucinda Becker. New York: Palgrave Macmillan, 2004.
7. Dictionary of Common Errors, Turton, N.D and Heaton, J.B. Addision Wesley Longman Ltd., Indian reprint 1998.

EXTENSIVE READING

1. The 7 Habits of Highly Effective People, Covey, Stephen R. New York: Free Press, 1989.
2. The Professional, Bagchi, Subroto. New Delhi: Penguin Books India, 2009.

Dr. M.RENUGA,
Professor & Head,
Department of Humanities & Languages,
a College of Technology,
SALEM - 8.

Semester –VI	U19GE601-SOFT SKILLS AND APTITUDE – IV (Common to All 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. Functions and Polynomials b. Clocks and Calendars c. Data Sufficiency: Introductions, 3 Options Data Sufficiency, 4 Options Data Sufficiency and 5 Options Data Sufficiency. d. Logical reasoning: Cubes, Non Verbal reasoning and Symbol based Reasoning. e. Decision making table and Flowchart Campus recruitment papers: Solving of previous year questions paper of all major recruiters f. Miscellaneous: Cognitive gaming Puzzles-(Picture, Word and Number based), IQ Puzzles, Calculation Techniques and Time Management Strategies. g. Trigonometry.- Concepts
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 verbal questions

06/01/2023

Dr.S.Anita

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

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.

U19EE1002   **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.

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.

U19EE1003   INNOVATION, IPR AND ENTREPRENEURSHIP DEVELOPMENT   3 0 0 3

COURSE OUTCOMES
At the end of this course the students will be able to,
1. Acquire the knowledge for establishment of an enterprise and management,
2. Derive the innovative ideas, right approach to the problem and arrive solution for problem with IPR and its legal aspects.
3. Prepare the project report preparation and assessment of Business.
4. Acquire the knowledge on costing, Techno-economic aspects, find out the sources of finance and opportunities in business.
5. Identify the support system for Entrepreneurs by Government and venture capitals.

COs														
	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

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

Programme Outcomes (POs) and Programme Specific Outcome (PSOs)

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.

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.

U19EE1004   **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.

<table>
<tr><td colspan="15">CO / PO, PSO Mapping
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<tr><td rowspan="2">COs</td><td colspan="14">Programme Outcomes (POs) and Programme Specific Outcome (PSOs)</td></tr>
<tr><td>PO1</td><td>PO2</td><td>PO3</td><td>PO4</td><td>PO5</td><td>PO6</td><td>PO7</td><td>PO8</td><td>P09</td><td>PO10</td><td>PO11</td><td>PO12</td><td>PSO1</td><td>PSO2</td></tr>
<tr><td>CO1</td><td>3</td><td>2</td><td></td><td>2</td><td></td><td></td><td></td><td></td><td>2</td><td></td><td>2</td><td>3</td><td>3</td><td>3</td></tr>
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<tr><td>CO3</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>3</td><td>1</td><td>2</td><td></td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO4</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>3</td><td>1</td><td>2</td><td></td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
<tr><td>CO5</td><td>3</td><td>3</td><td>3</td><td>2</td><td>2</td><td>3</td><td>3</td><td>1</td><td>2</td><td></td><td>3</td><td>3</td><td>3</td><td>3</td></tr>
</table>

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.

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.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VII Regulations 2019
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Theory					
1	U19GE701	Professional Ethics and Human Values	3	0	0	3	45
2	U19EE916	**Professional Elective** – Power System Operation and Control	3	0	0	3	45
3	U19EE919	**Professional Elective** – Power Quality Engineering	3	0	0	3	45
4	U19EE923	**Professional Elective** – Electrical Energy Conservation and Auditing	3	0	0	3	45
5	-	**Professional Elective ***	3	0	0	3	45
6	U19BM1001	**Open Elective** - Hospital Management	3	0	0	3	45
	U19BM1002	**Open Elective** - Basic Life Support					
	U19CE1004	**Open Elective** - Disaster Management					
	U19CS1002	**Open Elective** - Cloud Computing					
	U19EC1006	**Open Elective** - Mobile Technology and its Applications					
	U19EE1003	**Open Elective** - Innovation, IPR and Entrepreneurship Development					
	U19MC1004	**Open Elective** - Fundamentals of Robotics					
	U19ME1002	**Open Elective** - Industrial Safety					
	U19ME1004	**Open Elective** - Renewable Energy Sources					
		Practical					
7	U19EE701	Power Systems Laboratory	0	0	4	2	60
					Total Credits	20	

*All 127 Students have completed 3 one credit industry oriented courses during their summer vacation (dropped one professional elective course).

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, Seventh Semester BE EEE Students and Staff, COE

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. Analyze and practice engineering ethics in their profession.
3. Apply codes of ethics in the context of social experimentation.
4. Explore various safety issues and ethical responsibilities of an engineer.
5. Adopt ethical practices pertaining to 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	2	1	1	1	1	2	3	3	3	2	2	3	2	2
CO2	2	1	1	1	2	2	3	3	3	3	3	3	2	2
CO3	2	1	3	1	2	3	3	3	3	3	3	3	2	2
CO4	2	1	3	1	1	3	3	3	3	2	3	3	2	2
CO5	2	1	3	1	1	3	3	3	3	3	3	3	2	2

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 – Introduction to Yoga and meditation for professional excellence and stress management.

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- Self Interest- Customs and Religion-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 – Industrial Standards- 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 –Respect for Authority- Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Importance and consequences of whistle blowing - Professional Rights – Employee Rights – Intellectual Property Rights (IPR) and its components– Discrimination.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of Electrical
Sona College of Technology
Salem-636 005. Tamil Nadu.

Multinational Corporations – Environmental Ethics – Computer Ethics and Internet- Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Participation in professional societies- –Code of Conduct – Corporate Social Responsibility.

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", Cengage Learning, 2009.

4. R.Subramanian, "Professional Ethics",Oxford University Press , Second Edition, 2017.

S. Padma
15.7.23
Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

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	3	3			2					3	3	3
CO2	3	2	3	3			2					3	3	3
CO3	3	2	3	3			2					3	3	3
CO4	3	2	3	3	3	2	3					3	3	3
CO5	3	2	3	3	3	2	3					3	3	3

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

Definition of Harmonics - Harmonic Number (h), Odd and Even Order Harmonics - Harmonic Phase Rotation and Phase Angle Relationship - Causes of Voltage and Current Harmonics - Individual and Total Harmonic Distortion - Harmonic Signatures, Fluorescent Lighting, Adjustable Speed Drives, Personal Computer and Monitor - Effect of Harmonics on Power System Devices, Transformers, AC Motors, Capacitor Banks, Cables, Busways, Protective Devices.

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 - Guidelines for Harmonic Voltage and Current Limitation.

Need for power quality monitoring, evolution of power quality monitoring, brief introduction to power quality measurement tools – planning, conducting and analysing power quality survey - Power quality monitoring and the Internet - Future applications.

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

TEXT BOOKS:

1. Roger C. Dugan, Mark F. Mc Granaghan and H.Wayne Beaty, "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.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

COURSE OUTCOMES

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

1. Explain the load characteristics of power systems.
2. Explain Economic dispatch and Unit Commitment solutions to power systems.
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 different 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	2		2					2	2	3	2
CO2	3	3		3	2		2	2		2		2	2	3
CO3	3	3	2	3	3			2	2	2	2	2	2	3
CO4	3	2		3	2	2		2		2		2	2	3
CO5	3	2	2	2	2	2	2	2	2		2	3	3	2

UNIT-I   INTRODUCTION   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   9

Economic dispatch – Input-output curve of a generating unit - Optimum economic dispatch (lossless) - Economic load distribution (Including losses)- Unit Commitment – Introduction - Statement of Unit Commitment (UC) problem - constraints in UC: spinning reserve, thermal unit constraints, hydro constraints, fuel constraints and other constraints - Priority-list method.

UNIT-III   REAL POWER - FREQUENCY CONTROL   9

Fundamentals of speed governing mechanisms and modeling - 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 modelling - Static analysis for uncontrolled case.

UNIT-IV   REACTIVE POWER–VOLTAGECONTROL   9

Excitation systems - Introduction - Types of excitation systems - DC, AC, Static - Recent developments and future trends – Modelling of typical excitation system-Methods of voltage control - Shunt capacitors, series capacitors, shunt reactors – Comparison- Synchronous condenser – Tap changing transformer.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu

Introduction - Energy management system (EMS) - Energy control centre – 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: 45, Tutorial: 0, Total: 45Hours

TEXT BOOKS:

1. Olle I. Elgerd, "Electric Energy and System Theory – An Introduction", Tata McGraw Hill Publishing Company, New Delhi. 2nd edition 2017.

2. Allen J.Wood and 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. Jeraldin Ahila, "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. Prabha Kundur, "Power System Stability and Control", McGraw Hill Pub. Co., 1994.

S. Padma
15.7.23

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

U19EE923   ELECTRICAL ENERGY CONSERVATION AND AUDITING   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.

COs	CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
	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	-	-	-	-	2	3	2
CO2	3	3	3	3	3	3	2	-	-	-	-	2	3	2
CO3	3	3	3	3	3	3	3	-	-	-	-	2	3	2
CO4	3	3	3	3	3	3	3	-	-	-	-	2	3	2
CO5	3	3	3	3	3	3	3	-	-	-	-	2	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 labelling –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.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE
Sona College of Technology
Salem-636 005, Tamil Nadu

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: 0; Total: 45Hours

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.

REFERENCES:

1. Chakrabarti A, "Energy Engineering and Management", PHI, 2011.

2. Murphy W R and McKay G, "Energy Management", Elsevier, 2009.

3. Rajput R K, "Utilization of Electrical Power", Lakshmi Publications, 2006.

4. Frank Kreith and D. Yogi Goswami, "Energy Management and Conservation Hand book", CRC Press 2007.

S. Padma
15.7.23

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

COURSE OUTCOMES:

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

1. Evaluate line parameters, network matrices, power flow solutions and symmetrical fault.

2. Solve problems in Unsymmetrical fault, stability; Characteristics of MCB & MCCB and bus bar Protection using relays.

3. Develop parallel operation of alternators using synchronization relay; Examine various parameters of relays and testing of transformer oil break down voltage.

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	1	1	3	2	2		2	2	2	3	2	2
CO2	2	2	2	1	3	2	1		2	2	2	3	3	2
CO3	2	2	1	1	3	2	2		2	2	2	3	3	2

LIST OF EXPERIMENTS

1. Computation of line parameters.

2. Formation of network matrices (Y_{bus} and Z_{bus}).

3. Power Flow Analysis: Solution of Power Flow Using Gauss-Seidal Method.

4. Symmetrical fault analysis.

5. Unsymmetrical fault analysis.

6. Transient and small signal stability Analysis: Single Machine Infinite Bus System.

7. Time line characteristics of MCB and MCCB.

8. Stimulation of bus bar protection using differential relay.

9. Parallel operation of alternators using synchronization relay.

10. Testing of transformer oil break down voltage (BDV)

11. Determination of various parameters of contactors and relays.

12. Stimulate a fault and analyse the functions of power system using relay.

Total: 60 Hours

S. Padma
15.7.23

Dr. S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

15.07.2023   Electrical and Electronics Engineering   Regulations - 2019

U19BM1001   **HOSPITAL MANAGEMENT**   **L   T   P   C**
                                                                     3   0   0   3

COURSE OUTCOMES:

At the end of the course, the students will be able to,
- Describe the basics of Hospital Management.
- Illustrate the knowledge of Human resource management and marketing in hospitals.
- Apply various Quantitative methods in healthcare management.
- Amalgamate their knowledge in Hospital information system and supportive services.
- Explain the quality and safety aspects in Hospital.

	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**	**PO9**	**PO10**	**PO11**	**PO 12**	**PSO1**	**PSO2**	**PSO3**
CO1	-	-	3	-	2	3	3	-	-	-	-	1	-	-	3
CO2	-	-	3	-	2	3	3	-	-	-	-	1	-	-	3
CO3	-	-	3	-		3	3	-	-	-	-	1	-	-	3
CO4	-	-	3	-	3	2	-	-	-	-	-	1	-	-	3
CO5	-	-	3	-	-	3	3	3	-	-	-	1	-	-	3

UNIT I   INTRODUCTION TO HOSPITAL ADMINISTRATION   9

Distinction between Hospital and Industry, Challenges in Hospital Administration, HospitalPlanning, Equipment Planning, Functional Planning, Current Issues in Hospital Management, Role of Manager, Leadership, Motivation, Organizational behaviour, Strategic planning, Ethics and Law, Fraud and abuse.

UNIT II   HUMAN RESOURCE MANAGEMENT AND MARKETING   9

Principles of HRM, Functions of HRM, Profile of HRD Manager, Tools of HRD, Human Resource Inventory, Manpower Planning. Different Departments of Hospital, Recruitment, Selection, Training Guidelines, Methods of Training, Leadership grooming and Training, Promotion, Transfer.

UNIT III   QUANTITATIVE METHODS IN HEALTHCARE MANAGEMENT   9

Introduction to quantitative decision-making methods in healthcare management, Forecasting, Decision making in healthcare facilities, Facility location, Facility layout, Reengineering, Staffing, Scheduling, Productivity, Resource allocation, Supply chain and inventory management, Quality Control, Project Management, Queuing models and capacity planning.

UNIT IV   HOSPITAL INFORMATION SYSTEM AND SUPPORTIVE SERVICES 9

Clinical Information Systems, Administrative Information Systems, Support Service Technical Information Systems, Medical Records Department, Central Sterilization and Supply Department – Pharmacy, Food Services, Laundry Services, Telemedicine.

UNIT V   QUALITY AND SAFETY ASPECTS IN HOSPITAL MANAGEMENT   9

Quality system, Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004. Features of ISO 9001, ISO 14000, Environment Management Systems. NABA, JCI, NABL. Security, Loss Prevention, Fire Safety, Alarm System, Safety Rules.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.C. Goyal, Hospital Administration and Human Resource Management, PHI, 4th Edition, 2006.
2. G.D. Kunders, Hospitals – Facilities Planning and Management, TMH, New Delhi, 5th Reprint, 2007.

REFERENCE BOOKS:

1. Sharon B. Buchbinder and Nancy H. Shanks, Introduction to Healthcare Management, Jones and Bartlett Learning, 2017
2. Blane, David, Brunner, Health and SOCIAL Organization: Towards a Health Policy for the 21st Century, Eric Calrendon Press, 2002.
3. Yasar A. Ozcan, Quantitative Methods in Healthcare management, Jossey Bass- John Wiley and Sons, 2009.

Chairperson

BOS-BME

Dr.S.PRABAKAR, M.E.,Ph.D.,
Professor and Head
Department of Biomedical Engineering
Sona College of Technology, Salem-5

U19BM1002   **BASIC LIFE SUPPORT**   **L T P C**
                                                              3 0 0 3

COURSE OUTCOMES:

At the end of the course, the students will be able to
- Analyze Various BLS and First Aid Techniques
- Understand the Essentials of Anatomy and Physiology
- Analyze Various BLS techniques for adults.
- Analyze Various BLS techniques for children and infants
- Apply Respiratory techniques and AED in critical conditions

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	PO9	PO10	PO11	PO 12	PSO1	PSO2	PSO3
CO1	3	-	-	-	-	3	1	1	1	-	-	1	-	-	-
CO2	3	-	-	-	-	1	2	1	-	-	-	1	1	-	-
CO3	3	-	-	-	-	1	1	1	1	-	-	1	-	-	-
CO4	3	-	-	-	-	3	2	1	-	-	-	1	-	-	1
CO5	3	-	-	-	-	2	1	1	1	-	-	1	1	-	1

UNIT I   INTRODUCTION TO BASIC LIFE SUPPORT   9
General Concepts of Basic Life Support (BLS)-Chain of survival. BLS Algorithm, First Aid: Basic First Aid techniques- first aid kit, Law, Resuscitation, Top to Toe Assessment, Hygiene and Hand Washing.

UNIT II   ESSENTIALS OF ANATOMY AND PHYSIOLOGY OF HUMAN BODY
                                                                              9
Levels of Organization-Chemicals-Cells-Tissues-Organs-Organ Systems, Metabolism and Homeostasis, Terminology and General Plan of the Body-Case Studies.

UNIT III   ADULT BASIC LIFE SUPPORT   9
BLS for adults: Adult BLS Algorithm, CPR, One Rescuer and Two Rescuer BLS for Adults- Adult Mouth-to-Mask Ventilation, Adult Bag-Mask Ventilation, Self-Assessment for Adult BLS

UNIT IV   PAEDIATRIC BASIC LIFE SUPPORT   9
BLS for children: BLS Algorithm children, One Rescuer and Two Rescuer BLS for children, Child Ventilation. BLS for Infants: One Rescuer and Two Rescuer BLS for infants-Case Studies.

UNIT V AUTOMATED EXTERNAL DEFIBRILLATOR AND FOREIGN BODY AIRWAY OBSTRUCTION   9
AED for Adults, AED for Children and Infant, Self-Assessment for AED, FBAO- Respiration, Difficult Breathing, Drowning, Strangulation and Hanging, Chocking, Suffocation - Airway Management-Chest Discomforts-Case Studies.

                                                              TOTAL PERIODS:45

REFERENCES:

1. Dr. Karl Disque, Basic Life Support Provider Handbook, Satori Continuum Publishing, USA, 2021.
2. INDIAN FIRST AID MANUAL – 7th Edition, St. John Ambulance Association (India) – Indian Red Cross Society National Headquarters, New Delhi, 2016.
3. Basic Life Support Training Manual, 1st Edition, Published by in Medical Development Division, Ministry of Health Malaysia, Malaysia in December 2017.
4. Valerie C. Scanlon, Tina Sanders, Essentials of Anatomy and Physiology, 5th Edition, F. A. Davis Company.

Chairperson
BOS-BME

Dr.S.PRABAKAR, M.E.,Ph.D.,
Professor and Head
Department of Biomedical Engineering
Sona College of Technology, Salem-5

PREAMBLE
To
Disaster Management

We observe that during the last three decades, disaster both natural and man-made occur frequently and their impact on life, live hoods, natural resources, property, infrastructure and facilities is very severe. Though hazards and disasters could not be prevents, by taking preparedness activities, we can minimize their harmful effects.

This course on disaster management emphasizes the need for disaster preparedness rather than emergency response. It throws light on risk assessments, risk resolution and risk sharing and transfer. The importance of community participation, building self-reliant resilient communities and awareness creation is highlights in this course. Application of modern communication tools, remote sensing and GIS technologies in search and resource operations and stream lining activities is elaborated. Way and means of financial arrangements to carry out disaster management activities are discussed.

The physics of earthquake and tsunamis is explained. Safety measures against tsunamis are described. The functioning and tsunamis warning system is described.

COURSE CODE	COURSE NAME	L	T	P	C
U19CE1004	DISASTER MANAGEMENT	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:

1.	Provide knowledge on the types and effects of disasters.
2.	Impart basic knowledge to reduce the impact of disasters.
3.	Understand the relationship and impact of development projects on environment and society.
4.	Disseminate the National policy and role played by our country during disasters.
5.	Provide basic knowledge in assessment of disasters with case study.

Course Outcome (s) (COs): At the end of this course, the students will be able to:

CO1	Distinguish various types of disasters, their causes and impacts on environment and society (K2)
CO2	Explain different phases of disaster management cycle (K3)
CO3	Assess vulnerability and prepare disaster risk reduction measures (K4)
CO4	Explain the vulnerability profile of India(K5)
CO5	Prepare hazard zonation maps for all types of hazards (K4)

Knowledge Level: K1 – Remember: K2 – Understand: K3 – Apply: K4 – Analyze: K5 – Evaluate:

CO – PO Mapping

Cos	Pos												PSOs	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	POS
CO1	3	2	3	3	1	2	3	3	3	3	2	3	2	2
CO2	3	2	3	2	3	3	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO5	3	3	3	2	3	3	3	2	2	2	3	3	3	3
CO (Avg)	3	2.6	3	2.6	2.6	2.8	3	2.8	2.8	2.8	2.8	3	2.8	2.8

Correlation Level: 1:Slight (Low) 2:Moderate (Medium) 3:Substantial (High)

UNIT-I	INTRODUCTION TO DISASTERS	9 Hours
	Definitions: Disaster, Hazard, Vulnerability, Resilience, Disaster Preparedness - Classification of Disasters - Causes for Disasters - Impacts of Disasters on Society, Environment, Economics, Politics, Health, etc. - Types of Vulnerability - The Sphere Project	

UNIT-II	APPROACHES TO DISASTER RISK REDUCTION	9 Hours
	Phases of Disaster Management Cycle - Culture of safety, prevention, mitigation, and preparedness - Community-based Disaster Risk Reduction - Structural and Non-structural mitigation measures	

UNIT-III	INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT	9 Hours

Linkage between Development and Disasters -Impact of Development Projects on Environment and Society - Climate Change Adaptation - IPCC - India's Participation - Relevance of Indigenous Knowledge, Appropriate Technology, and Local Resources

UNIT-IV	DISASTER RISK MANAGEMENT IN INDIA	9 Hours

Hazards-Vulnerability Profile of India - Components of Disaster Relief: Water, Sanitation, Food, Shelter, Health, etc. - National Policy and Disaster Management - Institutional Framework for Disaster Management in India - Role of NGOs in Disaster Risk Reduction - Role of Armed Forces during Disasters

UNIT-V	DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD WORKS	9 Hours

Application of Information Technology, Remote Sensing Technology, and Geographic Information System in Disaster Risk Reduction - Case Studies on Landslide Hazard Zonation, Seismic Assessment of Buildings and Infrastructures, Drought Assessment, Coastal Flooding Assessment, Storm Surge Assessment, Fluvial and Pluvial Floods Assessment, Forest Fires Assessment

	TOTAL: 45 Hours

TEXT BOOKS:

1.	Singhal J.P. "Disaster Management", Laxmi Publications, 2010.
2.	Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012.
3.	Pardeep Sahni and Madhavi Malalgoda Ariyabandu, "Disaster Risk Reduction in South Asia", PHI Learning Private Limited, Delhi- 110092, 2017
4.	Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
5.	Kapur Anu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

REFERENCES:

1.	Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005
2.	Government of India, National Disaster Management Policy,2009.
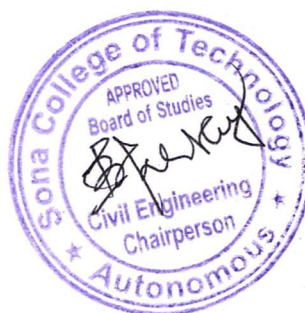
COURSE OUTCOMES:

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

1. Provide an overview of cloud computing
2. Explain the various tasks in developing cloud services
3. Analyze the provision of cloud computing services to different users
4. Configure the various cloud services according to the environment.
5. Analyze various ways to collaborate online

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	1	1	2	1	2	0	1	0	2	1	2	2	2
CO2	2	1	2	3	3	2	0	1	1	2	2	3	3	3
CO3	2	1	3	3	3	2	0	1	0	3	3	2	3	3
CO4	2	1	2	3	3	2	0	1	0	2	3	3	3	3
CO5	2	2	3	3	3	1	0	1	0	2	3	2	3	3

UNIT I Understanding Cloud Computing   6

Cloud Computing – History of Cloud Computing – Cloud Architecture – Cloud Storage – Why Cloud Computing Matters – Advantages of Cloud Computing – Disadvantages of Cloud Computing – Companies in the Cloud Today – Cloud Services

UNIT II Developing Cloud Services   10

Web-Based Application – Pros and Cons of Cloud Service Development – Types of Cloud Service Development – Software as a Service – Platform as a Service – Web Services – On-Demand Computing – Discovering Cloud Services Development Services and Tools – Amazon – Google App Engine – IBM Clouds

UNIT III Cloud Computing for Everyone   10

Centralizing Email Communications – Collaborating on Schedules – Collaborating on To-Do Lists – Collaborating Contact Lists – Cloud Computing for the Community – Collaborating on Group Projects and Events – Cloud Computing for the Corporation

UNIT IV Using Cloud Services   10

Collaborating on Calendars, Schedules and Task Management – Exploring Online Calendar Applications- Collaborating on Contact Management – Collaborating on Project Management – Collaborating on Word Processing - Collaborating on Spread sheets- Collaborating on Databases – Storing and Sharing Files

05.07.2023   Regulation 2019

Dr.B. SATHIYABHAMA, B.E.,M.Tech.,Ph.D.
PROFESSOR & HEAD,
Dept. of Computer Science and Engineering
SONA COLLEGE OF TECHNOLOGY
SALEM-636 005

Collaborating via Web-Based Communication Tools – Evaluating Web Mail Services – Evaluating Web Conference Tools – Collaborating via Social Networks and Groupware – Collaborating via Blogs and Wikis

Total:45 hours

TEXT BOOK:

1. Michael Miller, Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online, Que Publishing, August 2008.

REFERENCE BOOK:

1. Haley Beard, Cloud Computing Best Practices for Managing and Measuring Processes for On-demand Computing, Applications and Data Centers in the Cloud with SLAs, Emereo Pty Limited, July 2008.

Dr.B. SATHIYABHAMA, B.E.,M.Tech.,Ph.D.
PROFESSOR & HEAD,
Dept. of Computer Science and Engineering
SONA COLLEGE OF TECHNOLOGY
S A L E M - 636 005

Course Outcomes

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

1) Analyze the 1G and 2G Technologies.

2) Explain the 2.5G evolutions

3) Analyze the principles of 3G and UMTS

4) Analyze the evolutions of 4G.

5) Summarize the various wireless security applications and solve the mobile phone faults.

COs	CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak
	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		1		1	1	3		
CO2	3	3	3	3	3	3		1		1	1	3		
CO3	3	3	3	3	3	3		1		1	1	3		
CO4	3	3	3	3	3	3		1		1	1	3		
CO5	3	3	3	3	3	3		1		1	1	3		

Unit I   1G and 2G   9

First Generation (1G): 1G Systems – General 1G System Architecture – Generic MTSO Configuration – Generic Cell Site Configuration – Call Setup Scenarios – Handoff – Frequency Reuse – Spectrum Allocation – Channel Band Plan
Second generation (2G): Enhancements over 1G Systems – Integration with Existing 1G Systems – GSM - iDEN – CDPD

Unit II   2.5G Generation   9

Enhancements over 2G – Technology Platforms – General Packet Radio Service (GPRS) – Enhanced Data Rates for Global Evolution (EDGE) – High-Speed Circuit Switched Data (HSCSD) – CDMA2000 (1XRTT) – WAP-Migration Path from 2G to 2.5G to 3G..

05/07/23
Dr.R.S.SABEENIAN, M.E.,MBA.,Ph.D.,FIETE,
Professor and Head of Department
Electronics and Communication Engineering
SONA COLLEGE OF TECHNOLOGY,
Salem - 636 005. Tamilnadu, India.

05.07.2023   Regulations 2019

Unit III   3G Generation

Introduction – Universal Mobile Telecommunications Service (UMTS), UMTS Basics, The UTRAN Architecture, Handover, UMTS Services – The UMTS Air Interface – Overview of the 3GPP Network Architecture – Overview CDMA2000 – Commonality Between WCDMA/CDMA2000/CDM

Unit IV   4G and Beyond   9

Introduction to LTE - Network architectures – EPC – E-UTRAN architecture – Mobility management – Resource management – Services – Channel – logical and transport channel mapping – downlink/uplink data transfer – MAC control element – PDU packet formats – scheduling services – random access procedure – Objectives of 5G-Architecture – Features and benefits.

Unit V   Wireless Security and Mobile Phone service   9

Introduction – Fingerprint – Classification of major security attacks against RFID systems – GSM Security – Barcode scanner technology features and applications – QR code – BAR code – OTP – AirDrop.
Mobile phone Service: Parts in the mobile phones -Mobile phones assembling and disassembling –motherboard - Mobile Operating Systems - Fault finding - Advanced troubleshooting techniques.

TOTAL : 45 HOURS

Text Book

1) Clint Smith,P.E, Dannel Collins, "3G Wireless Networks" 2nd edition, Tata McGraw-Hill, 2008.
2) Vijay K.Garg, "Wireless Network Evolution- 2G & 3G" Pearson, 2013.

References

1) T.S Rapp port, "Wireless Communications" Principles and Practice, Second Edition, Pearson Education/ Prentice Hall of India, Third Indian Reprint, 2013.
2) JochenH.Schiller, "Mobile Communications", 2/e, Pearson, 2014
3) SassanAhmadi, "LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies", Elsevier, 2014

Dr.R.S.SABEENIAN, M.E.,MBA.,Ph.D.,FIETE,
Professor and Head of Department
Electronics and Communication Engineering
SONA COLLEGE OF TECHNOLOG
Salem-636 005. Tamilnadu, India.

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.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

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.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

UNIT V   SUPPORT TO ENTREPRENEURS

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.

Dr.S.PADMA, M.E., Ph.D.,
Professor and Head,
Department of EEE,
Sona College of Technology
Salem-636 005. Tamil Nadu.

Department of Mechatronics Engineering

Open Elective

U19MC1004	FUNDAMENTALS OF ROBOTICS	L	T	P	C
		3	0	0	3

Course Outcomes

After successful completion of this course, the students should be able to

CO1:	Understand the basic robotic concepts
CO2:	Select the suitable drive system for robot application
CO3:	Select the suitable sensors and grippers for the respective application
CO4:	Develop VAL Programming for simple applications
CO5:	Illustrate the robotic application in various sectors

Pre-requisite

NIL

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	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3		2			3	2		3		3	3	3	3
CO2	2	2	2		3				3		2	3	2	3
CO3	3	2	2		3				3		2	3	3	3
CO4	3	3	3	3	3				3		2	3	3	2
CO5	3	3	3	3	3	3	3		3		2	3	3	

Course Assessment methods

Direct		Indirect
Internal test I (8)	Online test (6)	
Internal test II (8)	Attendance (5)	Course end survey
Internal test III (8)	End semester Examination (60)	
Assignment/seminar/Quiz (5)		

Unit 01: INTRODUCTION TO ROBOTICS	9 Hours

Introduction to Robotics – History of Robotics – Laws of Robotics - Anatomy of a Robot – Classification of Robots – Robot Configurations - Robot subsystems: Motion subsystem, Recognition subsystem, Control subsystem – Robot Links – Joints in robot –Robot Specifications.

Unit 02: ROBOT MOTIONS AND DRIVE SYSTEMS	9 Hours

Degrees of freedom – DOF associated with arm and body - DOF associated with wrist –Joint Notation scheme- Robot Kinematics – Robot Drive systems – Hydraulic Actuators – Pneumatic actuators – Electrical actuators: Stepper motors, DC motors, Servomotor.

Unit 03: ROBOT SENSORS AND END EFFECTORS	9 Hours

Classification of Robotic sensors and their functions – Tactile sensors – Inductive Proximity sensor – Hall effect sensor – Range sensor –Force ant Torque sensors- Types of end effectors – Mechanical grippers – Vacuum cups – Magnetic grippers – Adhesive grippers – Tools as end effectors.

Unit 04: ROBOT PROGRAMMING	9 Hours

Methods of Robot Programming: Lead through methods, Textual robot Languages – Robot language structure – First generation Languages – Second generation Languages – VAL Programming – Simple Programming examples.

Unit 05: ROBOT APPLICATIONS	9 Hours

Robotics Applications in Manufacturing: Welding Robot, AGVs– Healthcare: Surgery Robot, Therapeutic Robot – Agriculture: Crop Harvesting & Fruit Picking Robot – Defence & Space: Exoskeleton Robot, Telerobotics.

Theory: 45 Hrs	Tutorial: --	Practical: --	Total Hours: 45 Hrs

TEXT BOOKS

1. M.P.Groover, M.Weiss,R.N. Nagal,N.G.Odrey, "Industrial Robotics - Technology, programming and Applications" Tata McGraw-Hill Publication, 2012.

REFERENCES

1. Richard D.Klafter, "Robotics Engineering" PHI Learning Private Limited, 2009.

2. Ganesh S.Hedge, "A text book in Industrial Robotics", Laxmi Publications, 2006.

3. S K Saha, "Introduction to Robotics", Tata McGraw-Hill Publication, 2012.

4. Sathya Ranjan Deb, "Robotics Technology & flexible Automation" Second edition, Tata McGraw-Hill Publication, 2009.

Dr. P. SURESH
Professor and Head
Department of Mechatronics Engineering
SONA COLLEGE OF TECHNOLOGY
Junction Main Road. SALEM - 636 005.
Ph:0427-4099999

COURSE CODE	U19ME1002	L	T	P	C
COURSE NAME	INDUSTRIAL SAFETY	3	-	-	3

Course Outcomes

Upon completion of this course the students will be able to

CO1 Summarize various legal provisions available in safety regulation.

CO2 Analyze industrial environment hygiene and develop precautionary measure to avert occupational diseases.

CO3 Demonstrate the uses of different grades of fire protection systems related with different classes of fire.

CO4 Develop Agronomical study of different work environment in industries.

CO5 Discuss the importance of safety training and its impact on shop floor of factories.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak														
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)														
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	-	-	-	1	3	3	3	2	2	3	3	2	2
CO – 2	3	2	2	1	3	3	3	3	2	2	-	2	2	3
CO – 3	2	3	2	3	3	3	3	3	3	3	3	2	2	3
CO – 4	2	1	3	3	3	3	2	3	1	2	-	2	3	3
CO - 5	1	3	3	3	-	3	-	3	3	3	2	3	2	2

Unit I **BASICS OF SAFETY ENGINEERING & ACTS** L 9 T 0

Evolution of modern safety concept –safety performance monitoring. Acts – factories act – 1948 – Statutory authorities – inspecting staff – Tamilnadu Factories Rules 1950 under Safety and health – environment act – 1986 – Air act 1981, water act 1974 – other acts. Safety in industries – General safety concepts, machine guarding, hazards in metal removing process, welding process, cold and hot working process.

Unit II **OCCUPATIONAL HEALTH AND INDUSTRIAL HYGIENE** L 9 T 0

(Basic concepts, related hazards and exposure limits)

Physical Hazards – Noise, heat, radiation, vibration, recognition of chemical hazards-dust, fumes, mist, vapour, fog, gases. Biological and Ergonomical Hazards-Basic concepts. Occupational Health-Concept and spectrum of health – functional units and activities of occupational health services, pre-employment and post-employment medical examinations – occupational related diseases, levels of prevention of diseases, notifiable occupational diseases. Hazard assessment, procedure, methodology; safety audit, checklist analysis, what-if analysis, safety review, Preliminary Hazard Analysis (PHA), human error analysis, hazard operability studies (HAZOP), safety warning systems.

Unit III   FIRE ENGINEERING AND EXPLOSIVE CONTROL   L 9 T 0

Fire properties of solid, liquid and gases – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – A, B, C, D, E – types of fire extinguishers – Principles of explosion – Explosion Protection – Electrical Safety. Electrical Hazards – Primary and Secondary hazards – concept of earthing – protection systems – fuses, circuit breakers and over load relays – first aid cardiopulmonary resuscitation techniques.

Unit IV   ERGONOMICS   L 9 T 0

Introduction to ergonomics: The focus of ergonomics, ergonomics and its areas of application in the work system, modern ergonomics, and future directions for ergonomics. Anatomy, Posture and Body Mechanics: anatomy of the sprine and pelvis related to posture, posture stability and posture adaptation, low back pain, risk factors for musculoskeletal disorders in the workplace, effectiveness and cost effectiveness. Anthropometry and its uses in ergonomics, Applications of human factors engineering, man as a sensor, man as information processor, man as controller – Ergonomics in IT industries.

Unit V   SAFETY EDUCATION AND TRAINING   L 9 T 0

Importance of training – identification of training needs – training methods – programs, seminars, conferences, competitions –motivation – communication – role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety Training.

Total Number of hours: 45

Learning Resources

Text Books

1. Krishnan N.V., "Safety Management in Industry", Jaico Publishing House, Bombay, 1997.
2. Hand book of "Occupational Safety and Health", National Safety Council, Chicago, 1982.

Reference Books

1. Derek, James, "Fire Prevention Hand Book", Butter Worths and Company, London, 1986.
2. Guidelines for Hazard Evaluation Procedures Centre for Chemical Process Safety, AICHE 1992.
3. The factories Act 1948, Madras Book Agency, Chennai, 2000.
4. Introduction to Ergonomics, R.S. Bridger, Taylor & Francis.

Dr. D. SENTHIL KUMAR, M.E.,Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

COURSE CODE	U19ME1004		L	T	P	C
COURSE NAME	RENEWABLE ENERGY SOURCES		3	-	-	3

Prerequisites- subject: Environmental Sciences.

Course Outcomes

Upon completion of this course the students will be able to

CO1 Discuss the power demand scenario in world level and impact of various renewable energy sources in satisfying power demand.

CO2 Explain the different components and the principle of operation and the application of solar PV system and Bio Mass power generation system.

CO3 Outline in the components and to find the suitability based on the performance of wind energy conversion system, geothermal and hydel power system.

CO4 Describe the components of tidal power generation scheme and wave energy scheme and to discuss the performance of two schemes.

CO5 Compare and contrast the various components and methods of Ocean Energy Conversion Systems.

CO / PO, PSO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak													
Programme Outcomes (POs) and Programme Specific Outcome (PSOs)													
COs, POs PSOs Mapping	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO – 1	3	3	3	-	3	3	3	2	3	3	2	3	3	3
CO – 2	3	-	3	3	3	3	3	-	3	3	3	3	3	3
CO – 3	3	3	3	2	3	3	3	-	3	3	3	3	3	3
CO – 4	3	3	3	2	3	3	3	-	3	3	2	3	3	3
CO – 5	3	2	3	3	3	3	3	2	3	3	2	3	3	3

Unit I   INTRODUCTION   L 9 T 0

World energy use – reserves of energy resources – energy cycle of the earth – environmental aspects of energy Utilization – renewable energy resources and their importance.

Unit II   SOLAR & BIO ENERGY   L 9 T 0

Introduction – extra-terrestrial solar radiation – radiation at ground level – collectors – solar cells – applications of solar energy – Biomass Energy – Introduction – Biomass Conversion – Biogas Production – Ethanol Production – Pyrolysis and Gasification – Direct Combustion – Applications.

Unit III   GEO THERMAL AND HYDRO ENERGY SOURCES   L 9 T 0

Geothermal energy – types of geothermal energy sites, site selection, and geothermal power plants, Hydro energy – Feasibility of small, mini and micro hydro plants: scheme, layout and economics.

Unit IV   WIND AND TIDAL ENERGY   L 9 T 0

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

Introduction – origin of tides – power generation schemes – Wave Energy – basic theory – wave power Devices.

Unit V   OTHER RENEWABLE ENERGY SOURCES   L 9 T 0

Introduction – Open and Closed OTEC cycles – Ocean Currents – Salinity Gradient Devices – Potential impacts of harnessing the different renewable energy resources.

Total Number of hours: 45

Learning Resources

Text Books

1. Twidell John; Weir, Tony, "Renewable energy resources", Taylor & Francis, 2010
2. Godfrey Boyle, "Renewable energy – power for a sustainable future", Oxford University Press, 2010
3. Kothari DP, Singal KC and Rakesh Ranjan, 'Renewable Energy Sources and Emerging Technologies' PHI Learning Pvt. Ltd.2011.
4. S.A. Abbasi and Naseema Abbasi, "Renewable energy sources and their environmental impact", Prentice- Hall of India, 2001.

Reference Books

1. T.N.Veziroglu, Alternative Energy Sources, Vol 5 and 6, McGraw Hill, 1978.
2. G D Rai, "Non-conventional sources of energy", Khanna Publishers, 2002.
3. G D Rai, "Solar energy utilization", Khanna Publishers, 2005.
4. MukundR.Patel, "Wind and Solar Power Systems", CRC Press, Taylor and Francis, 2005.
5. Yogi Goswami, 'Principles of Solar Engineering' CRC Press, 2015, ISBN 10: 1466563788

Dr.D.SENTHIL KUMAR, M.E.,Ph.D
PROFESSOR & HEAD
DEPT. OF MECHANICAL ENGG.
SONA COLLEGE OF TECHNOLOGY
JUNCTION MAIN ROAD, SALEM-5.

U19GE701   PROFESSIONAL ETHICS AND HUMAN VALUES   3 0 0 3

COURSE OUTCOMES:

At the end of the course, the student will be able to
- Identify the core values that shape the ethical behavior of an engineer.
- Analyze and practice engineering ethics in their profession.
- Apply codes of ethics in the context of social experimentation.
- Explore various safety issues and ethical responsibilities of an engineer.
- Adopt ethical practices pertaining to global issues.

	CO / PO Mapping (3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak											
COs	Programme Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12
CO1	2	1	1	1	1	2	3	3	3	2	2	3
CO2	2	1	1	1	2	2	3	3	3	3	3	3
CO3	2	1	3	1	2	3	3	3	3	3	3	3
CO4	2	1	3	1	1	3	3	3	3	2	3	3
CO5	2	1	3	1	1	3	3	3	3	3	3	3

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 – Introduction to Yoga and meditation for professional excellence and stress management.

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- Self Interest- Customs and Religion-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 – Industrial Standards- 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 –Respect for Authority- Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Importance and consequences of whistle blowing - Professional Rights – Employee Rights – Intellectual Property Rights (IPR) and its components– Discrimination.

UNIT-V   GLOBAL ISSUES   9

Multinational Corporations – Environmental Ethics – Computer Ethics and Internet- Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership – Participation in professional societies- –Code of Conduct – Corporate Social Responsibility.

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", Cengage Learning, 2009.
4. R.Subramanian, "Professional Ethics ",Oxford University Press , Second Edition, 2017.

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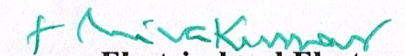Member Secretary-Academic Council
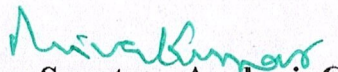SONA COLLEGE OF TECHNOLOGY
SALEM - 636 005.

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VIII Regulations 2019
Branch: Electrical and Electronics Engineering

S. No	Course Code	Course Title	Lecture	Tutorial	Practical	Credit	Total Contact Hours
		Practical					
1	U19EE801	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 28/12/23

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

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

22.12.2023

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