SONA COLLEGE OF TECHNOLOGY, SALEM-5

(An Autonomous Institution)

B.E-Electrical and Electronics Engineering

CURRICULUM and SYLLABI

[For students admitted in 2021-2022]

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	Total Contact Hours
Theory								
1	U19ENG101B	English for Engineers - I	1	0	2	2	HS	45 (15L+30P)
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS	60
3	U19CHE104D	Chemistry for Electrical Engineers	3	0	0	3	BS	45
4	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES	45
5	U19EGR106	Engineering Graphics	2	0	2	3	ES	60 (30L+30P)
Laboratory								
6	U19CHL109	Chemistry Laboratory	0	0	3	1.5	BS	45
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES	30
8	U19WPL112	Workshop Practice	0	0	2	1	ES	30
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC	30
Total Credits						18.5		
Optional Language Elective*								
10	U19OLE1101	French	0	0	2	1	HS	30
11	U19OLE1102	German						30
12	U19OLE1103	Japanese						30

*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, 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	0	0	2	1	HSMC	30
11	U19OLE1202	German						
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

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

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
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

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

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

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
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

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

EEE
V

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

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	noc23-ee124	**NPTEL** - Smart Grid: Basics To Advanced Technologies	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

S. Padma 10.7.23

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

Shivakumar

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

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

Sona College of Technology, Salem
(An Autonomous Institution)
Courses of Study for B.E/B.Tech. Semester VI 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	U19EE923	**Professional Elective-** Electrical Energy Conservation and Auditing	3	0	0	3	45
	U19EE928	**Professional Elective -** Electric Vehicle Technology					
5	U19EE929	**Professional Elective -** Electrical System Design	1	0	4	3	75
6	U19BM1001	**Open Elective-** Hospital Management	3	0	0	3	45
	U19CE1002	**Open Elective-** Municipal Solid Waste Management					
	U19CE1003	**Open Elective-** Energy Efficiency and Green Building					
	U19CS1001	**Open Elective-** Big Data Analytics					
	U19CS1002	**Open Elective-** Cloud Computing					
	U19EC1006	**Open Elective-** Mobile Technology and Its Applications					
	U19EE1003	**Open Elective-** Innovation, IPR and Entrepreneurship Development					
	U19FT1001	**Open Elective-** Fundamentals of Fashion Design					
	U19FT1002	**Open Elective-** Garment Manufacturing Technology					
	U19MC1003	**Open Elective-** Smart Automation					
	U19MC1004	**Open Elective-** Fundamentals of Robotics					
	U19ME1002	**Open Elective-** Industrial Safety					
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** 26.12.23	**Dr.S.R.R.Senthil Kumar**

Copy to:-

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

Sona College of Technology, Salem-5

List of Professional Electives B.E/B.Tech under Regulation 2019

Department:-EEE

S.No	Course Code	Course Name	L	T	P	C
1.	U19EE901	Computer Architecture	3	0	0	3
2.	U19EE902	Introduction to Database Technology	3	0	0	3
3.	U19EE903	Deep Learning	3	0	0	3
4.	U19EE904	Machine Learning	3	0	0	3
5.	U19EE905	Computer Networking	3	0	0	3
6.	U19EE906	Java Programming	3	0	0	3
7.	U19EE907	Big Data Analytics for Electrical Engineers	3	0	0	3
8.	U19EE908	Operating Systems	3	0	0	3
9.	U19EE909	Cyber Security	3	0	0	3
10.	U19EE910	Communication Engineering	3	0	0	3
11.	U19EE911	Electromagnetic Waves	3	0	0	3
12.	U19EE912	Computational Electromagnetics	3	0	0	3
13.	U19EE913	Digital Control Systems	3	0	0	3
14.	U19EE914	Advanced Electrical Drives	3	0	0	3
15.	U19EE915	Flexible AC Transmission Systems	3	0	0	3
16.	U19EE916	Power System Operation and Control	3	0	0	3
17.	U19EE917	Wind and Solar Energy Systems	3	0	0	3
18.	U19EE918	Renewable Energy Sources	3	0	0	3
19.	U19EE919	Power Quality Engineering	3	0	0	3
20.	U19EE920	HVDC Transmission Systems	3	0	0	3
21.	U19EE921	High Voltage Engineering	3	0	0	3
22.	U19EE922	Industrial Electrical Systems	3	0	0	3
23.	U19EE923	Electrical Energy Conservation and Auditing	3	0	0	3
24.	U19EE924	Smart Grid	3	0	0	3
25.	U19EE925	Line-Commutated and Active PWM Rectifiers	3	0	0	3
26.	U19EE926	Automotive Electrical Technology	3	0	0	3
27.	U19EE927	PLC and Industrial Automation	3	0	0	3
28.	U19EE928	Electric Vehicle Technology	3	0	0	3
29.	U19EE929	Electrical System Design	1	0	4	3

SONA COLLEGE OF TECHNOLOGY, SALEM-5
DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING
LIST OF PROFESSIONAL ELECTIVES FOR HONOURS Degree

Date:03.05.2023

S.No	Vertical 1: Power Engineering	Vertical 2: Power Electronics and Drives	Vertical 3: Embedded Systems and IoT	Vertical 4: Energy Engineering	Vertical 5: Electric Mobility	Vertical 6: Intelligent Techniques
1.	Flexible AC Transmission Systems	Electromagnetic Waves	Communication Engineering	Wind and Solar Energy Systems	Automotive Electrical Technology	Computer Architecture
2.	Power System Operation and Control	Computational Electromagnetics	Digital Control Systems	Renewable Energy Sources	Electric Vehicle Technology	Introduction to Database Technology
3.	HVDC Transmission Systems	Advanced Electrical Drives	Introduction to Embedded Systems	Electrical Energy Conservation and Auditing	Automotive Embedded Systems	Deep Learning
4.	High Voltage Engineering	Power Quality Engineering	Embedded Systems Design	Smart Grid	Electrical Vehicles and Power Management	Machine Learning
5.	Smart Grid	Industrial Electrical Systems	High Speed Digital Design	Energy Storage Systems	Sensors and Actuators	Computer Networks
6.	Electrical System Design	Line-Commutated and Active PWM Rectifiers	PCB Hardware Design	Energy Conservation in Industrial Utilities	Electric and Hybrid Vehicles	Java Programming
7.	Power System Transients	Industrial Drives and Automation	Introduction to Automotive Embedded Systems and AUTOSAR	Advanced Energy Storage Technologies	Energy Storage Systems	Big Data Analytics for Electrical Engineers
8.	EHVAC Transmission Systems	Nanotechnology Fundamentals and its Applications	Introduction to IoT	Distributed Generation and Microgrid	Advanced Energy Storage Technologies	Operating Systems
9.	Distributed Generation and Microgrid	Power Converter Analysis and Design	Introduction to Industry 4.0 and Industrial Internet of Things		Automobile Chassis and Body Engineering	Cyber Security
10.	Deregulation and Restructured Power Systems	Micro-electromechanical Systems	Introduction and Programming with IoT Boards			PLC and Industrial Automation
11.			Sensors-Concepts and Techniques			Block Chain Technology
12.			IoT Devices			
13.			Microcontroller Based System Design			
14.			Automotive Embedded Systems			

SONA COLLEGE OF TECHNOLOGY, SALEM-5

Department of Electrical and Electronics Engineering

Honours Degree- Verticals & Courses

(Offered to UG students admitted during AY 2021- 2022 onwards, Regulation 2019)

Vertical 1: Power Engineering

S. No.	Course Code	Course Name	L	T	P	C
1	U19EE915	Flexible AC Transmission Systems	3	0	0	3
2	U19EE916	Power System Operation and Control	3	0	0	3
3	U19EE920	HVDC Transmission Systems	3	0	0	3
4	U19EE921	High Voltage Engineering	3	0	0	3
5	U19EE924	Smart Grid	3	0	0	3
6	U19EE929	Electrical System Design	1	0	4	3
7	U19EE2001	Power System Transients	3	0	0	3
8	U19EE2002	EHVAC Transmission Systems	3	0	0	3
9	U19EE2003	Distributed Generation and Microgrid	3	0	0	3
10	U19EE2004	Deregulation and Restructured Power Systems	3	0	0	3

Vertical 2: Power Electronics and Drives

S. No.	Course Code	Course Name	L	T	P	C
1	U19EE911	Electromagnetic Waves	3	0	0	3
2	U19EE912	Computational Electromagnetics	3	0	0	3
3	U19EE914	Advanced Electrical Drives	3	0	0	3
4	U19EE919	Power Quality Engineering	3	0	0	3
5	U19EE922	Industrial Electrical Systems	3	0	0	3
6	U19EE925	Line-Commutated and Active PWM Rectifiers	3	0	0	3
7	U19EE2005	Industrial Drives and Automation	3	0	0	3
8	U19EE2006	Nanotechnology Fundamentals and its Applications	3	0	0	3
9	U19EE2007	Power Converter Analysis and Design	3	0	0	3
10	U19EE2008	Micro-electromechanical Systems	3	0	0	3

Vertical 3: Embedded Systems and IoT

S. No	Course Code	Course Name	L	T	P	C
1	U19EE910	Communication Engineering	3	0	0	3
2	U19EE913	Digital Control Systems	3	0	0	3
3	U19EE2009	Introduction to Embedded Systems	3	0	0	3
4	U19EE2010	Embedded Systems Design	3	0	0	3
5	U19EE2011	High Speed Digital Design	3	0	0	3
6	U19EE2012	PCB Hardware Design	3	0	0	3
7	U19EE2013	Introduction to Automotive Embedded Systems and AUTOSAR	3	0	0	3
8	U19EE2014	Introduction to IoT	3	0	0	3
9	U19EE2015	Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3
10	U19EE2016	Introduction and Programming with IoT Boards	3	0	0	3
11	U19EE2017	Sensors-Concepts and Techniques	3	0	0	3
12	U19EE2018	IoT Devices	3	0	0	3
13	U19EE2019	Microcontroller Based System Design	3	0	0	3
14	U19EE2020	Automotive Embedded Systems	3	0	0	3

Vertical 4: Energy Engineering

S. No.	Course Code	Course Name	L	T	P	C
1	U19EE917	Wind and Solar Energy Systems	3	0	0	3
2	U19EE918	Renewable Energy Sources	3	0	0	3
3	U19EE923	Electrical Energy Conservation and Auditing	3	0	0	3
4	U19EE924	Smart Grid	3	0	0	3
5	U19EE2021	Energy Storage Systems	3	0	0	3
6	U19EE2022	Energy Conservation in Industrial Utilities	3	0	0	3
7	U19EE2023	Advanced Energy Storage Technologies	3	0	0	3
8	U19EE2003	Distributed Generation and Microgrid	3	0	0	3

Vertical 5: Electric Mobility

S. No.	Course Code	Course Name	L	T	P	C
1	U19EE926	Automotive Electrical Technology	3	0	0	3
2	U19EE928	Electric Vehicle Technology	3	0	0	3
3	U19EE2020	Automotive Embedded Systems	3	0	0	3
4	U19EE2024	Electrical Vehicles and Power Management	3	0	0	3
5	U19EE2025	Sensors and Actuators	3	0	0	3
6	U19EE2026	Electric and Hybrid Vehicles	3	0	0	3
7	U19EE2021	Energy Storage Systems	3	0	0	3
8	U19EE2023	Advanced Energy Storage Technologies	3	0	0	3
9	U19EE2027	Automobile Chassis and Body Engineering	3	0	0	3

Vertical 6: Intelligent Techniques

S. No.	Course Code	Course Name	L	T	P	C
1	U19EE901	Computer Architecture	3	0	0	3
2	U19EE902	Introduction to Database Technology	3	0	0	3
3	U19EE903	Deep Learning	3	0	0	3
4	U19EE904	Machine Learning	3	0	0	3
5	U19EE905	Computer Networks	3	0	0	3
6	U19EE906	Java Programming	3	0	0	3
7	U19EE907	Big Data Analytics for Electrical Engineers	3	0	0	3
8	U19EE908	Operating Systems	3	0	0	3
9	U19EE909	Cyber Security	3	0	0	3
10	U19EE927	PLC and Industrial Automation	3	0	0	3
11	U19EE2028	Block Chain Technology	3	0	0	3

SONA COLLEGE OF TECHNOLOGY, SALEM-5

Department of Electrical and Electronics Engineering

Minor Degree- Verticals & Courses

(Offered to UG students admitted during AY 2021- 2022 onwards, Regulation 2019)

Minor Vertical : Embedded Systems and IoT

S. No.	Course Code	Course Name	L	T	P	C
1	U19EE2010	Embedded Systems Design	3	0	0	3
2	U19EE2011	High Speed Digital Design	3	0	0	3
3	U19EE2012	PCB Hardware Design	3	0	0	3
4	U19EE2013	Introduction to Automotive Embedded Systems and AUTOSAR	3	0	0	3
5	U19EE2014	Introduction to IoT	3	0	0	3
6	U19EE2015	Introduction to Industry 4.0 and Industrial Internet of Things	3	0	0	3
7	U19EE2016	Introduction and Programming with IoT Boards	3	0	0	3
8	U19EE2017	Sensors-Concepts and Techniques	3	0	0	3
9	U19EE2018	IoT Devices	3	0	0	3
10	U19EE2020	Automotive Embedded Systems	3	0	0	3

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	Total Contact Hours
Theory								
1	U19ENG101B	English for Engineers - I	1	0	2	2	HS	45 (15L+30P)
2	U19MAT102A	Linear Algebra and Calculus	3	1	0	4	BS	60
3	U19CHE104D	Chemistry for Electrical Engineers	3	0	0	3	BS	45
4	U19PPR105	Problem Solving using Python Programming	3	0	0	3	ES	45
5	U19EGR106	Engineering Graphics	2	0	2	3	ES	60 (30L+30P)
Laboratory								
6	U19CHL109	Chemistry Laboratory	0	0	3	1.5	BS	45
7	U19PPL111	Python Programming Laboratory	0	0	2	1	ES	30
8	U19WPL112	Workshop Practice	0	0	2	1	ES	30
9	U19GE101	Basic Aptitude - I	0	0	2	0	EEC	30
Total Credits						18.5		
Optional Language Elective*								
10	U19OLE1101	French	0	0	2	1	HS	30
11	U19OLE1102	German						30
12	U19OLE1103	Japanese						30

*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, 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.

S.No	Course outcomes	Programme outcomes													
		1	2	3	4	5	6	7	8	9	10	11	12	Pso1	Pso2
1	Frame sentences correctly with accuracy	2	1	1	1	1	2	3	2	2	3	3	3	3	3
2	Write emails and formal letters	3	2	2	3	3	3	3	2	3	3	3	3	3	3
3	Speak effectively in real time and business situations	3	3	2	3	3	3	3	2	3	3	3	3	3	3
4	Write email, formal letters and descriptions of graphics	1	1	1	2	2	1	2	2	1	3	1	1	1	1
5	Develop skills for writing reports and proposals, and for general purpose and technical writing.	2	1	1	3	2	2	3	3	3	3	2	3	3	3

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

1. find the rank of the matrix and solve linear system of equations by direct and indirect methods
2. apply the concepts of vector spaces and linear transformations in real world applications
3. 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
4. find the Taylor's series expansion, Jacobians and the maxima and minima of functions of two variables
5. apply appropriate techniques of multiple integrals to find the area and volume.

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

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,

CO1: Analyze the types of polymers, polymerization reactions, polymerization techniques and fabrication methods of polymers for engineering applications.

CO2: Describe the construction, working principle and applications of energy storage devices for electronic appliances.

CO3: Discuss the principles, advantages and applications of organic electronic materials in electronic devices.

CO4: Explain the electrochemical processes carried out in electronic industries.

CO5: Outline the principle and process of fabrication of Integrated Circuits.

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												2
CO – 2	3	3												2
CO – 3	3	3												2
CO – 4	3	3												2
CO - 5	3	3												3

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
(Common to BME, CSE, ECE, EEE, IT and MCT)

L	T	P	C
3	0	0	3

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

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

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	PSO3
CO1	3	3	3	3	3	3	1	1	2	2	1	3	2	3	3
CO2	3	3	3	3	3	2	1	1	1	1	1	3	1	3	3
CO3	3	3	3	3	3	3	2	1	1	1	1	3	1	3	3
CO4	3	3	3	3	3	2	2	1	1	2	1	3	1	3	3
CO5	3	3	3	3	3	3	3	1	1	1	1	3	2	3	3

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.

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	1	1	1	1	1	3	2	2	3	2	2
CO 2	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 3	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 4	3	2	2	1	2	1	1	1	3	2	2	3	2	2
CO 5	3	2	2	1	1	1	1	1	3	2	2	3	2	2

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,

CO1: Analyse the given water sample to determine the amount of hardness and alkalinity.

CO2: Determine the molecular weight of various polymers, analyse the quality of brass by estimating copper and estimate the amount of calcium oxide in the given cement sample. Calculate the amount of chromium present in the given sample of water,

CO3: Estimate the amount of DO in water and evaluate the amount of iron content in the given sample using spectrophotometry

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

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

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	PSO3
CO1	3	2	2	3	2	1	0	1	2	2	1	2	3	3	3
CO2	3	3	3	3	2	2	0	1	2	2	1	2	3	3	3
CO3	3	3	3	3	2	2	0	1	2	2	1	3	3	3	3

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.

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	3	2	1	3	3	2	3	2	3	3	2	2
CO 2	3	2	3	2	1	3	3	2	3	2	3	3	2	2
CO 3	3	2	3	2	1	3	3	2	3	2	3	3	2	2

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

CO1: Solve fundamental problems in specific areas of quantitative aptitude

CO2: Solve basic problems in stated areas of logical reasoning

CO3: Demonstrate rudimentary verbal aptitude skills in English with regard to specific topics

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	1	2	2	2	1	3	3	3	3	1	1	3	2	2
CO 2	3	3	1	1	2	3	2	3	3	2	2	3	3	3
CO 3	1	2	1	2	1	1	1	3	3	3	1	3	3	3

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: 24 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	0	0	2	1	HSMC	30
11	U19OLE1202	German						
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

L T P C
1 0 2 2

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													
		1	2	3	4	5	6	7	8	9	10	11	12	Pso 1	Pso 2
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.

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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.

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

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

U19EE202 MEASUREMENTS AND INSTRUMENTATION

L	T	P	C
3	0	0	3

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

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	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3			1		1					1			2
CO2	3			1		1					1			2
CO3	3			1		1					1			2

Course Assessment methods

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

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

L	T	P	C
0	0	3	1.5

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.

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	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO 2	2	3	3	3	3	2	2	2	3	3	3	3	3	3
CO 3	2	3	3	3	3	2	2	2	3	3	3	3	3	3

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

TOTAL : 45 Hours

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 under Regulations 2019
Branch: Electrical and Electronics Engineering

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
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

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

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

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.

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

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 Ai, Zi, reverse Av and Yo – 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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	3	1		2		3			2	1
CO2	3	3	3	1		1		3		1			2	1
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.

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

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.

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

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.

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

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

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.

UNIT V STREAMS AND EXCEPTION HANDLING 9

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.

U19EE306 ANALOG ELECTRONICS LABORATORY 0 0 2 1

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

U19EE307 ELECTRICAL MACHINES LABORATORY – I 0 0 2 1

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++ LABORATORY 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.

TOTAL: 30 Hours

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	

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

MANDATORY COURSES

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

COURSE CODE	**U19GE302**	L T P C
COURSE NAME	**MANDATORY COURSE:**	
	ENVIRONMENT AND CLIMATE SCIENCE	2 0 0 0

Course outcome:

Upon completion of this course the students will be able to

CO1 Describe the importance of the acute need for environmental awareness and discuss significant aspects of natural resources like forests, water and food resources.

CO2 Illustrate the concepts of an ecosystem and provide an overview of biodiversity and its conservation.

CO3 Analyze the causes, effects of various environmental pollution and their appropriate remedial measures.

CO4 Provide solutions to combat environmental issues like global warming, acid Rain, ozone layer depletion.

CO5 Analyze the effect of climate change in various sectors and their remedial measures.

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							-
CO – 2	2	-												-
CO – 3	3	2				2	2							2
CO – 4	3	2				2	2							2
CO - 5	3	2				2	2							2

Unit I **INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES** L 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** L 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** L 6

29.08.2022 **B.E. / B.Tech. Regulations 2019**

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.

Unit IV FUNDAMENTALS OF CLIMATE CHANGE L 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 L 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 Number of hours: 30

Learning Resources

Text Book:

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

Reference Books:

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. ErachBharucha, "Textbook of Environmental Studies for Undergraduate Courses", 2005, University Grands Commission, Universities Press India Private Limited, Hyderguda, Hyderabad – 500029.

29/8/22

Dr. M. Raja
Course Coordinator / Sciences

29/8/2022

Dr. C. Shanthi
HOD / Sciences

29/8

Dr. M. Renuga
Chairperson BOS,
Science and Humanities

29.08.2022 **B.E. / B.Tech. Regulations 2019**

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

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
Dr.S.Padma

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

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

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
(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	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 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.

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.

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13. 01. 2021 **B. E. / B. Tech. Regulations 2019**

U19EE401 SIGNALS AND SYSTEMS 2 1 0 3

COURSE OUTCOMES:

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

1. Explain the basic properties of signal & systems and the various methods of classification.
2. Apply Laplace transform & Fourier transform for continuous signals and systems analysis.
3. Analyse discrete time signals and linear time invariant systems.
4. Analyse LTI systems in the time domain and various transform domains.
5. 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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	3	3							3	3	3
CO2	3	3	2	3	3							3	3	3
CO3	3	3	2	3	3							3	3	3
CO4	3	3	2	3	3							3	3	3
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 this course, the students will 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
CO1	3	3	3	3	2					2	2	3	3	3
CO2	3	3	3	3	2					2	2	3	3	3
CO3	3	3	3	3	2					2	2	3	3	3
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 & A C drives.

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

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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3							2	3	3
CO2	3	3	3	3	3							2	3	3
CO3	3	3	3	3	3							2	3	3
CO4	3	3	2	2	2						2	3	3	3
CO5	3	3	2	2	2						2	3	3	3

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: 45 Hours

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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3			3	3			3	2	2
CO2	3	3	3	3	3			3	3			3	2	2
CO3	3	3	3	3	3			3	3			3	2	2
CO4	3	3	3	3	3			3	3			3	2	2
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.

U19EE405 ELECTRICAL MACHINES LABORATORY–II 0 0 2 1

COURSE OUTCOMES:

At the end of this course, the students will 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

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

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

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	3
CO2	3	3	3	3	3				3		3		3	3
CO3	3	3	3	3	3				3		3		3	3

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 cyclo converter.
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.

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

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

06/01/2023

Dr.S.Anita

Head/Training

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

SEMESTER – IV

MANDATORY COURSE

U19GE403 - ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

(Common for EEE, CIVIL, MECH and CSE)

L	T	P	C
2	0	0	0

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 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

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

23/1/21	23/1/2024	
Dr. M. Raja	**Dr. C. Shanthi**	**Dr. M. Renuga**
Course Coordinator / Sciences	HOD / Sciences	Chairperson BOS, Science and Humanities

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

EEE
V

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

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	noc23-ee124	**NPTEL** - Smart Grid: Basics To Advanced Technologies	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

S. Padma 10.7.23

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

Shivakumar

Member Secretary, Academic Council
Dr.R.Shivakumar

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

Copy to:-

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

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 various networks.
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.

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		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 short line, medium line (end condenser, nominal T, nominal π method) and long line (rigorous method) – equivalent circuits – calculation of ABCD constants – Ferranti effect and corona loss – calculation of sag and tension (equal, unequal supports and effect of wind and ice).

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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.

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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)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	2	-	-	-	-	-	1	1	3	1
CO2	3	3	2	3	3	-	-	-	-	-	1	2	3	2
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

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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.

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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.

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

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

UNIT I 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.

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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 Programmersl, Apress, 2014.
4. Marco Schwartz, —Internet of Things with the Arduino Yunl, Packt Publishing, 2014..

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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.

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

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.

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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.

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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

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

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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

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noc23-ee124 SMART GRID: BASICS TO ADVANCED TECHNOLOGIES 3 0 0 3

PROF. N.P. PADHY
Department of Electrical Engineering
IIT Roorkee

PROF. PREMALATA JENA
Department of Electrical Engineering
IIT Roorkee

ABOUT THE COURSE:

This course covers the fundamental aspects of the smart grid and its application to the existing power system. It introduces state-of-the-art smart grid technologies like electric vehicles, AC/DC microgrids, energy storage, phasor measurement unit, cyber security, etc. In addition, the course talks about the trends, modeling, planning, operation, and control of energy storage technologies. Further, it discusses the architecture, operation, and control strategy of AC, DC, and hybrid AC-DC microgrids. This course also emphasizes on renewable energy sources integration into the present grid and microgrids, and further explores its operation, analysis, management, control, protection, and monitoring issues. The laboratory-scale demonstrations have been provided to validate a few concepts covered in this course.

PRE-REQUISITES: Basic Understanding of Power System and Power Electronics Engineering

COURSE LAYOUT

Week 1:

- Introduction to Smart Grid-I.
- Introduction to Smart Grid-II.
- Architecture of Smart Grid system
- Standards for Smart Grid system
- Elements and Technologies of Smart Grid System-I

Week 2:

- Elements and Technologies of Smart Grid System-II
- Distributed Generation Resources-I
- Distributed Generation Resources-II
- Distributed Generation Resources-III
- Distributed Generation Resources-IV

Week 3:

- Introduction to energy storage devices
- Different types of energy storage technologies
- Analytical modelling of energy storage devices
- Optimal sizing and siting of storages
- Battery management system (BMS)

Week 4:

- Wide area Monitoring Systems-I
- Wide area Monitoring Systems-II
- Phasor Estimation-I
- Phasor Estimation-II
- Digital Relays for Smart Grid Protection

Week 5:

- Islanding Detection Techniques–I
- Islanding Detection Techniques –II
- Islanding Detection Techniques –III
- Smart Grid Protection-I
- Smart Grid Protection-II

Week 6:

- Smart Grid Protection-III
- Smart Grid Protection-IV
- Modelling of storage devices
- Modelling of DC smart grid components
- Operation and control of AC Microgrid-I

Week 7:

- Operation and control of AC Microgrid -II
- Operation and control of DC Microgrid -I
- Operation and control of DC Microgrid -II
- Operation and control of AC-DC hybrid Microgrid -I
- Operation and control of AC-DC hybrid Microgrid -II

Week 8:

- Phasor measurement unit placement
- Cyber security and resiliency
- Virtual inertia and ancillary support
- Demand side management of smart grid
- Demand Response Analysis of smart grid

Week 9:

- Demonstration of solar power generation
- Demonstration of wind power generation
- Demonstration of Battery Management System
- Demonstration of EV charging system
- Hierarchical control techniques in hybrid ac-dc microgrid

Week 10:

- Simulation and case study of AC Microgrid
- Simulation and case study of DC Microgrid
- Simulation and case study of AC-DC Hybrid microgrid
- Demonstration of parallel inverter operation in AC microgrid
- Harmonic effects and its mitigation techniques

Week 11:

- Energy management
- Design of Smart Grid and Practical Smart Grid Case Study-I
- Design of Smart Grid and Practical Smart Grid Case Study-II
- System Analysis of AC/DC Smart Grid
- Demonstration of grid-connected DC microgrid

Week 12:

- Demonstration of energy management in microgrid
- Demonstration of PHIL experimentation for symmetric and asymmetric fault analysis of grid-connected DFIG wind turbine.
- Demonstration of ancillary support from virtual synchronous generator
- Demonstration on peak energy management using energy storage system.
- Conclusions

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

BOOKS AND REFERENCES:

1. Smart power grids by A Keyhani, M Marwali.
2. Computer Relaying for Power Systems by ArunPhadke
3. Microgrids Architecture and control by Nikos Hatziargyriou
4. Renewable Energy Systems by Fang Lin Luo, Hong Ye
5. Voltage-sourced converters in power systems_ modeling, control, and applications by Amirnaser Yazdani, Reza Iravani"

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.

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	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

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

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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.

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

S.Padma 15.7.23

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V Sem

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

S. Anit 31/07/2023.

Dr.S.Anita

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Syllabi for

B.E/B.Tech Honours (Specialization in the same Discipline)

B.E/B.Tech Honours

B.E/B.Tech Minor

courses

EEE (Hons)

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.

UNIT I INTRODUCTION 9

Need for electric and hybrid vehicles, Electric vehicle and Hybrid vehicle Layouts, Components of Electric Vehicle. Cost and Emissions, End of life, Comparative study of electric and hybrid vehicles – Advantages and Disadvantages of Electric Vehicles - Petroleum resources, Global warming – Process of recycling Battery.

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, 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, Solar, wind.

Battery Management System (BMS): Need of BMS, Rule based control and optimization based control, Software – based high level supervisory control

UNIT IV DESIGN OF ELECTRIC VEHICLES FUNDAMENTALS 9

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

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.

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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, 2016.

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U19EE2024 ELECTRICAL VEHICLES AND POWER MANAGEMENT 3 0 0 3

COURSE OUTCOMES

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

1. Understand the concept of electric vehicle and its operation.
2. Illustrate the architecture of Electric and hybrid vehicles.
3. Describe the principles of operation of power electronics converters and electrical drives
4. Describe the parameters monitoring of batteries.
5. Analyze various energy storage systems based on fuel cells and hydrogen storage systems.

UNIT I ELECTRIC VEHICLES AND VEHICLE MECHANICS 9

Electric Vehicles (EV), Hybrid Electric Vehicles (HEV), Engine ratings– Comparisons of EV with internal combustion Engine vehicles– Fundamentals of vehicle mechanics.

Simulation(Matlab Simulink): Simulation for AC to AC conversion. (Assignment Purpose only)

UNIT II ARCHITECTURE OF EV'S AND POWER TRAIN COMPONENTS 9

Architecture of EV's and HEV's–Plug-in Hybrid Electric Vehicles (PHEV)–Power train component sand sizing, Gears, Clutches, Transmission and Brakes.

Simulation(Matlab Simulink): Simulation for AC to DC conversion and Simulation for DC to DC conversion. (Assignment Purpose only)

UNIT III POWER ELECTRONICS AND MOTOR DRIVES 9

Electric drive components – Power electronic switches– four quadrant operation of DC drives – Induction motor and permanent magnet synchronous motor–based vector control operation – Switched reluctance motor (SRM) drives–EV motor sizing.

Simulation(Matlab Simulink): Speed control of BLDC motor using IGBT. (Assignment Purpose only)

UNIT IV BATTERIES FOR ELECTRIC VEHICLES 9

Selection of battery for EVs & HEVs, Traction Battery Pack design, Requirement of Battery Monitoring, Battery State of Charge Estimation methods, Battery Cell equalization problem, thermal control, protection interface, SOC Estimation, Energy & Power estimation.

Simulation(Matlab Simulink): Speed control of switched Reluctance Motor. (Assignment Purpose only)

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UNIT V ALTERNATIVE ENERGYSTORAGESYSTEMS 9

Introduction to proton exchange membrane (PEM) fuel cell for E-mobility – comparison of phosphoric acid Fuel cell and Proton membrane fuel cell – hydrogen storage systems–Ultra capacitors and Super capacitors for transportation applications.

Simulation(Matlab Simulink): Simulation of four Quadrant operation of three phase Induction Motor. (Assignment Purpose only)

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

TEXT BOOKS

1. IqbalHussain,"ElectricandHybridVehicles:DesignFundamentals",SecondEditionCRC Press,Taylor &FrancisGroup, SecondEdition(2011).
2. Wie Liu, "Hybrid Electric Vehicle System Modeling and Control", Second Edition, John Wiley & Sons 2017.

REFERENCES

1. Ali E madi, Mehrdad Ehsani, John M. Miller, "Vehicular Electric Power Systems", Special Indian Edition, Marceldekker, Inc 2010.
2. Mehrdad Ehsani, Yimin Gao, Sebastian E.Gay, Ali Emadi, "Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals", Theory and Design, CRC Press, 2004.
3. C.C. Chanand K. T. Chau, "Modern Electric Vehicle Technology", OXFORD University Press, 2001.

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U19EE2012 **PCB HARDWARE DESIGN** **3 0 0 3**

COURSE OUTCOMES:

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

1. Outline the overview of OrCAD schematic level layout.
2. Explain the library tools and creation of parts
3. Design a PCB layout and explain then various tools
4. Explain PCB Layout process and Keys factor for reducing noise in PCB
5. Create a PCB manufacturing output and generate a file for fabrication.

UNIT I OVERVIEW OF SCHEMATIC LEVEL (OrCAD) **9**

Building parts and symbols – Creating a new project – Creating multi-sheet flat designs – Assigning reference designators – Design checking – Adding inter sheet signal references – Creating a Bill of Materials and other reports – Adding part and net properties – Creating a net list for ORCAD Layout

UNIT II SCHEMATICS TOOL / LIBRARY & DESIGN **9**

Introduction to CADANCE / ORCAD Software – Orcad UI / Tools walk through – Component Selection from Libraries to circuit design – Introduction to parts/symbol library – Accessing to default library – Creating Parts & Symbol Building simple / Multi Page Schematics. – Placing, Editing & connecting Components for ckt design (Th, SMD) – Assigning reference designator (Annotation) – Design Rule checking (DRC error) – Creation Bill Of Materials for design – Creation of PDF Documentation of Design

UNIT III LAYOUT INPUT & PCB LAYOUT TOOL AND LIBRARY DEVELOPMENT **9**

Preparing the design for layout (Net listing) – Create net list (.ASC) PC – Generate Final bill of material (BOM) – Exporting and importing Schematic data Tools introduction and Walkthrough – UI and Constraint Manager – Introduction to various DIP and Surface mount Component – Learn about design preparation (libraries/Footprints) – PAD stack Designing (SMD/SMT Pads and Via) – Creation of Footprints for DIP and SMD Devices.

UNIT IV PCB LAYOUT PROCESS & KEYS FACTOR FOR REDUCING NOISE IN PCB **9**

Net listing/logic import from schematic to PCB – Layer stack up – Component Placement – Introduction to manual routing – Introduction to different parameter of perfect routing – Introduction to copper pour for power plane – Verification of PCB checklist. Key factor for routing power track (VCC & GND) – Reducing Crosstalk effect – Reducing EMI effect

UNIT V PCB MANUFACTURING OUTPUT **9**

Assigning specific text (silkscreen) to design – DRC cleaning – Creating report of design – Creating manufacturing data (GERBER) for design – Tracks, PAD's, Hole width and design rules – Release Gerber file for PCB Fabrication

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

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TEXT BOOKS

1. Kraig Mitzner, "Complete PCB Design Using OrCad Capture and Layout", Elsevier Science, 2011.
2. Roger Hu, "PCB Design and Layout Fundamentals for EMC", Independently Published, 2019.

REFERENCES

1. Mark I. Montrose, "EMC and the Printed Circuit Board Design, Theory, and Layout Made Simple", Wiley, 2004.
2. Christopher T. Robertson, "Printed Circuit Board Designer's Reference, Prentice Hall Professional Technical Reference, 2004.
3. Kraig Mitzner, "Complete PCB Design Using OrCad Capture and PCB Editor", Elsevier Science, 2009.
4. R. S. Khandpur, "Printed Circuit Boards: Design, Fabrication, and Assembly" McGraw Hill LLC, 2005.

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COURSE OUTCOMES:

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

1. Describe the selection procedure of Processors in the embedded domain.
2. Explain the various types of processor and memory in Embedded Systems.
3. Visualize the role of Real time Operating Systems in Embedded Systems.
4. Evaluate the Correlation between task synchronization and latency issues.
5. Explain the development of processor, optimization and testing.

UNIT I INTRODUCTION 9

Definition of Embedded System Embedded Systems Versus General Computing Systems, History of Embedded Systems, Classification, Major Application Areas. Concept of embedded system design: challenges, processor technology, IC technology, design technology, trade-offs: Power Consumption Versus System Performance in Embedded Systems, Cost Versus Reliability, Scalability Versus Complexity.

UNIT II PROCESSOR AND MEMORY 9

Introduction to processors, basic architecture, operation, super-scalar and VLSIIW architecture, Application Specific Instruction Set Processors (ASIPS), microcontrollers, digital signal processors, selecting a microprocessor, introduction to memory, memory writes ability, storage performance, common memory types, memory hierarchy and cache.

UNIT III PERIPHERAL DEVICES 9

Buffers and latches, crystal, reset circuit, chip select logic circuit, timers, counters, Universal Asynchronous Receiver Transmitter (UART), pulse width modulators, LCD controllers, keypad controllers, design tradeoffs due to thermal considerations and effects of EMI/ESD etc.

UNIT IV EMBEDDED SOFTWARE DEVELOPMENT 9

Real time operating systems(RTOS), Kernel architecture: hardware, task/process control subsystem, device drivers, file subsystem, system calls, embedded operating systems, task scheduling in embedded systems: task scheduler, First in first out(FIFO), shortest job first, round robin, priority based scheduling, context switch: task synchronization: mutex, semaphore, timers, types of embedded operating systems, programming languages: assembly languages, high level language.

UNIT V EMBEDDED SYSTEM DEVELOPMENT 9

Embedded system development process, determine the requirements, design the system architecture, selection of the operating system, processor, development platform, programming language, coding issues, code optimization, efficient input/output, testing and debugging.

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

TEXT BOOKS

1. R. Kamal, "Embedded Systems: Architecture, Programming and Design" MGH, 2008.
2. Shibu, "Introduction to Embedded Systems", McGraw Hill, 2017.

REFERENCES

1. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
2. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Cengage, 2000.
3. Bahadure, "Microcontrollers and Embedded System Design" Wiley, 2019.
4. Mazidi, "PIC Microcontroller and Embedded Systems" Pearson, 2008.

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Minor

U19CS2048 **CRYPTOGRAPHY ESSENTIALS** **3 0 0 3**

COURSE OUTCOMES

At the end of the course, student will able to

- Describe various types of attacks with their characteristics and apply classical encryption algorithms to encrypt the data.
- Apply the different symmetric cryptographic algorithms for encryption and decryption.
- Apply the different public key cryptography algorithms for encryption and decryption.
- Compare the various message authentication schemes.
- Analyze the different system security mechanisms and algorithms that are specific to some particular applications like email, user authentication, key exchange and message integrity.

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	PSO3
CO1	3	3	2	2	1	2	1	2	2	2	3	3	1	2	3
CO2	3	3	2	2	2	2	1	2	2	2	3	3	1	2	3
CO3	3	3	2	2	2	2	1	2	2	2	3	3	3	2	3
CO4	3	3	2	2	2	2	1	2	2	2	3	3	3	2	3
CO5	3	3	2	2	2	2	1	2	2	2	3	3	3	2	3

UNIT I INTRODUCTION 9

Security trends - Legal, Ethical and Professional Aspects of Security, Need for Security at Multiple levels, Security Policies - Model of network security – Security attacks, services and mechanisms – OSI security architecture – Classical encryption techniques: substitution techniques, transposition techniques, steganography- Foundations of modern cryptography: perfect security – information theory – product cryptosystem – cryptanalysis.

UNIT II SYMMETRIC KEY CRYPTOGRAPHY 9

Mathematics Of Symmetric Key Cryptography: Algebraic structures – Modular arithmetic-Euclid's algorithm- Congruence - SYMMETRIC KEY CIPHERS: SDES – Block cipher Principles of DES – Block cipher mode of operation – Evaluation criteria for AES – Advanced Encryption Standard.

UNIT III PUBLIC KEY CRYPTOGRAPHY 9

Mathematics of Asymmetric Key Cryptography: Primes – Primality Testing –Factorization – Euler's totient function, Fermat's and Euler's Theorem - Chinese Remainder Theorem – Asymmetric Key Ciphers: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange.

UNIT IV MESSAGE AUTHENTICATION AND INTEGRITY 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC – SHA –Digital signature – DSS- Entity Authentication applications - Kerberos, X.509.

UNIT V SECURITY PRACTICE AND SYSTEM SECURITY 9

Electronic Mail security – PGP, S/MIME – IP security – Web Security – System Security: Firewalls -Recent trends in cryptography.

TEXT BOOK:

1. William Stallings, "Cryptography and Network Security: Principles and Practice", PHI 3rd Edition, 2006.

TOTAL: 45 H

REFERENCES:

1. C K Shyamala, N Harini and Dr. T R Padmanabhan,"Cryptography and Network Security", Wiley India Pvt.Ltd, 2011
2. BehrouzA.Foruzan, "Cryptography and Network Security", Tata McGraw Hill 2007.
3. Charlie Kaufman, Radia Perlman, and Mike Speciner," Network Security: Private Communication in a Public World", Prentice Hall, 2002

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Minor CSE

U19CS2047 DATA COMMUNICATIONS AND NETWORKING 3 0 0 3

Course Outcomes:

At the end of the course, student will able to

- Comprehend the Categories and functions of various Data communication Networks.
- Analyze various error detection techniques in the data link layer.
- Demonstrate the mechanism of routing the data in network layer.
- Compare the various Flow control and Congestion control Mechanisms.
- Analyze the Functioning of various Application layer Protocols.

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	PSO3
CO1	2	3	1	2	1	3	1	3	2	1	1	3	2	2	2
CO2	3	3	3	3	3	2	3	2	3	1	3	3	3	3	3
CO3	3	3	2	3	3	2	2	3	1	2	3	3	3	3	3
CO4	3	3	2	3	2	2	2	3	3	2	3	3	3	3	3
CO5	3	3	2	3	2	3	2	3	1	2	3	3	3	3	3

UNIT I Introduction to Data Communications **9**

Components, Data Representation, Data Flow, Networks- Distributed Processing, Network Criteria, Physical Structures, Network Models, Categories of Networks Interconnection of Networks, The Internet - A Brief History, The Internet Today, Protocol and Standards - Protocols, Standards, Standards Organizations, Internet Standards. Network Models, Layered Tasks, OSI model, Layers in OSI model, TCP/IP Protocol Suite

UNIT II Data Link Layer **9**

Links, Access Networks, and LANs- Introduction to the Link Layer, The Services Provided by the Link Layer, Types of errors, Redundancy, Detection vs Correction, Forward error correction Versus Retransmission Error-Detection and Correction Techniques, Parity Checks, Check summing Methods, Cyclic Redundancy Check (CRC) , Framing, Flow Control and Error Control protocols , Noisy less Channels and Noisy Channels, HDLC, Multiple Access Protocols, Random Access ,ALOHA, Controlled access, Channelization Protocols. 802.11 MAC Protocol, IEEE 802.11 Frame.

UNIT III The Network Layer 9

Introduction, Forwarding and Routing, Network Service Models, Virtual Circuit and Datagram Networks-Virtual-Circuit Networks, Datagram Networks, Origins of VC and Datagram Networks, Inside a Router-Input Processing, Switching, Output Processing, Queuing, The Routing Control Plane, The Internet Protocol(IP):Forwarding and Addressing in the Internet-Datagram format, IPv4 Addressing, Internet Control Message Protocol(ICMP), IPv6

UNIT IV Transport Layer 9

Introduction and Transport Layer Services : Relationship Between Transport and Network Layers, Overview of the Transport Layer in the Internet, Multiplexing and Demultiplexing, Connectionless Transport: UDP -UDP Segment Structure, UDP Checksum, Principles of Reliable Data Transfer-Building a Reliable Data Transfer Protocol, Pipelined Reliable Data Transfer Protocols, Go- Back-N(GBN), Selective Repeat(SR), Connection Oriented Transport: TCP - The TCP Connection, TCP Segment Structure, Round-Trip Time Estimation and Timeout, Reliable Data Transfer, Flow Control, TCP Connection Management, Principles of Congestion Control - The Cause and the Costs of Congestion, Approaches to Congestion Control.

UNIT V Application Layer 9

Principles of Networking Applications – Network Application Architectures, Processes Communicating, Transport Services Available to Applications, Transport Services Provided by the File Transfer: FTP,- FTP Commands and Replies, Electronic Mail in the Internet- STMP, Comparison with HTTP, DNS-The Internet's Directory Service – Service Provided by DNS, Overview of How DNS Works, DNS Records and messages.

TOTAL: 45 H

TEXT BOOK:

1. Data Communications and Networking Behrouz A. Forouzan 4th Edition McGraw-Hill Education, 2007

REFERENCES:

1. Computer Networking A Top-Down Approach – Kurose James F, Keith W, 6th Edition, Pearson,2017.
2. Bhusan Trivedi , Data communication and Networks -, Oxford university press, 2016
3. Andrew S Tanenbaum ,Computer Networks, 4th Edition, Pearson Education, 2003
4. Shay W.A, Understanding Communications and Networks, 3rd Edition, , Cengage Learning, 2008

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Minor MET

U19MC2035	INTRODUCTION TO ROBOTICS	L	T	P	C
		3	0	0	3

Course Outcomes

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

CO1:	Describe the basic concepts of robotics
CO2:	Identify the suitable drive system for robot cation
CO3:	Select the suitable sensors for the respective application
CO4:	Select the suitable grippers for the respective application
CO5:	Understand the economic and social implications of Robotics.

Pre-requisite

NIL

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcomes (PSOs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	P09	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) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)	Objective test (6) Attendance (5) End semester Examination (60)	Course end survey

Unit 01: INTRODUCTION — **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 wrist –Joint Notation scheme - Robot Kinematics – Robot Drive systems – Hydraulic Actuators – Pneumatic actuators – Electrical actuators: Stepper motors, DC motors, Servomotor.

Unit 03: ROBOT SENSORS	9 Hours
Classification of Robotic sensors and their functions – Position Sensors : Piezoelectric sensor , LVDT, Optical encoders ,Pneumatic position sensors – Proximity Sensors : Inductive Proximity sensor, Capacitive proximity sensor, Hall effect sensor –Range sensosr –Tactile sensors - Force ant Torque sensors.	
Unit 04: END EFFECTORS	**9 Hours**
Introduction – Types of end effectors – Mechanical grippers: Types of gripper mechanisms, Gripper force analysis – Vacuum cups – Magnetic grippers – Adhesive grippers – Tools as end effectors – End effector interface – Remote Center Compliance – Considerations in gripper selection and design.	
Unit 05: ECONOMIC ANALYSIS AND SOCIAL IMPLICATIONS	**9 Hours**
Type of Robot Installation – Cost data required for analysis – Methods of economic analysis: Pay back method, EUAC method, Rate of return method – Implementation of robots in industries – various steps – Safety considerations for Robot operations.	

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.

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Ph: 0427-4099999

minor MCT

U19MC2039	FUNDAMENTALS OF DRONES	L	T	P	C
		3	-	-	3

Course Outcomes

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

CO1:	Describe the basic knowledge about the development and potential of UAV in professional activities
CO2:	Explain the features and characteristics of an Unmanned Aerial System
CO3:	Discuss the basic concepts and features of flight
CO4:	Describe the drone equipment maintenance and repair
CO5:	Infer the regulatory measures and regulations

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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO2	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO3	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO4	2	3	2	3	3	-	-	-	-	-	2	3	3	3
CO5	2	3	2	3	3	2	2	2	-	-	3	3	3	3

Course Assessment methods

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

Unit 01: INTRODUCTION TO UNMANNED AERIAL VEHICLES — **9 Hours**

Overview and background: History of UAVs, Classifications of UAVs, Lift generation and thrust generation method, working of an UAV, Contemporary applications like military and civil areas –Ethical implications LOS / BLOS, Advantages and disadvantages of an UAV.

Unit 02: UNMANNED AERIAL SYSTEM COMPONENTS — **9 Hours**

Platforms – Configurations – Characteristics – Propulsion: Internal combustion engines, Turbine engines, Electric systems – On-board flight control – Payloads: Sensing/Surveillance. Communications: Command/Control, Telemetry, Launch/recovery systems – Ground control stations

Unit 03: CONCEPTS OF FLIGHT — **9 Hours**

Aerodynamics: Lift, weight, Thrust and drag – Flight performance: Climbing vs. Gliding flight, Range / Endurance – Stability and control: Flight axes, Flight controls, Autopilots – Fixed wing operations: Types of fixed wing drones, Make, Parts, Terminology and Operation.

Unit 04: DRONE MAINTENANCE AND APPLICATIONS			9 Hours
Maintenance of drone: Flight control box – Maintenance of ground equipment – Batteries – Fault finding and rectification –Weather and meteorology, Surveying & mapping, construction & Agriculture sector.			
Unit 05: UAS REGULATORIES			**9 Hours**
Homeland Regulatories: FCC, FAA and Foreign regulatory – Regulations: FCC compliance, European union regulations, UAS registration, Federal Aircraft Regulations (FARs) - Safety considerations			
Theory: 45 Hrs	**Tutorial: --**	**Practical: --**	**Total Hours: 45Hrs**

TEXT BOOKS	
1.	Reg Austin, "Unmanned Aircraft Systems UAV design, development and deployment", Wiley, 2010.
2.	Paul Fahlstrom, Thomas Gleason, "Introduction to UAV Systems", 4th Edition, John Wiley & Sons, NA, 2016.
REFERENCES	
1.	P K Garg, "Introduction to Unmanned Aerial Vehicles", New Age International Private Limited, 2020
2.	Garvit Pandya, "Basics of Unmanned Aerial Vehicles", Notion press, 2021
3.	Jha, "Theory, Design, and Applications of Unmanned Aerial Vehicles", 1st Edition, CRC press, Florida, 2017.
4.	Randal W. Beard & Timothy W. McLain, "Small Unmanned Aircraft: Theory and Practice", Princeton University Press, Newjersy, 2010.

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BME

U19BM1001	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

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

CO1	•	Describe the basics of Hospital Management.
CO2	•	Illustrate the knowledge of Human resource management and marketing in hospitals.
CO3	•	Apply various Quantitative methods in healthcare management.
CO4	•	Amalgamate their knowledge in Hospital information system and supportive services.
CO5	•	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

CO's	Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	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, Hospital Planning, 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 Hours	

TEXTBOOKS:		
	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.
REFERENCES:		
	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.

COORDINATOR

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U19BM2047	HOME MEDICARE TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

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

CO1	•	Understanding about basics of home medicare system.
CO2	•	Identify the critical elements for providing effective integrated health care at home.
CO3	•	Evaluate home Medicare devices and their clinical applications.
CO4	•	classify advances in healthcare technologies and wireless technology related to healthcare system
CO5	•	Demonstrate the various first aid techniques at emergency situations

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2	PSO3
CO1	1	2	-	-	-	1	-	2	-	-	-	1	-	-	-
CO2	1	1	-	-	-	1	-	1	-	-	-	1	-	-	-
CO3	3	1	-	-	-	1	-	1	-	-	-	1	-	-	-
CO4	3	1	-	-	2	1	-	1	-	1	-	1	-	-	-
CO5	1	2	-	-	-	1	-	2	1	-	-	1	-	-	-

UNIT I **INTRODUCTION TO HOME MEDICARE** **9**

Home healthcare, purpose, Legal and Ethical aspects, User Issues, Organization of Homecare system, Historical Development of Homecare, Environmental Influences on Home Care, Home Care Organization, Homecare Nursing Practice, Role of Home Care Nurse and Orientation Strategies, Infection Control in Home, Patient Education in Home.

UNIT II **WORKING WITH CLIENTS** **9**

Basic human needs, Communication and Interpersonal skills, Caregiver observation, Recording and Reporting, Confidentiality, Working with elderly-aging and Body systems, Working with children - Need for homecare, Mobility-transfers and Ambulation, Range of motion exercises, Skin care and Comfort measures.

UNIT III **HOME MEDICAL DEVICES** **9**

Medical devices at home, User Centred Design and Implementation, Co-Design with Old Users, Device Types, Smart Watch, Infant Monitors: Wireless infant monitoring system, Medical Alert Services, Activity Monitors. The ventilator dependent patient at Home, Device for patient with congestive heart failure, Device for Patient with chronic Obstructive pulmonary disease, Device for patient with Diabetic.

UNIT IV	TELEMEDICAL TECHNOLOGY FOR HOMECARE	9
Wireless Communication Basics, Types of Wireless Network, Body Area Network, Emergency Rescue, Remote Recovery, Personalized ambient monitoring, General Health Assessments Technology in Medical Information Processing, Multi model interaction and technologies for care at home, Cost of home healthcare, Future Trends In Telemedicine. Direction for emerging technology.		
UNIT V	**FIRST AID TECHNIQUES FOR HOMECARE**	**9**
Emergencies in rural area, Disasters and Multiple casualty accidents, Emergency triage. First Aid Techniques: Dressings, Bandages, Transport Techniques and Stretchers. Content of a First Aid Kit: Small and medium First Aid Box.		
	TOTAL: 45 Hours	
TEXTBOOKS:		
1.	Robyn Rice, "Home care nursing practice: Concepts and Application", 4th edition, Elsevier, 2006.	
2.	INDIAN FIRST AID MANUAL – 7th Edition, St. John Ambulance Association (India) – Indian Red Cross Society National Headquaters, New Delhi, 2016.	
3.	LodewijkBos, "Handbook of Digital Homecare: Successes and Failures", Springer, 2011.	
REFERENCES:		
1.	Yadin David, Wolf W. von Maltzahn, Michael R. Neuman, Joseph D. Bronzino,"Clinical Engineering", CRC Press, 2010.	
2.	Kenneth J. Turner, "Advances in Home Care Technologies: Results of the match Project", Springer, 2011.	

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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	U19EE923	**Professional Elective-** Electrical Energy Conservation and Auditing	3	0	0	3	45
	U19EE928	**Professional Elective -** Electric Vehicle Technology					
5	U19EE929	**Professional Elective -** Electrical System Design	1	0	4	3	75
6	U19BM1001	**Open Elective-** Hospital Management	3	0	0	3	45
	U19CE1002	**Open Elective-** Municipal Solid Waste Management					
	U19CE1003	**Open Elective-** Energy Efficiency and Green Building					
	U19CS1001	**Open Elective-** Big Data Analytics					
	U19CS1002	**Open Elective-** Cloud Computing					
	U19EC1006	**Open Elective-** Mobile Technology and Its Applications					
	U19EE1003	**Open Elective-** Innovation, IPR and Entrepreneurship Development					
	U19FT1001	**Open Elective-** Fundamentals of Fashion Design					
	U19FT1002	**Open Elective-** Garment Manufacturing Technology					
	U19MC1003	**Open Elective-** Smart Automation					
	U19MC1004	**Open Elective-** Fundamentals of Robotics					
	U19ME1002	**Open Elective-** Industrial Safety					
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** 26.12.23	**Dr.S.R.R.Senthil Kumar**

Copy to:-

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

EEE
VI

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
CO1	3	3	3	3	1	2	2	2	1	3	2	3	3	3
CO2	3	3	3	3	2	2	2	2	1	3	2	3	3	3
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.

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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. HadiSaadat, "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

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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.

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

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.

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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. BadriRam andB.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 PowerSystem Engineering", Dhanpatrai&Co. pvt.ltd., 2013.
2. C.L. Wadhwa, "Electrical Power Systems", New Age International (P) Ltd., 2016.
3. RavindraP.Singh , " Digital Power System Protection" , PHI , New Delhi, 2007.
4. Sunil S. Rao, "Switchgear and Protection", Khanna Publishers, 13th Edition, 2015.

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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.

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

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.

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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.

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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 energyaudit 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	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 efficiencystandards 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 ACand lighting system.

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UNIT V ENERGY SAVINGS 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: 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 Handbook",CRCPress 2007

23.12.23

Dr.S.PADMA, M.E., Ph.D.,
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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 celltypes (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.

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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. MehrdadEhsani,YiminGao, Stefano Longo and KambizEbrahimi , "Modern Electric, HybridElectric, 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.

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U19EE929 **ELECTRICAL SYSTEM DESIGN** **1 0 4 3**

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", DhanpatRai& Sons, 2007.
2. J.B.Gupta, "Utilization of Electric Power and Electric Traction", S.K.Kataria& Sons, 2012.

REFERENCE BOOKS

1. V.K.Metha, RohitMetha, "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.

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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 prototypefor the identified problem.
3. Evaluate the solution and compile the report for oral presentation.

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	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

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

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U19ENG601	Communication Skills Laboratory	L	T	P	C	
		0	0	2	1	

Course Outcomes

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

CO1:	Communicate confidently and appropriately in professional environment
CO2:	Demonstrate active interpersonal skill knowledge to excel in their career
CO3:	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 the strength of correlation) 3-Strong, 2-Medium, 1-Weak

COs	Programme Outcomes (POs) and Programme Specific Outcomes (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

Theory:--	Tutorial: --	Practical: 30 hours-	Project:--	Total Hours: 30 Hrs

	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.
REFERENCES	
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.

HOD 12/12/23

Dr. M.RENUGA,
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SALEM - 6

Semester –VI	U19GE601: SOFT SKILLS AND APTITUDE – IV (Common to all dept 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

30 Hours

S. Anita
18/12/2023

Dr.S.Anita
Professor and Head
Department of Training

Dr. S. ANITA
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Department of Training,
SONA COLLEGE OF TECHNOLOGY,
SALEM-636 005.

U19BM1001	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

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

CO1	•	Describe the basics of Hospital Management.
CO2	•	Illustrate the knowledge of Human resource management and marketing in hospitals.
CO3	•	Apply various Quantitative methods in healthcare management.
CO4	•	Amalgamate their knowledge in Hospital information system and supportive services.
CO5	•	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

CO's	Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	2	1	2	2	1	2	1	-	2	1
CO2	2	1	1	-	-	2	1	2	3	1	2	1	-	2	1
CO3	2	1	1	-	-	2	1	2	3	1	1	1	-	2	1
CO4	2	1	1	-	-	2	1	2	2	1	1	1	-	2	1
CO5	2	1	1	-	-	2	1	2	2	1	1	1	-	2	1

UNIT I INTRODUCTION TO HOSPITAL ADMINISTRATION 9

Distinction between Hospital and Industry, Challenges in Hospital Administration, Hospital Planning, 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 Hours

TEXTBOOKS:

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.

REFERENCES:

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.

COORDINATOR

K.MANIKANDAN

Asst. Prof /BME

CHAIRMAN

BoS-BME

Dr.S.PRABAKAR, M.E.,Ph.D.,
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PREAMBLE
To
Municipal Solid Waste Management

Solid wastes represent one of the main environmental problems in India that needs to be dealt with. In order to minimize environmental impacts and pave the way for a sustainable development, integrated and specific actions need to be adopted and implemented. Due to rapid increase in the production and consumption processes, societies generate as well as reject solid materials regularly from various sectors – agricultural, commercial, domestic, industrial and institutional. The present course covers evaluation on the type and nature of wastes, estimation of total volumes and assessment of handling, storage, transportation and disposal methods to be adopted and the potential environmental impacts.

The overall objectives of the course:

- To assess the activities involved for the proposed and determine the type, nature and estimated volumes of waste to be generated.
- To identify any potential environmental impacts from the generation of waste at the site;
- To recommend appropriate waste handling and disposal measures / routings in accordance with the current legislative and administrative requirements; and
- To categories waste material where practicable (inert material / waste fractions) for disposal considerations i.e. public filling areas / landfill.

COURSE CODE	COURSE NAME	L	T	P	C
U19CE1002	MUNICIPAL SOLID WASTE MANAGEMENT	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:	
1.	Provide a broader understanding on various aspects of sources and solid waste management.
2.	Impart the basic knowledge in the methods and processing of on-site storage.
3.	Provide the basic knowledge of types of collection vehicles and transfer stations.
4.	Aware the students about different techniques involved in off-site processing.
5.	Awareness to be given on disposing the wastes using sanitary landfills.
Course Outcome (s) (COs): At the end of this course, the students will be able to:	
CO1	Identify the sources, types and characteristics of solid wastes. **(K1)**
CO2	Choose the on-site storage methods and processing techniques. **(K2)**
CO3	Summarize the methods of collection and its components. **(K2)**
CO4	Outline the off-site processing techniques & equipment's and resource recovery from solid wastes. **(K3)**
CO5	Evaluate the processing techniques and disposal methods for managing the municipal solid wastes. **(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	-	-	-	2	2	1	-	-	-	-	2	-
CO2	3	-	-	-	-	3	2	-	-	-	-	-	2	-
CO3	3	-	-	-	-	2	2	1	-	-	-	3	2	-
CO4	3	-	-	-	3	3	2	1	-	-	-	3	2	3
CO5	3	3	3	-	3	3	2	1	-	-	-	3	2	3
CO (Avg)	3	1	0.6	-	1.2	2.6	2	0.8	-	-	-	1.8	2	1.2

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

UNIT-I	SOURCES AND TYPES	9 Hours

Sources and types of solid wastes - Quantity - factors affecting generation of solid wastes; characteristics - methods of sampling and characterization; Effects of improper disposal of solid wastes - public health effects. Principle of solid waste management –IOT Applications in Waste management; Public awareness; Role of NGOs; Solid waste management rules 2016 - Construction and demolition Wastes

UNIT-II	ON-SITE STORAGE AND PROCESSING	9 Hours

On-site storage methods - Materials used for containers - on-site segregation of solid wastes - public health & economic aspects of storage - options under Indian conditions - Critical evaluation of options.

UNIT-III	COLLECTION AND TRANSFER	9 Hours

Methods of Residential and commercial waste collection - Collection vehicles - Manpower- collection routes - Analysis of collection systems; Transfer stations - Selection of location, operation & maintenance; options under Indian conditions - Field problems- solving

UNIT-IV	OFF-SITE PROCESSING	9 Hours

Processing techniques and equipment; Resource recovery from solid wastes - Composting, incineration, Pyrolysis - Options under Indian conditions - Case studies.

UNIT-V	DISPOSAL	9 Hours

Dumping of solid waste; Sanitary landfills - Site selection, design and operation of sanitary landfills -Leachate collection and treatment, Land fill bio reactor, Landfill capping, Landfill mining.

TOTAL: 45 Hours

TEXT BOOKS:

1. George Tchobanoglous, "Integrated Solid Waste Management", McGraw-Hill Publishers,2003.
2. Vesilind P.A. and Rimer A.E, "Unit Operations in Resource Recovery Engineering", Prentice Hall, Inc., 1981

REFERENCES:

1. Manual on Municipal Solid Waste Management, CPHEEO, Ministry of Urban Development, Government of India, New Delhi, 2000.
2. Landreth R.E, and P.A and Rebers, "Municipal Solid Wastes –problems and Solutions", Lewis Publishers, 2000.
3. Ramachandra T.V, "Management of Municipal Solid Waste", TERI press, New Delhi, 2009.
4. Paul T Willams, "Waste Treatment and Disposal", John Wiley and Sons, 2000
5. http://nptel.iitm.ac.in

22/12/23.

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Dean (R&D) of Civil Engg.
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PREAMBLE
To
Energy Efficiency and Green Building

- Green building, or sustainable design, is the practice of increasing the efficiency with which buildings and their sites use energy, water, and materials, and of reducing impacts on human health and the environment for the entire lifecycle of a building.
- A sustainable building or green building is an outcome of a design philosophy which focuses on increasing the efficiency of resource use-energy, water, and materials-while reducing building impacts on human health and the environment during the building's lifecycle, through better siting, design and construction.
- Solar water heating further reduces energy costs. Onsite generation of renewable energy through solar power, wind power, hydro power, or biomass can significantly reduce the environmental impact of the building. Power generation is generally the most expensive feature to add to a building.

Green buildings are designed in such a way to reduce overall impact on environment and human health by:

- Reducing trash, pollution and degradation of environment.
- Efficiently using energy, water and other resources.
- Protecting occupant health and improving productivity.

COURSE CODE	COURSE NAME	L	T	P	C
U19CE1003	ENERGY EFFICIENCY AND GREEN BUILDING	3	0	0	3

Course Objective (s): The Purpose of learning this course is to:	
1.	To describe the importance of energy resources, its availability and conservation for sustainability goals.
2.	To study and identify the methods adopted to make the building as energy efficient.
3.	To gain knowledge about use of construction materials based on embodied energy values
4.	To study about different green building rating systems with real time examples.
5.	To create awareness about clean development mechanism and the role of UNFCCC in sustainability
Course Outcome (s) (COs): At the end of this course, the students will be able to:	
CO1	Acquire the basics understanding of green building concept and associated resources. **(K1)**
CO2	Analyze the various methods to design green building parameters. **(K3)**
CO3	Understand the availability of construction materialsfor energy efficient construction **(K4)**
CO4	Aware about the various green building rating systems prevail in the country**(K3)**
CO5	Understand the role of UNFCCC and know about clean development mechanism **(K2)**
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	1	3	1	2	1	3	1	1	-	-	3	2	2
CO2	3	1	3	1	2	1	3	1	1	-	-	3	2	2
CO3	3	1	3	1	1	1	3	1	1	-	-	2	2	2
CO4	2	2	3	1	1	1	3	2	1	-	-	2	2	1
CO5	2	2	3	1	1	1	3	2	1	-	-	2	2	1
CO (Avg)	2.6	1.4	3	1	1.4	1	3	1.4	1	-	-	2.4	2	1.6

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

UNIT-I	INTRODUCTION	9 Hours
Definition and concepts, Energy and water as a resource - Criticality of resources - Needs of modern living - Heat loss and heat gain in buildings- thermal comfort improvement methods - other building comforts -indoor air quality requirements - electrical energy conservation.		
UNIT-II	**ENERGY EFFICIENT BUILDINGS**	**9 Hours**
Zero Energy Building (ZEB) - Nearly Zero Energy Building (NZEB) - energy consumption - defining low energy buildings- opportunities and techniques for energy conservation in buildings - water conservation - water management system - water efficient landscaping - green roofing - rainwater harvesting - sanitary fixtures and plumbing systems - wa4stewater treatment and reuse - process water strategies - adoption to sustainable resources, process and technologies- Energy Conservation Opportunities in Public and Private Buildings.		
UNIT-III	**CONSTRUCTION MATERIALS AND PRACTICES**	**9 Hours**
Construction materials - Embodied energy, carbon content, and emission of CO_2 ,SO_2 and NO_x of building materials, elements and construction process- Current practice and low environmental impact alternatives.		
UNIT-IV	**BUILDING ASSESSMENT SCHEMES**	**9 Hours**
Energy efficiency ratings & ECBC - 2007 - Various energy efficiency rating systems for buildings - LEED, BEE, & GRIHA - case studies.		
UNIT-V	**CLEAN DEVELOPMENT MECHANISM**	**9 Hours**
Clean Development Mechanism - CDM Benefits for energy conservation methodology and procedure - Eligibility Criteria - UNFCCC - role of UNFCCC and Government of India.		
		TOTAL: 45 Hours

TEXT BOOKS:

1.	Sustainable Building, Design Manual: Published by The Energy and Resources Institute, Darbari Seth block, IHC Complex, Lodhi Road, New Delhi-110003.
2.	KILBERT, Charles , (2008) Sustainable construction : Green Building Design and Delivery John Wiley and Sons..
3.	BROWN, G.Z. and DEKAY, Mark, 2001. Sun, Wind & Light - Architectural Design Strategies, Second Edition , John Wiley & sons, Inc.

REFERENCES:

1.	ECBC Code 2007 (Edition 2008) published by Bureau of Energy Efficiency, New Delhi
2.	Bureau of Energy Efficiency Publications - rating System, TERI PUBLICATIONS .
3.	GRIHA Rating System, LEED Publications

22/12/23
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U19CS1001 BIG DATA ANALYTICS 3 0 0 3

COURSE OUTCOMES:

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

- Compare and analyze different types of digital data characteristics of Big Data
- Implement programs using Hadoop open source software framework
- Design and develop programs using NoSQL Databases like Mongo DB and Cassandra
- Apply MapReduce programming for various big data based problems
- Implement programs using Hive and Pig Databases

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

UNIT I INTRODUCTION TO BIG DATA 9

Types of Digital Data: Classification of Digital Data Characteristics of Data, Evolution of Big Data, Definition of Big Data, Challenges with Big Data, Characteristics of Big Data ,Traditional Business Intelligence (BI) versus Big Data, A Typical Data Warehouse Environment , A Typical Hadoop Environment.

UNIT II BIG DATA ANALYTICS 9

Introduction -Big Data Analytics, Classification of Analytics, Challenges in Big Data, Technologies to handle Challenges Posed by Big Data- Data Science- Data Scientist, Terminologies Used in Big Data Environments, Basically Available Soft State Eventual Consistency (BASE), Few Top Analytics Tools.

UNIT III HADOOP 9

Introduction Hadoop, RDBMS versus Hadoop, Distributed Computing Challenges ,History of Hadoop , Hadoop Overview, Use Case of Hadoop ,Hadoop Distributors ,HDFS (Hadoop Distributed File System),Processing Data with Hadoop, Managing Resources and Applications with Hadoop YARN (Yet another Resource Negotiator),Interacting with Hadoop Ecosystem, MapReduce Programming -Mapper, Reducer, Combiner, Partitioner, Searching, Sorting, Compression

UNIT IV NO SQL DATABASES 9

Cassandra :Apache Cassandra - An Introduction , Features of Cassandra, CQL Data types, CQLSH, Keyspaces, CRUD (Create, Read, Update and Delete) Operations, Collections, Using a Counter, Time to Live (TTL), Alter Commands, Import and Export, Querying System Tables, Practice Examples- MongoDB, Terms Used in RDBMS and MongoDB, Data Types in MongoDB , MongoDB Query Language

UNIT V HIVE AND PIG 9

Hive: Introduction to Hive, Hive Architecture, Hive Data Types, Hive File Format, Hive Query Language (HQL), RCFile Implementation, SerDe, User-defined Function(UDF).

Pig: Introduction to Pig, The Anatomy of Pig, Pig on Hadoop , Pig Philosophy, Use Case for Pig: ETL Processing, Pig Latin Overview , Data Types in Pig ,Running Pig , Execution Modes of Pig ,HDFS Commands ,Relational Operators ,Eval Function ,Complex Data Types ,Piggy Bank, User-Defined Functions (UDF) ,Parameter Substitution , Diagnostic Operator , Word Count Example using Pig,Pig versus Hive

Total: 45 hours

TEXT BOOKS:

1. **Big Data and Analytics**, Seema Acharya, Subhashini Chellappan, Infosys Limited, Publication: Wiley India Private Limited,1st Edition 2015(Chapters 1,2,3,4,5,6,7,8,9,10)

REFERENCE BOOKS:

1. **Hadoop in Practice**, Alex Holmes, Manning Publications Co., September 2014, Second Edition.
2. **Programming Pig,** Alan Gates, O'Reilly, Kindle Publication.
3. **Programming Hive,** Dean Wampler, O'Reilly, Kindle Publication.

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U19CS1002 CLOUD COMPUTING 3 0 0 3

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

UNIT V Other Ways to Collaborate Online **9**

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.

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U19EC1006 MOBILE TECHNOLOGY AND ITS APPLICATIONS 3 0 0 3

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.

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		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..

22/12/23

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Unit III **3G Generation** **9**

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

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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. Derivetheinnovative 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.

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.

S.P 23.12.23

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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.

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U19FT1001 FUNDAMENTALS OF FASHION DESIGN 3 0 0 3

COURSE OUTCOMES

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

1. Define and discuss the fashion and related terms and reason for change in fashion and the classification
2. Describe clothing and its purpose, Role of clothing and its status.
3. Describe the selection of clothing for various age groups, Fashion apparel and wardrobe planning.
4. Explain the elements and principles of the design, with the effects in the apparel
5. Bounce out the theme and development of portfolio.

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	PO12	PSO1	PSO2	PSO3
CO1	3	3	3							3	3	3	3	3
CO2	3	3	3									3	3	3
CO3	3	3	3								3	3	3	3
CO4	3	3	3								3	3	3	3
CO5	3	3	3							3	3	3	3	3

UNIT I Introduction to Fashion **9**

Origin of fashion - terms and definitions - reasons for change in fashion - classification of fashion – Style, Classic, FAD, Trend – theories of fashion – movement of fashion - fashion cycle.

UNIT II Introduction to Clothing **9**

Understanding clothing - Purpose of clothing: protection, modesty, attraction etc - Importance of clothing - Clothing Culture, Men and Women clothing and ornamentation - Role and status of clothing - Clothing according to climatic conditions – factors to be considered in the selection of clothing

UNIT III Selection of clothes **9**

Clothes for children, middle-aged and adults. Types of clothes according to different types of human figure, Different materials for different clothes, Fabrics and colours suitable for different garments.

Planning for clothing needs: Formal clothing, Clothes for parties, Clothes for sports, Casual Clothes for casualwear. Wardrobe Planning: Wardrobe for men and women

UNIT IV Elements and Principles of Design **9**

Dr. D. RAJA, M.Tech., Ph.D.,
Professor & Head
Department of Fashion Technology
Sona College of Technology
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Elements of Design: Introduction on basics Elements of design - Silhouette, Details, Texture, Color, Lines,

Principle of design: Introduction to principles of Elements of design - Proportion, Balance, Rhythm, Center of Interest, Harmony

UNIT 5 Design and Development **9**

Boards: Mood board, fabric board, colour board, accessory board. Fashion illustration – head theories, Illustration techniques – strokes, hatching, shading; Colouring techniques – Medias for colouring. Portfolio presentation – styles of presentation - Fashion shows.

TOTAL: 45 hours

Dr. D. RAJA, M.Tech., Ph.D.,
Professor & Head
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TEXT BOOKS

1. Munslow, Janine, McKelvey, Kathryn "**Fashion Design Process Innovation and Practice**", 2nd Edition, wiley, 2012.
2. Nicola White, Ian Griffiths, "**The Fashion Business Theory, Practice, Image**", Berg, 2000.

REFERENCE

1. Sumathi, G. J. **Elements of fashion and apparel design**. New Age International, 2007.
2. Kathryn McKelvey "**Fashion Source Book**" Balckwell Publishing New Delhi.
3. Mills, Jane, and Janet K. Smith. **Design concepts**. Fairchild Books, 1985.
4. Rasband J. **Wardrobe strategies for women**. Fairchild Publications; 2002.
5. Jarnow JA, Judelle B, Guerreiro M**. Inside the fashion business**. Wiley; 1981.

U19FT1002 GARMENT MANUFACTURING TECHNOLOGY 3 0 0 3

COURSE OUTCOMES

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

1. Explain the basics of garment technology.
2. Explain in detail about the various seams, stitches, needle type, sewing thread and types of sewing machines.
3. Explain in detail about the various garment accessories.
4. Explain the sewing quality parameters and method of garment laundering.
5. Discuss the quality standards of apparel industry and finishing of garments.

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	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	2						3	3	2
CO2	3	3	3	3	3	3	1					3	3	2
CO3	2	3	3	3	3	3	3					3	3	3
CO4	3	3	3	3	3	3	3	3				3	3	2
CO5	2	3	2	3	3		3	2				3	3	2

UNIT-I Basics of apparel industry - lay out, process sequence 9

Introduction: Apparel industry in world, types of workers in apparel industry, typical layout of apparel industry.

Garment Production Sequence: Fabric selection, pattern making, grading, marker planning, spreading, cutting and sewing , finishing and packing.

UNIT II Seams, Stitches, Needle and Sewing Threads, Types of sewing Machines 9

Seam and Stitches: Classification of seams and stitches, single needle lock stitch machine, parts and functions.

Needle and Sewing Thread: Needle, functions, special needles, needle size, numbering, needlepoint, sewing thread construction, material, thread size, sewing thread packages.

Basics of sewing machines: Single needle Lock stitch, Double needle lock stitch, Over lock, Flat lock, Feed of the arm, Button Attaching, Button hole machine.

Unit III Garment Accessories 9

Garment add-on: Labels, linings, interlinings, wadding, lace, braid, elastic, hook and loop fastening, shoulder pads, eyelets and laces, zip fasteners, buttons, Tapes, Tags.

UNIT IV Overview of garment making and care labelling of garment 9

Sewing Process: Garment basic components and assembly process.

Alternative sewing process: Fusing, welding, adhesive, seamless garments, moulding, robotics in sewing.

Basic sizes of mens wear, women's wear, childrens wear and its description.

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Types of labels: Size label, brand label, wash care label, designer label.

UNIT V Defects in garment, pressing and Packing 9

Defects: Common defects in woven fabric, knitted fabric and garment.
Garment pressing: Pressing types and pressing equipments.
Packing: Types of packing and different types of packing materials.

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TOTAL: 45 hours

TEXT BOOKS

1. Rajkishore Nayak Rajiv Padhye, "**Garment Manufacturing Technology**" 1st Edition, woodhead publication, 2015.
2. Ganesan, P., Gopalakrishnan, D., Karthik, T, **"Apparel manufacturing technology",** CRC Publication, 2016.
3. Gerry Cooklin, Steven George Hayes, John McLoughlin, Dorothy Fairclough. "**Cooklin's Garment Technology for Fashion Designers"**, John Wiley & Sons, 2011.

REFERENCE

1. EIRI Consultants and Engineers, **"Hand book of garment manufacturing technology",** 2017.
2. Janace E. Bubonia, **"Apparel production terms and processes",** 2017.
3. Harold Carr, Barbara Latham, **"The Technology of Clothing Manufacture",** Wiley, 1994.

O.E

MCT VI

Department of Mechatronics Engineering

Open Elective

U19MC1003	SMART AUTOMATION	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 automation concepts
CO2:	Identify the components for automation
CO3:	Know the home and smart city automation concepts
CO4:	Apply the concepts of automation in agriculture
CO5:	Suggest solutions for automation and control applications in textile and medical industry

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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2		3			2			3		3	3
CO2	2	3	3		3		3		3			2	2	3
CO3	3	3	3		3		2				2		3	3
CO4	3	2	3		2					3			3	2
CO5	3	3	3		2			2				2	3	3

Course Assessment methods

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

Unit 01: BASICS OF AUTOMATION — **9 Hours**

Introduction – Drawbacks of manual process – Need of automation in current era – Advantages of automation system – Industry 1.0 to 4.0 – Automation required areas: Heavy Industries – Home – Agriculture – Health care – Defence – Automotive Industries

Unit 02: COMPONENTS FOR AUTOMATION	9 Hours
Sensing: Sensors – Transducers – transduction principle: resistive, Inductive and capacitive type – sensors for detecting temperature, pressure, flow and objects – Decision making: Diode – Transistor – Microprocessor and microcontroller, Raspberry Pi- Relay and PLC – Actuation: Hydraulic and pneumatic cylinders, stepper and servo motors – Lights and buzzers – Analog valves – Bluetooth, Zigbee and Wifi for communication.	
Unit 03: HOME AND SMART CITY AUTOMATION	**9 Hours**
Need of Home automation – Home automation using IoT – Automated gate unlock system – smart domestic appliances – Wifi camera – object detection (dark mode) – biometric based door opening system - Smart Building using IoT – Automatic Solar Tracker - GPS & GSM based Tracker – Automated Street Lighting - Automated Railway Crossing – Smart Traffic Lighting System.	
Unit 04: AGRICULTURE AUTOMATION	**9 Hours**
Standards for agriculture – Need for agriculture digitalization – Dielectric Soil Moisture Sensors – Weather sensors – Measurement of leaf health, chlorophyll detection, crop mapping, fertilizing, seeding and weeding machine, ripeness level detection, fruit picking robot, smart sorting system.	
Unit 05: MEDICAL AND TEXTILE AUTOMATION	**9 Hours**
Types of medical robots – State of art of robotics in the field of healthcare – Assistive robots – Types of assistive robots – Yarn clearer controls – Knotter /splicer carriage controls – Pre-set length/full cone monitors – Warping machine monitors and controls – Humidification system	

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

TEXT BOOKS

1. D. Patranabis, "Sensors and Transducers", PHI Learning pvt ltd., 2004
2. Dwight Spivey, "Home Automation For Dummies", Wiley, 2015

REFERENCES

1. Diego Galar, Pascual Pasquale and Daponte Uday Kumar, "Handbook of Industry 4.0 and SMART Systems", CRC Press, 2021
2. Shimon Y. Nof, "Springer Handbook of Automation", Springer, 2009
3. Pradeep Tomar and Gurjit Kaur, "Artificial Intelligence and IoT-Based Technologies for Sustainable Farming and Smart Agriculture", IGI Global, 2021
4. Ramesh C. Poonia, Xiao-Zhi Gao, Linesh Raja, Sugam Sharma and Sonali Vyas, "Smart Farming Technologies for Sustainable Agricultural Development", IGI Global, 2018
5. Achim Schweikard, Floris Ernst, "Medical Robotics", Springer, 2015
6. George stylios, "Textile objective measurement and automation in garment manufacture", E.Horwood, 1991.

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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	P09	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) Internal test II (8) Internal test III (8) Assignment/seminar/Quiz (5)	Online test (6) Attendance (5) End semester Examination (60)	Course end survey

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.

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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.

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Syllabi for

B.E/B.Tech Honours (Specialization in the same Discipline)

B.E/B.Tech Honours

B.E/B.Tech Minor

courses

U19EE2021 **ENERGY STORAGE SYSTEMS** **3 0 0 3**

COURSE OUTCOMES

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

1. Explain the renewable energy sources and Indian energy market
2. Classify and explain various types of batteries used in energy storage systems.
3. Explain the different thermo electric materials
4. Describe super capacitors and mention its applications
5. Analyze the thermodynamics of fuel cell.

UNIT I INTRODUCTION TO ENERGY SECTOR **9**

Prospect for both traditional and renewable energy sources – detailed analysis of Indian energy market and future need– energy, economic growth and the environment, implications of the Kyoto Protocol, and structural change in the electricity supply industry

UNIT II BATTERY ENERGY STORAGE SYSTEMS **9**

Batteries – performance, charging and discharging, storage density, energy density, and safety issues, classical batteries – Lead Acid, Nickel-Cadmium, Zinc Manganese dioxide, and modern batteries – Zinc-Air, Nickel Hydride, Lithium Battery.

UNIT III THERMO-ELECTRIC SYSTEMS **9**

Thermoelectric – electron conductor and phonon glass, classical thermoelectric materials four probe resistivity measurement, See beck coefficient measurement, and thermal conductivity measurement, Applications.

UNIT IV SUPER CAPACITORS **9**

Super capacitors – types of electrodes and electrolytes, Electrode materials – high surface area activated carbons, metal oxide, and conducting polymers, Electrolyte – aqueous or organic, disadvantages and advantages of super capacitors – compared to battery systems, applications – transport vehicles, private vehicles, and consumer electronics – energy density, power density, price, and market.

UNIT V FUEL CELLS **9**

Fuel cells – direct energy conversion – maximum intrinsic efficiency of an electrochemical converter, physical interpretation – carnot efficiency factor in electrochemical energy convertors, types of fuel cells – hydrogen oxygen cells, hydrogen air cell, alkaline fuel cell, and phosphoric fuel cell.

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

TEXT BOOKS

1. Tetsuya Osaka, Madhav Datta, 'Energy Storage Systems in Electronics', Gordon and Breach Science Publishers, 2014.

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2. Ru-shi Liu, Lei Zhang and Xueliang sun, Electrochemical technologies for energy storage and conversion, Wiley publications, 2nd Volume set, 2012.

REFERENCE BOOKS

1. James Larminie, Andrew Dick, 'Fuel Cell System Explained', J. Wiley, 2003.
2. D.M. Rowe, 'Thermoelectrics Handbook: Macro to Nano', CRC Press, 2006.
3. https://ocw.tudelft.nl/wp-content/uploads/Sustainable-hydrogen-and-electrical-energystorage-lecture1.pdf
4. https://ocw.tudelft.nl/courses/sustainable-hydrogen-electrical-energy-storage/

28.12.23

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U19EE2025 **SENSORS AND ACTUATORS** **3 0 0 3**

COURSE OUTCOMES:

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

1. Explain the principles of various sensors and transducers.
2. Describe the different types of thermal and magnetic sensors
3. Explain the characteristics of radiation and gas sensors.
4. Identify suitable sensors for real time applications.
5. Explain the working principles of actuator and its types.

UNIT I SENSORS AND TRANSDUCERS 9

Principles – Classification – Parameters – Characteristics – Environmental Parameters (EP) – Characterization. – Inductive Sensors: Sensitivity and Linearity of the Sensor – Types – Capacitive Sensors– Electrostatic Transducer – Force/Stress Sensors Using Quartz Resonators – Ultrasonic Sensors.

UNIT II THERMAL AND MAGNETIC SENSORS 9

Introduction – thermometric Sensors types- Gas thermometric Sensors – Thermal Expansion Type Thermometric Sensors – Acoustic Temperature Sensor – Dielectric Constant and Refractive Index thermosensors – Helium Low Temperature Thermometer – Nuclear Thermometer – Magnetic Thermometer – Resistance Change Sensors – Hall Effect Sensors – Inductance and Eddy Current Sensors – Angular/Rotary Movement Transducers – Synchros – Synchro resolvers – Electromagnetic Flowmeter – Switching Magnetic Sensors -SQUID Sensors

UNIT III RADIATION AND GAS SENSORS 9

Introduction – Basic Characteristics – Types of Photosensistors/Photo detectors – Xray and Nuclear Radiation Sensors – Optical gas sensor, Metal oxide semiconductor gas sensor, Field effect transistor gas sensor, Piezoelectric gas sensor, Polymer gas sensor, Nano-structured based gas sensors.

UNIT IV SMART SENSORS 9

Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation – Information Coding/Processing – Data Communication – Standards for Smart Sensor Interface –Automation.

Sensors Application: On-board Automobile Sensors (Automotive Sensors)

UNIT V ACTUATORS 9

Piezoelectric and Piezoresistive actuators, micropumps and micro actuators - Pneumatic and Hydraulic Actuation Systems – Directional Control valves – Pressure control valves – Cylinders – Servo and proportional control valves – Process control valves – Rotary actuators – Mechanical actuation systems – Electrical Actuation Systems .

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

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26-12-23

TEXT BOOKS

1. D. Patranabis, "Sensors and Transducers", PHI Learning Private Limited., 2003.
2. 2. W. Bolton, "Mechatronics", Pearson Education Limited, 2010.

REFERENCES

1. D. Patranabis, "Sensors and Actuators", 2nd Ed., PHI, 2013.
2. Jacob Fraden, "Handbook of Modern Sensors Physics, Designs, and Applications",Springer New York, 2004.
3. Ian Sinclair, "Sensors and Transducers", Elsevier Science, 2000.
4. Sergey Yurish , "Modern Sensors, Transducers and Sensor Networks", IFSA, 2012.

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U19EE904 **MACHINE LEARNING** **3 0 0 3**

COURSE OUTCOMES

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

- Explain the concepts of different types of learning and Data pre-processing methods.
- Summarize the concepts of linear regression and logistic regression and implement the same with python.
- Explain and apply the concepts of Neural networks and support vector machines.
- Evaluate the hypothesis based on factors like bias and variance.
- Explain the concepts of clustering, dimensionality reduction and anomaly detection.

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

UNIT I INTRODUCTION AND DATA PREPROCESSING 9

Supervised Learning – unsupervised learning- Reinforcement learning- Machine Learning Challenges-Python libraries for ML (scikit, pandas, numpy, matplotlib) - Data cleaning - Data integration - Data Reduction - Data Transformation and Data Discretization.

UNIT II REGRESSION AND CLASSIFICATION ALGORITHMS 9

Linear Regression – cost function – gradient descent algorithm – normal equation – implementation – Logistic Regression – Hypothesis representation – decision boundary – nonlinear decision boundaries – cost function – gradient descent – advanced optimizations.

UNIT III NEURAL NETWORKS AND SUPPORT VECTOR MACHINES 9

Overview and summary – neurons and brain – model representation – artificial neural networks representation – example – multiclass classification – cost function – back propagation algorithm – gradient checking – random initialization – Support vector machines – optimization objective – cost function – large margin intuition – decision boundary – kernels – adapting to nonlinear classifiers.

UNIT IV PERFORMANCE EVALUATION AND MACHINE LEARNING SYSTEM DESIGN 9

Debugging a learning algorithm – evaluating a hypothesis – model selection and training, validation test sets – bias Vs variance – regularization and bias/variance – learning curves machine learning system design.

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UNIT V CLUSTERING AND ASSOCIATION **9**

Unsupervised learning –Clustering and application - k-means algorithm – optimization objective Random initialization– choosing number of clusters - Dimensionality reduction: data compression and visualization- principle component analysis - Anomaly detection – algorithm – developing and evaluating the algorithm – anomaly detection Vs supervised algorithm -Case study – recommender system

Assignment: Python Implementation of machine learning algorithms.

Lecture: 45 Hours, **Tutorial:** -- Hours, **Total:** 45 Hours.

TEXT BOOKS

1. Stanford's machine learning course presented by Professor Andrew Ng – online resource - http://www.holehouse.org/mlclass/
2. Data Mining: Concepts and Techniques", Third Edition, Jiawei Han, Micheline Kamber and Jian Pei, ISBN 0123814790,(2011).

REFERENCES

1. James, G., Witten, D., Hastie, T., Tibshirani, R, "An Introduction to Statistical Learning with Applications in R", Springer, 2013.
2. Tom M. Mitchell, "Machine Learning", 1st edition, McGraw Hill Education, 2017.
3. Ethem Alpaydın, "Introduction to Machine Learning", The MIT Press, 2nd edition, 2013.
4. Sebastianraschka, "Python Machine Learning", Packt Publishing Ltd., 2017.

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U19EE2020 **AUTOMOTIVE EMBEDDED SYSTEMS** **3 0 0 3**

COURSE OUTCOME:

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

1. Explain the basics of electronic engine control systems.
2. Describe fuel cell types and characteristics for automotive power.
3. Illustrate various controls in vehicle management systems.
4. Explain the communication protocols and electronics in embedded systems.
5. Develop electronic diagnostic units for vehicles.

UNIT I BASICS OF ELECTRONIC ENGINE CONTROL SYSTEMS 9

Motivation ,concept for electronic engine controls and management – Standards; introduction to fuel economy – automobile sensors – volumetric, thermal, air-fuel ratio, solenoid, hall effect – exhaust gas oxygen sensors, Oxidizing catalytic efficiency, emission limits and vehicle performance; advantages of using Electronic engine controls – open and closed loop fuel control.

UNIT II FUEL CELL FOR AUTOMOTIVE POWER 9

Fuel cell – Introduction–Proton exchange membrane FC (PEM), Solid oxide fuel cell (SOFC) – properties of fuel cells for vehicles – Power system of an automobile with fuel cell based drive, and their characteristics.

UNIT III VEHICLE MANAGEMENT SYSTEMS 9

Electronic Engine Control – Engine mapping, air/fuel ratio spark timing control strategy, fuel control, electronic ignition – Vehicle cruise control – Speed control – Anti-locking braking system – Electronic suspension – Electronic steering , Wiper control ; Vehicle system schematic for interfacing with EMS and ECU.

UNIT IV AUTOMOTIVE TELEMATICS 9

Role of Bluetooth, CAN, LIN and flex ray communication protocols in automotive applications; Multiplexed vehicle system architecture for signal and data / parameter exchange between EMS, ECUs with other vehicle system components and other control systems; Realizing bus interfaces for diagnostics, dashboard display ,multimedia electronics.

UNIT V ELECTRONIC DIAGNOSTICS FOR VEHICLES 9

System diagnostic standards and regulation requirements – On board diagnosis of vehicles – electronic units &electric units – Speedometer, oil & temperature gauges and audio system. Integration of vehicle diagnostics modules over CAN, Serial Interfaces.

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

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TEXT BOOKS:

1. William B. Ribbens ,"Understanding Automotive Electronics", Elseiver,8th edition, 2017.
2. L.Vlacic,M.Parent,F.Harahima,Intelligent Vehicle Technologies,SAE International, 2001, 1st Edition, 2017.

REFERENCES

1. Jack Erjavec, Jeff Arias, "Alternate Fuel Technology-Electric", Hybrid & Fuel Cell Vehicles", Cengage ,2012
2. Electronic Engine Control technology – Ronald K Jurgen Chilton's guide to Fuel Injection =Ford
3. Automotive Electricals / Electronics System and Components, Tom Denton, 3rdEdition, 2004.
4. Robert Bosch," Automotive Hand Book", Fifth edition, SAE Publications.

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U19MC2037	MACHINE VISION SYSTEM	L	T	P	C
		3	0	0	3

Course Outcomes

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

CO1:	Explain the fundamental concepts of digital image processing.
CO2:	Apply Image enhancement techniques in spatial domain.
CO3:	Identify the features and region of interest for a given image using segmentation approaches.
CO4:	Implement different compression techniques.
CO5:	Choose vision techniques for different applications.

Pre-requisite

Nil

CO/PO, PSO Mapping

(3/2/1 indicates the strength of correlation) 3-Strong, 2-Medium, 1-Weak

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

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/Seminar/Quiz (5)	Objective test (6) Attendance (5) End Semester Examination (60)	Course end survey

Unit 01: IMAGE PROCESSING FUNDAMENTALS — **9 Hours**

Fundamental Steps in Digital Image Processing – Elements of Visual Perception – Image Sensing and Acquisition - Some Basic Relationship Between Pixels – Connectivity – Distance Measure – Brightness – Contrast – Hue – Saturation – Mach Band Effect – Types of Image – False Contouring – Colour Image Fundamentals RGB – HSI Models – Conversion from RGB to HSI.

Unit 02: IMAGE ENHANCEMENT — **9 Hours**

Spatial domain filtering: Image negative, Contrast stretching, Gray level slicing – Histogram equalization – Smoothing filters – Sharpening filters – Maximum filter – Minimum filter – Median

filter – Bit Plane Slicing – Frequency domain filtering: Low-pass filter, High-pass filter, Butterworth High-pass filter, Low-pass and High-pass Gaussian filter.			
Unit 03: IMAGE SEGMENTATION			**9 Hours**
Image segmentation: Point, line and edge detection – Basics of intensity thresholding – Region based segmentation : Region growing, Region splitting and merging – Thresholding – Standard Binary Morphological Operations – Dilation and Erosion based Operations.			
Unit 04: IMAGE COMPRESSION			**9 Hours**
Image Compression – Lossless Compression – Huffman Coding –Arithmetic Coding – LZW Coding – Lossy Compression – Transform Coding - Compression Standards: JPEG Image Compression Standards and MPEG Video Compression Standards.			
Unit 05: VISION SYSTEMS			**9 Hours**
Industrial automation and quality inspection - Object detection - Gesture Recognition - Finger print Recognition - Vision for robot control - Selection of camera based on applications.			
Theory: 45 Hrs	**Tutorial: --**	**Practical: --**	**Total Hours: 45 Hrs**

TEXT BOOKS	
1.	Jayaraman S., Esakkirajan and Verrakumar, "Digital Image Processing", TMH New Delhi, 2nd edition, 2020.
2.	Anil K.Jain, "Fundamentals of Digital Image Processing", Prentice Hall of India, 2004.
REFERENCES	
1.	Richard Szeliski, "Computer Vision Algorithms and Applications", Springer Verlag London Limited, 2011.
2.	Sabeenian R.S., "Digital Image Processing", Sonaversity publication, Second Edition, 2010.
3.	Annadurai S., R. Shanmugalakshmi, "Fundamentals of Digital Image Processing", Pearson Education India, 2007.
4.	Sridhar.S, "Digital Image Processing", Oxford University Press, First Edition, 2011.
5.	Rafael C.Gonzalex, Richard E.Woods, "Digital Image Processing", Pearson Education, Forth Edition, 2018.

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U19MC2038	SENSORS AND ACTUATORS	L	T	P	C
		3	0	0	3

Course Outcomes

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

CO1:	Describe the various sensor effects, sensor characteristics, signal types, calibration methods and obtain transfer function and empirical relation of sensors.
CO2:	Analyze and select suitable sensor for motion, proximity and range measurement.
CO3:	Analyze and select suitable sensor for force, magnetic field, speed, position and direction measurement.
CO4:	Analyze and select suitable sensor for light detection, pressure and temperature measurement and also familiar with other miniaturized smart sensors.
CO5:	Select the advanced actuators for implementing macro and micro applications.

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	P09	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2			2			2			3	2
CO2	3	2	3	2			2			2			3	2
CO3	3	2	3	2			2			2			3	2
CO4	3	3	2	2			2			2			3	2
CO5	3	3	3	2			2			2			3	2

Course Assessment methods

Direct		Indirect
Internal test I (8) Internal test II (8) Internal test III (8) Assignment/Seminar/Quiz (5)	Objective test (6) Attendance (5) End Semester Examination (60)	Course end survey

Unit 01: INTRODUCTION TO SENSORS — **09 Hours**

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor calibration techniques – Sensor Output Signal Types. Temperature – IC, Thermistor, RTD, Thermocouple.

Unit 02: MOTION, OPTICAL AND RANGING SENSORS — **09 Hours**

Motion Sensors – Brush Encoders, Potentiometers, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer– GPS, Range Sensors – RF beacons,

Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR)- Photo voltaic, LDR – Fiber optic sensors.	
Unit 03: FORCE, MAGNETIC, AND HEADING SENSORS	**09 Hours**
Strain Gage, Load Cell Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.	
Unit 04: FLUID POWER ACTUATORS	**09 Hours**
Hydraulic and Pneumatic System– ISO Symbols for their Elements - Hydraulic Pumps and Motor - Linear Actuators and Types - Control and Regulating Elements — Direction, Flow and Pressure Control Valves - Methods of Actuation, Types, Sizing of Ports - Spool Valves - Electro Hydraulic Servo Valves - Types - Sequencing Circuits Design - Combinational Logic Circuit Design – Interfacing to PLC.	
Unit 05: ADVANCED ACTUATORS	**09 Hours**
Servomotors - Stepper Motors - BLDC Motor and its Operating Modes – Linear Electrical Actuators - Piezo Electric Actuators - Piezoresistive actuators, micropumps and micro actuators with practical applications.	

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

Text Books

1. Bolton W., "Mechatronics", Pearson; 5th edition, 2015
2. Bradley D.A., and Dawson, Burd and Loader, "Mechatronics", Thomson Press India Ltd., 2004

REFERENCES

1. Ernest O. Doeblin, "Measurement system, Application and Design", Tata McGraw Hill Publishing Company Ltd., Fiftieth Edition, 2004
2. Patranabis D., "Sensor and Actuators", Prentice Hall of India (Pvt) Ltd., 2005.
3. Renganathan S., "Transducer Engineering", Allied Publishers (P) Ltd., 2003
4. Antony Esposito, "Fluid Power Systems and Control", Prentice-Hall, 2006.
5. Austin Hughes, "Electric Motors and Drives Fundamentals, Types and Applications", Fourth Edition, Elsevier, 2013

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U19BME201	BIOLOGY FOR ENGINEERS	L	T	P	C
		3	0	0	3

COURSE OUTCOMES

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

- Analyze the cell growth and structure.
- Classify various nomenclatures of Enzymes.
- Compare different cycles of Metabolism.
- Analyze the human activity with the Genetic nature.
- Design the various industrial applications.

CO/PO, PSO Mapping

(3/2/1 indicates strength of correlation) 3-Strong, 2-Medium, 1-Weak

CO's	Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-
CO2	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-
CO3	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-
CO4	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-
CO5	3	3	1	-	-	-	-	-	-	-	-	2	1	1	-

UNIT I	CELL: THE BASIC UNIT OF LIFE	9

Cell- Basic Properties of Cells- Prokaryotic Cells- Eukaryotic Cells- Cell Cycle and Cell Division- M Phase- Meiosis- Cell Differentiation.

UNIT II	MOLECULAR ANALYSIS AND ENZYMES	9

Carbohydrates- Amino acids and Proteins- Nucleic Acids- Lipids- Nature of Bonding and Qualitative Tests- Classification and Nomenclature of Enzymes- Co-Factors- Importance of Enzymes.

UNIT III	METABOLISM	9

Metabolism and Its Concepts- Metabolic Basis for Living - Anabolic and Catabolic Pathways - Concept of Non- Equilibrium and Steady State- Photosynthesis- Photorespiration (C2 Cycle) - C4 Pathways CAM Cycle (In Succulent Plant) - Factors Affecting Photosynthesis-Respiration- Glycolysis Fermentation- Aerobic Respiration

UNIT IV	GENETICS	9

Mendel's Laws of Inheritance- Gene Interaction- Multiple Alleles- Chromosomal Theory of Inheritance Linkage- Recombination (Crossing Over) - Chromosome Mapping- Genetic Disorders.

UNIT V	MICROBIOLOGY AND ITS INDUSTRIAL APPLICATIONS	9

Microorganisms- Growth Kinetics- Culture Media- Sterilization- Microscopy- applications of Microbiology- Immunology and Immunity- Cancer Biology- Stem Cell.

		TOTAL: 45 Hours
TEXTBOOKS:		
	1.	Wiley,"Biology for Engineers", John Wiley & Sons,I Edition,2018.
	2.	S. ThyagaRajan, N. Selvamurugan, M. P. Rajesh, R. A. Nazeer, Richard W. Thilagaraj, S. Barathi, and M. K. Jaganathan, "Biology for Engineers," Tata McGraw-Hill, New Delhi, 2012
REFERENCES:		
	1.	Robert Weaver, "Molecular Biology," MCGraw-Hill, 5th Edition, 2012.
	2.	Kenneth Murphy, "Janeway's Immunobiology," Garland Science; 8th edition, 2011.

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U19BM1002	BASIC LIFE SUPPORT	L	T	P	C
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COURSE OUTCOMES

On successful completion of this course, the student 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

CO's	Programme Outcomes (PO's) and Programme Specific Outcomes (PSO's)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	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	AUTOMATED EXTERNAL DEFIBRILLATOR AND FOREIGN BODY AIRWAY OBSTRUCTION	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: 45 Hours
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

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U19CS2049 DIGITAL FORENSICS 3 0 0 3

COURSE OUTCOMES:

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

- Describe the basic principles of digital forensics.
- Apply the suitable data acquisition technique to collect the forensic data.
- Apply the different techniques to collect digital evidences from the acquired data.
- Validate the digital evidences and write report on the collected digital evidences.
- Apply the Sleuth Kit Autopsy tool to perform forensics on images and disks

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	PSO 1	PSO 2	PSO3
CO1	3	2	1	3	1	2	2	2	2	3	2	3	2	2	2
CO2	2	3	3	3	3	3	2	1	2	3	2	3	3	3	2
CO3	3	3	2	3	3	2	1	1	2	3	2	3	3	3	2
CO4	2	3	2	3	2	1	1	2	1	3	2	3	3	2	1
CO5	2	3	1	3	1	2	1	1	1	3	2	3	2	2	1

UNIT I INTRODUCTION **9**

An Overview of Digital Forensics - Preparing for Digital Investigations - Maintaining Professional Conduct - Preparing a Digital Forensics Investigation - Procedures for Private-Sector High-Tech Investigations - Understanding Data Recovery Workstations and Software - Conducting an Investigation.

UNIT II DATA ACQUISITION **9**

Understanding Storage Formats for Digital Evidence - Determining the Best Acquisition Method - Contingency Planning for Image Acquisitions - Using Acquisition Tools - Validating Data Acquisitions - Performing RAID Data Acquisitions - Using Remote Network Acquisition Tools - Using Other Forensics Acquisition Tools.

UNIT III PROCESSING CRIME AND INCIDENT SCENES **9**

Identifying Digital Evidence - Collecting Evidence in Private-Sector Incident Scenes - Processing Law Enforcement Crime Scenes - Preparing for a Search - Securing a Digital Incident or Crime

Scene - Seizing Digital Evidence at the Scene - Storing Digital Evidence - Obtaining a Digital Hash.

UNIT IV DATA VALIDATION AND REPORT WRITING 9

Determining What Data to Collect and Analyze - Validating Forensic Data - Understanding the Importance of Reports - Guidelines for Writing Reports - Generating Report Findings with Forensics Software Tools.

UNIT V DIGITAL FORENSIC TOOLS 9

Evaluating Digital Forensics Tool Needs - Digital Forensics Software Tools - Digital Forensics Hardware Tools – Validating and Testing Forensics Software – **Case Study:** Sleuth Kit Autopsy tool.

TOTAL: 45hours

TEXT BOOK:

1. Nelson, B, Phillips, A, Enfinger, F, Stuart, C., "Guide to Computer Forensics and Investigations, 6th ed., Cengage Learning, 2019.

REFERENCE BOOKS:

1. Eoghan Casey, "Handbook of Digital Forensics and Investigation", 1st edition, Academic Press, 2009.
2. Marjie T. Britz, "Computer Forensics and Cyber Crime", 3rd edition, Pearson Education, 2013.
3. Richard Boddington , "Practical Digital Forensics", 1st edition, Packt Publisher, 2016
4. Aaron Philipp, David Cowen and Chris Davis, "Hacking Exposed Computer Forensics: Computer Forensics Secrets & Solutions", Second Edition, McGraw Hill, 2009
5. Dejey and Murugan, "Cyber Forensics", 1st edition, Oxford Press, 2018.

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U19CS935 **ETHICAL HACKING** **3 0 0 3**

COURSE OUTCOMES

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

- Describe the ethical and legal aspects of ethical hacking .
- Perform penetration testing using metasploit framework.
- Exploit the vulnerabilities present in the different operating systems and web applications.
- Perform the vulnerability analysis using different tools.
- Penetrate the victim's network / system using privilege escalation.

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	P09	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3
CO1	3	3	1.	3	1	2	3	3	3	3	2	3	2	2	2
CO2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2
CO3	3	3	3	3	3	2	2	3	3	3	2	3	3	3	2
CO4	3	3	2	3	2	1	2	3	3	3	3	3	3	2	2
CO5	3	3	1	3	1	2	3	3	3	3	2	3	2	2	2

UNIT I INTROCUTION TO ETHICAL DISCLOSURE 9

Ethics of ethical hacking – Ethical hacking and the legal system – proper and ethical disclosure.

UNIT II PENETRATION TESTING AND TOOLS 9

Social engineering attacks – Physical penetration attacks – Insider attacks – Using the Backtrack Linux distribution – Using the Metasploit framework – Managing a penetration test.

UNIT III EXPLOITATION 9

Programming survival skills – Basic Linux exploits – Windows exploits – Understanding and detecting Content-Type attacks – Web application security vulnerabilities.

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UNIT IV VULNERABILITY ANALYSIS 9

Passive analysis – Advanced static analysis with IDA pro – Client side browser exploits – Exploiting the windows access control model – From vulnerability to exploit – Closing the holes: Mitigation.

UNIT V PENETRATION 9

Acquiring situation awareness – Privilege escalation – Maintaining access – Installing backdoors – Identifying and exploiting further targets.

TOTAL: 45hours

TEXT BOOK:

1. Allen Harper, Shon Harris, Jonathan Ness, Chris Eagle, Gideon Lenkey and Terron Williams, "Gray Hat Hacking The Ethical Hackers Handbook", 3rd Edition, McGraw Hill Education, 2017.

REFERENCES:

1. Rafay Baloch, "Ethical Hacking and Penetration Testing Guide", Auerbach Publications, 2014.
2. Stephen Fletcher, "Hacking with Kali Linux: A Beginner's Guide to Ethical Hacking with Kali and Cybersecurity, Includes Linux Command Line, Penetration Testing, Security Systems and Tools for Computer", Monticello Solutions Ltd, 2020.
3. Jon Erickson, "Hacking: The Art of Exploitation", Second Edition, No Starch Press, 2008.

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