ANNA UNIVERSITY, CHENNAI
NON-AUTONOMOUS AFFILIATED COLLEGES
CHOICE BASED CREDIT SYSTEM
REGULATION - 2021
B.E ELECTRICAL AND COMPUTER ENGINEERING
CURRICULUM FOR I TO VIII SEMESTERS AND SYLLABUS
SEMESTER I

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1	IP3151	Induction Programme	-	-			-	-
THEORY								
2	HS3152	Professional English I	HSMC	3	0	0	3	3
3	MA3151	Matrices and Calculus	BSC	3	1	0	4	4
4	PH3151	Engineering Physics	BSC	3	0	0	3	3
5	CY3151	Engineering Chemistry	BSC	3	0	0	3	3
6	CS3251	Programming in C	ESC	3	0	0	3	3
7	GE3152	தமிழர் மரபு / Heritage of Tamils	HSMC	1	0	0	1	1
PRACTICALS								
8	CS3271	Programming in C Laboratory	ESC	0	0	4	4	2
9	BS3171	Physics and Chemistry Laboratory	BSC	0	0	4	4	2
10	GE3172	English Laboratory[$]	EEC	0	0	2	2	1[$]
			TOTAL	**16**	**1**	**10**	**27**	**22**

$ Skill based course

SEMESTER II

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
THEORY								
1	HS3252	Professional English II	HSMC	2	0	0	2	2
2	MA3202	Linear Algebra and Numerical Methods	BSC	3	1	0	4	4
3	CP3201	Problem Solving and Python Programming	ESC	3	0	3	6	4.5
4	BE3255	Basic Civil and Mechanical Engineering	ESC	3	0	0	3	3
5	GE3251	Engineering Graphics	ESC	2	0	4	6	4
6	CP3202	Electric Circuit Analysis	PCC	3	0	2	5	4
7		NCC Credit Course Level 1[#]		2	0	0	2	2*
8	GE3252	தமிழரும் தொழில்நுட்பமும் / Tamils and Technology	HSMC	1	0	0	1	1
PRACTICALS								
9	GE3271	Engineering Practices Laboratory	ESC	0	0	4	4	2
10	GE3272	Communication Laboratory / Foreign Language[$]	EEC	0	0	4	4	2
			TOTAL	**19**	**1**	**17**	**37**	**26.5**

#NCC credit course level1 is offered for NCC students only. The grades earned by the students will be recorded in the mark sheet, however the same shall not be considered for the computation of CGPA.

$ Skill based course

SEMESTER III

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	MA3391	Probability and Statistics	BSC	3	1	0	4	4
2.	EE3301	Electromagnetic fields	PCC	3	1	0	4	4
3.	EC3301	Electron Devices and Circuits	PCC	3	0	0	3	3
4.	CS3301	Data Structures	PCC	3	0	0	3	3
5.	CS3351	Digital Principles and Computer Organization	PCC	3	0	2	5	4
6.	CS3352	Foundations of Data Science	PCC	3	0	0	3	3
PRACTICALS								
7.	EC3311	Electronic Devices and Circuits Laboratory	PCC	0	0	3	3	1.5
8.	CS3311	Data Structures Laboratory	PCC	0	0	3	3	1.5
9.	CS3361	Data Science Laboratory	PCC	0	0	4	4	2
			TOTAL	**18**	**2**	**12**	**32**	**26**

SEMESTER IV

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	GE3451	Environmental Science and Sustainability	BSC	2	0	0	2	2
2.	EE3503	Control Systems	PCC	3	0	0	3	3
3.	MA3354	Discrete Mathematics	BSC	3	1	0	4	4
4.	CS3391	Object Oriented Programming	PCC	3	0	0	3	3
5.	EE3406	Electrical Machines	PCC	3	1	0	4	4
6.	EE3404	Microprocessor and Microcontroller	PCC	3	0	0	3	3
7.		NCC Credit Course Level 2[#]		3	0	0	3	3[#]
PRACTICALS								
8.	EE3414	Electrical Machines Laboratory	PCC	0	0	4	2	2
9.	CS3381	Object Oriented Programming Laboratory	PCC	0	0	3	3	1.5
10.	EE3413	Microprocessor and Microcontroller Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**20**	**2**	**10**	**30**	**24**

NCC Credit Course level 2 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

SEMESTER V

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	EP3501	Power Systems I	PCC	3	0	0	3	3
2.	EE3403	Measurements and Instrumentation	PCC	3	0	0	3	3
3.	EE3402	Linear Integrated Circuits	PCC	3	0	0	3	3
4.	CS3401	Algorithms	PCC	3	0	2	5	4
5.	CS3492	Data Base Management Systems	PCC	3	0	0	3	3
6.		Professional Elective – I	PEC	3	0	0	3	3
7.		Open Elective - I	OEC	3	0	0	3	3
8.		Mandatory Course-I[&]	MC	3	0	0	3	Non-Credit Course
9.	CS3481	Data Base Management Systems Laboratory	PCC	0	0	3	3	1.5
			TOTAL	**21**	**0**	**3**	**26**	**23.5**

[&] Mandatory Course-I is a Non-credit Course (Student shall select one course from the list given under MC-I)

SEMESTER VI

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	EP3601	Power Systems II	PCC	3	0	0	3	3
2.	CS3451	Introduction to Operating Systems	PCC	3	0	2	5	4
3.	EE3591	Power Electronics	PCC	3	0	0	3	3
4.		Professional Elective – II	PEC	3	0	0	3	3
5.		Professional Elective – III	PEC	3	0	0	3	3
6.		Open Elective - II	OEC	3	0	0	3	3
7.		Mandatory Course-II[&]	MC	3	0	0	3	Non-Credit Course
PRACTICALS								
8.	EP3611	Computer Aided Electrical Systems Lab	PCC	0	0	4	2	2
			TOTAL	**18**	**0**	**6**	**25**	**21**

[&] Mandatory Course-II is a Non-credit Course (Student Shall select one course from the list given under MC-II)

SEMESTER VII/VIII *

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
THEORY								
1.	EP3701	Climatic Change and Sustainability	HSMC	2	0	0	2	2
2.	CS3491	Artificial Intelligence and Machine Learning	PCC	3	0	2	5	4
3.	CS3691	Embedded Systems and IoT	PCC	3	0	2	5	4
4.		Professional Elective – IV	PEC	3	0	0	3	3
5.	EP3702	Project Management	HSMC	2	0	0	2	2
PRACTICALS								
6.	EP3711	Summer Internship*	EEC	-	-	-	-	1
			TOTAL	**13**	**0**	**4**	**17**	**16**

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

SEMESTER VIII/VII*

S. NO	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
1.	EP3811	Project Work/ Internship	EEC	0	0	20	20	10
			TOTAL	**0**	**0**	**20**	**20**	**10**

*If students undergo internship in Semester VII, then the courses offered during semester VII will be offered during semester VIII.

TOTAL CREDITS: 169

MANDATORY COURSES I*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS
				L	T	P	
1.	MX3081	Introduction to Women and Gender Studies	MC	3	0	0	3
2.	MX3082	Elements of Literature	MC	3	0	0	3
3.	MX3083	Film Appreciation	MC	3	0	0	3
4.	MX3084	Disaster Risk Reduction and Management	MC	3	0	0	3

*Mandatory courses are offered as Non-Credit courses

MANDATORY COURSES II*

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS
				L	T	P	
1.	MX3085	Well Being with Traditional Practices -Yoga, Ayurveda and Siddha	MC	3	0	0	3
2.	MX3086	History of Science and Technology in India	MC	3	0	0	3
3.	MX3087	Political and Economic Thought for a Humane Society	MC	3	0	0	3
4.	MX3088	State, Nation Building and Politics in India	MC	3	0	0	3
5.	MX3089	Industrial Safety	MC	3	0	0	3

*Mandatory courses are offered as Non-Credit courses

ELECTIVE - MANAGEMENT COURSES

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	GE3751	Principles of Management	HSMC	3	0	0	3	3
2.	GE3752	Total Quality Management	HSMC	3	0	0	3	3
3.	GE3753	Engineering Economics and Financial Accounting	HSMC	3	0	0	3	3
4.	GE3754	Human Resource Management	HSMC	3	0	0	3	3
5.	GE3755	Knowledge Management	HSMC	3	0	0	3	3
6.	GE3792	Industrial Management	HSMC	3	0	0	3	3

OPEN ELECTIVE I

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OHS351	English for Competitive Examinations	OEC	3	0	0	3	3
2.	OMG352	NGOs and Sustainable Development	OEC	3	0	0	3	3
3.	MF3003	Reverse Engineering	OEC	3	0	0	3	3
4.	OCH351	Nano Technology	OEC	3	0	0	3	3
5.	OCH352	Functional Materials	OEC	3	0	0	3	3
6.	OEC351	Signals and Systems	OEC	3	0	0	3	3

7.	CME365	Renewable Energy Technologies	OEC	3	0	0	3	3
8.	AU3008	Sensors and Actuators	OEC	3	0	0	3	3
9.	ORA351	Foundation of Robotics	OEC	3	0	0	3	3
10.	CBM356	Medical Informatics	OEC	3	0	0	3	3

OPEN ELECTIVE II

S. NO.	COURSE CODE	COURSE TITLE	CATEGORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	OEI353	Introduction to PLC Programming	OEC	3	0	0	3	3
2.	CPE334	Energy Conservation and Management	OEC	3	0	0	3	3
3.	OMA352	Operations Research	OEC	3	0	0	3	3
4.	OHS352	Project Report Writing	OEC	3	0	0	3	3
5.	OMG355	Multivariate Data Analysis	OEC	3	0	0	3	3
6.	OME355	Industrial Design & Rapid Prototyping Techniques	OEC	3	0	0	3	3
7.	OML352	Electrical, Electronic and Magnetic Materials	OEC	3	0	0	3	3
8.	CRA332	Drone Technologies	OEC	3	0	0	3	3
9.	OEI354	Introduction to Industrial Automation Systems	OEC	3	0	0	3	3
10.	OCH353	Energy Technology	OEC	3	0	0	3	3

Programme Elective Courses – Streams

Power and Energy Engineering	Data Science and AI	Computer Technologies	e-Mobility	Emerging Technologies	Applications of Computer Science in Electrical Systems
Underground cable engineering	Deep Learning	Computer Networks	Electric Vehicle Architecture	Smart IoT Architecture and Applications	VLSI Design
High Voltage Engineering	Natural Language Processing	Compiler Design	Design of Motor and Power Converters for Electric Vehicles	Digital Twin	Computer Control in Power Systems
Utilization and Conservation of Electrical Energy	Generative AI	Full Stack Web Development	Batteries and Management System	Robotic Process and Automation	Deep Learning for Electrical System Applications
Special Electrical Machines	Responsible AI	Cryptography and Cyber Security	EV Charging Infrastructure	Augmented Reality/Virtual Reality	Intelligent Control for Electrical Systems
Electrical Drives	Bioinformatics	Ethical Hacking	Safety and Testing of Electric Vehicles	DevOps	Industry 5.O
Digital Signal Processing System Design	Big Data Analytics	Cloud Computing	Connected Vehicles	Quantum Computing	Advancements in Electronic warfare Systems
Power Electronics for Renewable Energy Systems	Vibe Coding	Block Chain Technologies	Drone Technologies	Edge and Fog Computing	Cyber Physical Systems

PROFESSIONAL ELECTIVE COURSES : VERTICALS

VERTICAL I : POWER AND ENERGY ENGINEERING

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE3002	Underground cable engineering	PEC	3	0	0	3	3
2.	EE3701	High Voltage Engineering	PEC	3	0	0	3	3
3.	EE3001	Utilization and Conservation of Electrical Energy	PEC	3	0	0	3	3
4.	EE3009	Special Electrical Machines	PEC	2	0	2	4	3
5.	EE3012	Electrical Drives	PEC	2	0	2	4	3
6.	EE3024	Digital Signal Processing System Design	PEC	2	0	2	4	3
7.	EE3014	Power Electronics for Renewable Energy Systems	PEC	2	0	2	4	3

VERTICAL II : DATA SCIENCE AND AI

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	AD3501	Deep Learning	PEC	3	0	0	3	3
2.	AL3501	Natural Language Processing	PEC	3	0	2	5	4
3.	CS3001	Generative AI	PEC	3	0	0	3	3
4.	CS3002	Responsible AI	PEC	3	0	0	3	3
5.	CS3003	Bioinformatics	PEC	3	0	0	3	3
6.	CCS334	Big Data Analytics	PEC	2	0	2	4	3
7.	CS3004	Vibe Coding	PEC	3	0	0	3	3

VERTICAL III : COMPUTER TECHNOLOGIES

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CS3591	Computer Networks	PEC	3	0	0	3	3
2.	CS3005	Compiler Design	PEC	3	0	0	3	3
3.	IT3501	Full Stack Web Development	PEC	3	0	0	3	3
4.	CB3491	Cryptography and Cyber Security	PEC	3	0	0	3	3
5.	CCS344	Ethical Hacking	PEC	2	0	2	4	3
6.	CCS335	Cloud Computing	PEC	2	0	2	4	3
7.	IT3001	Block Chain Technologies	PEC	3	0	0	3	3

VERTICAL IV : E-MOBILITY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE3025	Electric Vehicle Architecture	PEC	3	0	0	3	3
2.	EE3026	Design of Motor and Power Converters for Electric Vehicles	PEC	2	0	2	4	3
3.	AU3002	Batteries and Management System	PEC	3	0	0	3	3
4.	EP3001	EV Charging Infrastructure	PEC	2	0	2	4	3
5.	EP3002	Safety and Testing of Electric Vehicles	PEC	2	0	2	4	3
6.	EP3003	Connected Vehicles	PEC	3	0	0	3	3
7.	CRA332	Drone Technologies	PEC	3	0	0	3	3

VERTICAL V : EMERGING TECHNOLOGIES

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EP3004	Smart IoT Architecture and Applications	PEC	3	0	0	3	3
2.	EP3005	Digital Twin	PEC	3	0	0	3	3
3.	CCS361	Robotic Process and Automation	PEC	2	0	2	4	3
4.	CCS333	Augmented Reality/Virtual Reality	PEC	2	0	2	4	3
5.	CCS342	Dev Ops	PEC	2	0	2	4	3
6.	CCS359	Quantum Computing	PEC	2	0	2	4	3
7.	EP3006	Edge and Fog Computing	PEC	3	0	0	3	3

VERTICAL VI: APPLICATIONS OF COMPUTER SCIENCE IN ELECTRICAL SYSTEMS

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	EE3022	VLSI Design	PEC	2	0	2	4	3
2.	EP3007	Computer Control in Power Systems	PEC	3	0	0	3	3
3.	EP3008	Deep Learning for Electrical System Applications	PEC	3	0	0	3	3
4.	EP3009	Intelligent Control for Electrical Systems	PEC	3	0	0	3	3
5.	EP3010	Industry 5.O	PEC	3	0	0	3	3
6.	EP3011	Advancements in Electronic warfare Systems	PEC	3	0	0	3	3
7.	EP3012	Cyber Physical Systems	PEC	3	0	0	3	3

Enrollment for B.E. / B. Tech. (Honours) / Minor degree (Optional)

A student can also optionally register for additional courses (18 credits) and become eligible for the award of B.E./B.Tech. (Honours) Minor degree.

For B.E. / B. Tech. (Honours), a student shall register for the additional courses (18 credits) from semester V onwards. These courses shall be from the same vertical or a combination of different verticals of the same programme of study only.

For minor degree, a student shall register for the additional courses (18 credits) from semester V onwards. All these courses have to be in a particular vertical from any one of the other programmes, Moreover, for minor degree the student can register for courses from any one of the following verticals also.

Complete details are available in clause 4.10 (Amendments) of Regulations 2021.

VERTICALS FOR MINOR DEGREE (In addition to all the verticals of other degree programmes)

Vertical I	Vertical II	Vertical III	Vertical IV	Vertical V
Fintech and Block Chain	**Entrepreneurship**	**Public Administration**	**Business Data Analytics**	**Environment and Sustainability**
Financial Management	Foundations of Entrepreneurship	Principles of Public Administration	Statistics for Management	Sustainable infrastructure Development
Fundamentals of Investment	Team Building and Leadership Management for Business	Constitution of India	Data mining for Business Intelligence	Sustainable Agriculture and Environmental Management
Banking, Financial Services and Insurance	Creativity and Innovation in Entrepreneurship	Public Personnel Administration	Human Resource Analytics	Sustainable Bio Materials
Introduction to Blockchain and its Applications	Principles of Marketing Management for Business	Administrative Theories	Marketing and Social Media Web Analytics	Materials for Energy Sustainability
Fintech Personal Finance and Payments	Human Resource Management for Entrepreneurs	Indian Administrative System	Operation and Supply Chain Analytics	Green Technology
Introduction to Fintech	Financing New Business Ventures	Public Policy Administration	Financial Analytics	Environmental Quality Monitoring and Analysis
-	-	-	-	Integrated Energy Planning for Sustainable Development
-	-	-	-	Energy Efficiency for Sustainable Development

VERTICALS FOR MINOR DEGREE

(Choice of courses for Minor degree is to be made from any one vertical of other programmes or from anyone of the following verticals)

VERTICAL I : FINTECH AND BLOCK CHAIN

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG331	Financial Management	PEC	3	0	0	3	3
2.	CMG332	Fundamentals of Investment	PEC	3	0	0	3	3
3.	CMG333	Banking, Financial Services and Insurance	PEC	3	0	0	3	3
4.	CMG334	Introduction to Blockchain and its Applications	PEC	3	0	0	3	3
5.	CMG335	Fintech Personal Finance and Payments	PEC	3	0	0	3	3
6.	CMG336	Introduction to Fintech	PEC	3	0	0	3	3

VERTICAL II : ENTREPRENEURSHIP

SL. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG337	Foundations of Entrepreneruship	PEC	3	0	0	3	3
2.	CMG338	Team Building & Leadership Management for Business	PEC	3	0	0	3	3
3.	CMG339	Creativity & Innovation in Entrepreneurship	PEC	3	0	0	3	3
4.	CMG340	Principles of Marketing Management For Business	PEC	3	0	0	3	3
5.	CMG341	Human Resource Management for Entrepreneurs	PEC	3	0	0	3	3
6.	CMG342	Financing New Business Ventures	PEC	3	0	0	3	3

VERTICAL III: PUBLIC ADMINISTRATION

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG343	Principles of Public Administration	PEC	3	0	0	3	3
2.	CMG344	Constitution of India	PEC	3	0	0	3	3
3.	CMG345	Public Personnel Administration	PEC	3	0	0	3	3
4.	CMG346	Administrative Theories	PEC	3	0	0	3	3
5.	CMG347	Indian Administrative System	PEC	3	0	0	3	3
6.	CMG348	Public Policy Administration	PEC	3	0	0	3	3

VERTICAL IV : BUSINESS DATA ANALYTICS

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CMG349	Statistics For Management	PEC	3	0	0	3	3
2.	CMG350	Datamining For Business Intelligence	PEC	3	0	0	3	3
3.	CMG351	Human Resource Analytics	PEC	3	0	0	3	3
4.	CMG352	Marketing And Social Media Web Analytics	PEC	3	0	0	3	3
5.	CMG353	Operation And Supply Chain Analytics	PEC	3	0	0	3	3
6.	CMG354	Financial Analytics	PEC	3	0	0	3	3

VERTICAL V : ENVIRONMENT AND SUSTAINABILITY

S. NO.	COURSE CODE	COURSE TITLE	CATE GORY	PERIODS PER WEEK			TOTAL CONTACT PERIODS	CREDITS
				L	T	P		
1.	CES331	Sustainable infrastructure Development	PEC	3	0	0	3	3
2.	CES332	Sustainable Agriculture and Environmental Management	PEC	3	0	0	3	3
3.	CES333	Sustainable Bio Materials	PEC	3	0	0	3	3
4.	CES334	Materials for Energy Sustainability	PEC	3	0	0	3	3
5.	CES335	Green Technology	PEC	3	0	0	3	3
6.	CES336	Environmental Quality Monitoring and Analysis	PEC	3	0	0	3	3
7.	CES337	Integrated Energy Planning for Sustainable Development	PEC	3	0	0	3	3
8.	CES338	Energy Efficiency for Sustainable Development	PEC	3	0	0	3	3

SUMMARY

SL. NO.	SUBJECT AREA	CREDITS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII/VIII	VIII/VII	
1.	HSMC	4	3	-	-	-	-	4	-	11
2.	BSC	12	4	4	6	-	-	-	-	26
3.	ESC	5	13.5	-	-	-	-	-	-	18.5
4.	PCC	-	4	22	18	17.5	12	8	-	81.5
5.	PEC	-	-	-	-	3	6	3	-	12
6.	OEC	-	-	-	-	3	3	-	-	6
7.	EEC	1	2	-	-	-	-	1	10	14
	Total	22	26.5	26	24	23.5	21	16	10	169
8.	Mandatory Course (Non credit)					✓	✓			

IP3151 **INDUCTION PROGRAMME**

This is a mandatory 2 week programme to be conducted as soon as the students enter the institution. Normal classes start only after the induction program is over.

The induction programme has been introduced by AICTE with the following objective:

“Engineering colleges were established to train graduates well in the branch/department of admission, have a holistic outlook, and have a desire to work for national needs and beyond. The graduating student must have knowledge and skills in the area of his/her study. However, he/she must also have broad understanding of society and relationships. Character needs to be nurtured as an essential quality by which he/she would understand and fulfill his/her responsibility as an engineer, a citizen and a human being. Besides the above, several meta-skills and underlying values are needed.”

“One will have to work closely with the newly joined students in making them feel comfortable, allow them to explore their academic interests and activities, reduce competition and make them work for excellence, promote bonding within them, build relations between teachers and students, give a broader view of life, and build character. “

Hence, the purpose of this programme is to make the students feel comfortable in their new environment, open them up, set a healthy daily routine, create bonding in the batch as well as between faculty and students, develop awareness, sensitivity and understanding of the self, people around them, society at large, and nature.

The following are the activities under the induction program in which the student would be fully engaged throughout the day for the entire duration of the program.

(i) Physical Activity

This would involve a daily routine of physical activity with games and sports, yoga, gardening, etc.

(ii) Creative Arts

Every student would choose one skill related to the arts whether visual arts or performing arts. Examples are painting, sculpture, pottery, music, dance etc. The student would pursue it everyday for the duration of the program. These would allow for creative expression. It would develop a sense of aesthetics and
also enhance creativity which would, hopefully, grow into engineering design later.

(iii) Universal Human Values

This is the anchoring activity of the Induction Programme. It gets the student to explore oneself and allows one to experience the joy of learning, stand up to peer pressure, take decisions with courage, be aware of relationships with colleagues and supporting stay in the hostel and department, be sensitive to others, etc. A module in Universal Human Values provides the base. Methodology of teaching this content is extremely important. It must not be through do's and dont's, but get students to explore and think by engaging them in a dialogue. It is best taught through group discussions and real life activities rather than lecturing.

Discussions would be conducted in small groups of about 20 students with a faculty

mentor each. It would be effective that the faculty mentor assigned is also the faculty advisor for the student for the full duration of the UG programme.

(iv) Literary Activity

Literary activity would encompass reading, writing and possibly, debating, enacting a play etc.

(v) Proficiency Modules

This would address some lacunas that students might have, for example, English, computer familiarity etc.

(vi) Lectures by Eminent People

Motivational lectures by eminent people from all walks of life should be arranged to give the students exposure to people who are socially active or in public life.

(vii) Visits to Local Area

A couple of visits to the landmarks of the city, or a hospital or orphanage could be organized. This would familiarize them with the area as well as expose them to the under privileged.

(viii) Familiarization to Dept./Branch & Innovations

They should be told about what getting into a branch or department means what role it plays in society, through its technology. They should also be shown the laboratories, workshops & other facilities.

(ix) Department Specific Activities

About a week can be spent in introducing activities (games, quizzes, social interactions, small experiments, design thinking etc.) that are relevant to the particular branch of Engineering/Technology/Architecture that can serve as a motivation and kindle interest in building things (become a maker) in that particular field. This can be conducted in the form of a workshop. For example, CSE and IT students may be introduced to activities that kindle computational thinking, and get them to build simple games. ECE students may be introduced to building simple circuits as an extension of their knowledge in Science, and so on. Students may be asked to build stuff using their knowledge of science.

Induction Programme is totally an activity based programme and therefore there shall be no tests / assessments during this programme.

References:
Guide to Induction program from AICTE

HS3152 PROFESSIONAL ENGLISH I L T P C
3 0 0 3

COURSE OBJECTIVES :

- To improve the communicative competence of learners
- To learn to use basic grammatic structures in suitable contexts
- To acquire lexical competence and use them appropriately in a sentence and understand their meaning in a text
- To help learners use language effectively in professional contexts
- To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.

UNIT I INTRODUCTION TO EFFECTIVE COMMUNICATION 1

What is effective communication? (Explain using activities) Why is communication critical for excellence during study, research and work? What are the seven C's of effective communication? What are key language skills? What is effective listening? What does it involve? What is effective speaking? What does it mean to be an excellent reader? What should you be able to do? What is effective writing? How does one develop language and communication skills? What does the course focus on? How are communication and language skills going to be enhanced during this course? What do you as a learner need to do to enhance your English language and communication skills to get the best out of this course?

INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 8

Reading - Reading brochures (technical context), telephone messages / social media messages relevant to technical contexts and emails. Writing - Writing emails / letters introducing oneself. Grammar - Present Tense (simple and progressive); Question types: Wh/ Yes or No/ and Tags. Vocabulary - Synonyms; One word substitution; Abbreviations & Acronyms (as used in technical contexts).

UNIT II NARRATION AND SUMMATION 9

Reading - Reading biographies, travelogues, newspaper reports, Excerpts from literature, and travel & technical blogs. Writing - Guided writing-- Paragraph writing Short Report on an event (field trip etc.) Grammar –Past tense (simple); Subject-Verb Agreement; and Prepositions. Vocabulary - Word forms (prefixes& suffixes); Synonyms and Antonyms. Phrasal verbs.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 9

Reading – Reading advertisements, gadget reviews; user manuals. Writing - Writing definitions; instructions; and Product /Process description. Grammar - Imperatives; Adjectives; Degrees of comparison; Present & Past Perfect Tenses. Vocabulary - Compound Nouns, Homonyms; and Homophones, discourse markers (connectives & sequence words).

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 9

Reading – Newspaper articles; Journal reports –and Non Verbal Communcation (tables, pie charts etc,.). Writing – Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from non verbal (chart , graph etc, to verbal mode)

Grammar – Articles; Pronouns - Possessive & Relative pronouns. Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION 9

Reading – Reading editorials; and Opinion Blogs; Writing – Essay Writing (Descriptive or narrative). Grammar – Future Tenses, Punctuation; Negation (Statements & Questions); and Simple, Compound & Complex Sentences. Vocabulary - Cause & Effect Expressions – Content vs Function words.

TOTAL : 45 PERIODS

LEARNING OUTCOMES :

At the end of the course, learners will be able

CO1: To use appropriate words in a professional context

CO2: To gain understanding of basic grammatic structures and use them in right context.

CO3: To read and infer the denotative and connotative meanings of technical texts

CO4: To write definitions, descriptions, narrations and essays on various topics

TEXT BOOKS :

1. English for Engineers & Technologists Orient Blackswan Private Ltd. Department of English, Anna University, (2020 edition)
2. English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, 3. Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Technical Communication – Principles And Practices By Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By Aysha Viswamohan, Mcgraw Hill Education, ISBN : 0070264244.
4. Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.
5. Learning to Communicate – Dr. V. Chellammal, Allied Publishing House, New Delhi,2003.

ASSESSMENT PATTERN

Two internal assessments and an end semester examination to test students' reading and writing skills along with their grammatical and lexical competence.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO11	PO12	PSO1	PSO2	PSO3
1	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
2	1	1	1	1	1	3	3	3	1	3	-	3	-	-	-
3	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
4	2	3	2	3	2	3	3	3	2	3	3	3	-	-	-
5	2	3	3	3	-	3	3	3	2	3	-	3	-	-	-
Avg.	1.6	2.2	1.8	2.2	1.5	3	3	3	1.6	3	3	3	-	-	-

MA3151 **MATRICES AND CALCULUS** **L T P C**
3 1 0 4

COURSE OBJECTIVES :

- To develop the use of matrix algebra techniques that is needed by engineers for practical applications.
- To familiarize the students with differential calculus.
- To familiarize the student with functions of several variables. This is needed in many branches of engineering.
- To make the students understand various techniques of integration.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

UNIT I MATRICES **9 + 3**

Eigenvalues and Eigenvectors of a real matrix – Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation – Nature of quadratic forms – Applications : Stretching of an elastic membrane.

UNIT II DIFFERENTIAL CALCULUS **9 + 3**

Representation of functions - Limit of a function - Continuity - Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Implicit differentiation - Logarithmic differentiation - Applications : Maxima and Minima of functions of one variable.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9 + 3**

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Partial differentiation of implicit functions – Taylor's series for functions of two variables – Applications : Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.

UNIT IV INTEGRAL CALCULUS **9 + 3**

Definite and Indefinite integrals - Substitution rule - Techniques of Integration : Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction, Integration of irrational functions - Improper integrals - Applications : Hydrostatic force and pressure, moments and centres of mass.

UNIT V MULTIPLE INTEGRALS **9 + 3**

Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids – Change of variables in double and triple integrals – Applications : Moments and centres of mass, moment of inertia.

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Use the matrix algebra methods for solving practical problems.
CO2: Apply differential calculus tools in solving various application problems.
CO3: Able to use differential calculus ideas on several variable functions.
CO4: Apply different methods of integration in solving practical problems.
CO5: Apply multiple integral ideas in solving areas, volumes and other practical problems.

TEXT BOOKS :

1. Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2. Grewal.B.S., “Higher Engineering Mathematics”, Khanna Publishers, New Delhi, 44th Edition, 2018.
3. James Stewart, " Calculus : Early Transcendentals ", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCES :

1. Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2. Bali. N., Goyal. M. and Watkins. C., “ Advanced Engineering Mathematics”, Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3. Jain . R.K. and Iyengar. S.R.K., “Advanced Engineering Mathematics”, Narosa Publications, New Delhi, 5th Edition, 2016.
4. Narayanan. S. and Manicavachagom Pillai. T. K., “Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5. Ramana. B.V., " Higher Engineering Mathematics ", McGraw Hill Education Pvt. Ltd,New Delhi, 2016.
6. Srimantha Pal and Bhunia. S.C, " Engineering Mathematics " Oxford University Press, 2015.
7. Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus ", 14th Edition, Pearson India, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
2	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
3	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
4	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
5	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-
Avg.	3	3	1	1	0	0	0	0	2	0	2	3	-	-	-

PH3151 ENGINEERING PHYSICS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To make the students effectively to achieve an understanding of mechanics.
- To enable the students to gain knowledge of electromagnetic waves and its applications.
- To introduce the basics of oscillations, optics and lasers.
- Equipping the students to be successfully understand the importance of quantum physics.
- To motivate the students towards the applications of quantum mechanics.

UNIT I MECHANICS 9

Multiparticle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - theorems of M .I –moment of inertia of continuous bodies – M.I of a diatomic molecule - torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule - gyroscope - torsional pendulum – double pendulum –Introduction to nonlinear oscillations.

UNIT II ELECTROMAGNETIC WAVES 9

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure - Cell-phone reception. Reflection and transmission of electromagnetic waves from a non-conducting medium-vacuum interface for normal incidence.

UNIT III OSCILLATIONS, OPTICS AND LASERS 9

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave - sound waves - Doppler effect. Reflection and refraction of light waves - total internal reflection - interference –Michelson interferometer –Theory of air wedge and experiment. Theory of laser - characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO_2 laser, semiconductor laser –Basic applications of lasers in industry.

UNIT IV BASIC QUANTUM MECHANICS 9

Photons and light waves - Electrons and matter waves –Compton effect - The Schrodinger equation (Time dependent and time independent forms) - meaning of wave function - Normalization –Free particle - particle in a infinite potential well: 1D,2D and 3D Boxes- Normalization, probabilities and the correspondence principle.

UNIT V APPLIED QUANTUM MECHANICS 9

The harmonic oscillator(qualitative)- Barrier penetration and quantum tunneling(qualitative)- Tunneling microscope - Resonant diode - Finite potential wells (qualitative)- Bloch's theorem for particles in a periodic potential –Basics of Kronig-Penney model and origin of energy bands.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

CO1: Understand the importance of mechanics.
CO2: Express their knowledge in electromagnetic waves.
CO3: Demonstrate a strong foundational knowledge in oscillations, optics and lasers.
CO4: Understand the importance of quantum physics.
CO5: Comprehend and apply quantum mechanical principles towards the formation of energy bands.

TEXT BOOKS:

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw-Hill (Indian Edition), 2017.

REFERENCES:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3. K.Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4. D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5. N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer- Verlag, 2012.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	2	1	1	1	-	-	-	-	-	-	-	-	-
2	3	3	2	1	2	1	-	-	-	-	-	-	-	-	-
3	3	3	2	2	2	1	-	-	-	-	-	1	-	-	-
4	3	3	1	1	2	1	-	-	-	-	-	-	-	-	
5	3	3	1	1	2	1	-	-	-	-	-	-	-	-	-
Avg.	3	3	1.6	1.2	1.8	1	-	-	-	-	-	1	-	-	-

CY3151 ENGINEERING CHEMISTRY L T P C
3 0 0 3

COURSE OBJECTIVES:

- To inculcate sound understanding of water quality parameters and water treatment techniques.
- To impart knowledge on the basic principles and preparatory methods of nanomaterials.
- To introduce the basic concepts and applications of phase rule and composites.
- To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
- To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

UNIT I WATER AND ITS TREATMENT 9

Water: Sources and impurities, **Water quality parameters:** Definition and significance of- colour, odour, turbidity, pH, hardness, alkalinity, TDS, COD and BOD, flouride and arsenic. **Municipal water treatment:** primary treatment and disinfection (UV, Ozonation, break-point chlorination)**. Desalination of brackish water**: Reverse Osmosis. **Boiler troubles:** Scale and sludge, Boiler corrosion, Caustic
embrittlement, Priming &foaming. **Treatment of boiler feed water**: Internal treatment (phosphate, colloidal, sodium aluminate and calgon conditioning) and External treatment – Ion exchange demineralisation and zeolite process.

UNIT II NANOCHEMISTRY 9

Basics: Distinction between molecules, nanomaterials and bulk materials; **Size-dependent properties** (optical, electrical, mechanical and magnetic); **Types of nanomaterials**: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. **Preparation of nanomaterials:** sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. **Applications** of nanomaterials in medicine, agriculture, energy, electronics and catalysis.

UNIT III PHASE RULE AND COMPOSITES 9

Phase rule: Introduction, definition of terms with examples. One component system - water system; Reduced phase rule; Construction of a simple eutectic phase diagram - Thermal analysis; Two component system: lead-silver system - Pattinson process.
Composites: Introduction: Definition & Need for composites; **Constitution**: Matrix materials (Polymer matrix, metal matrix and ceramic matrix) and Reinforcement (fiber, particulates, flakes and whiskers). **Properties and applications of**: Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. **Hybrid composites** - definition and examples.

UNIT IV FUELS AND COMBUSTION 9

Fuels: Introduction: Classification of fuels; **Coal and coke**: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). **Petroleum and Diesel:** Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil - cetane number; **Power alcohol and biodiesel.**
Combustion of fuels: Introduction: Calorific value - higher and lower calorific values, Theoretical calculation of calorific value; **Ignition temperature**: spontaneous ignition temperature, Explosive range; **Flue gas analysis** - ORSAT Method. **CO_2 emission and carbon foot print.**

UNIT V ENERGY SOURCES AND STORAGE DEVICES 9

Stability of nucleus: mass defect (problems), binding energy; Nuclear energy: light water nuclear power plant, breeder reactor. **Solar energy conversion:** Principle, working and applications of solar cells**; Recent developments in solar cell materials. Wind energy; Geothermal energy;Batteries:** Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion-battery; **Electric vehicles-working principles; Fuel cells:** H_2-O_2 fuel cell, microbial fuel cell; **Supercapacitors:** Storage principle, types and examples.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.

CO2: To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.

CO3: To apply the knowledge of phase rule and composites for material selection requirements.

CO4: To recommend suitable fuels for engineering processes and applications.

CO5: To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

TEXT BOOKS:

1. P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, DhanpatRai Publishing Company (P) Ltd, New Delhi, 2018.
2. Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.
3. S.S. Dara, “A text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition, 2018.

REFERENCES:

1. B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Text book of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.
2. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
3. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
4. ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, Second Edition, 2019.
5. O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	2	2	1	-	1	1	-	-	-	-	1	-	-	-
2	2	-	-	1	-	2	2	-	-	-	-	-	-	-	-
3	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
4	3	1	1	-	-	1	2	-	-	-	-	-	-	-	-
5	3	1	2	1	-	2	2	-	-	-	-	2	-	-	-
Avg.	2.8	1.3	1.6	1	-	1.5	1.8	-	-	-	-	1.5	-	-	-

CS3251 PROGRAMMING IN C L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the constructs of C Language.
- To develop C Programs using basic programming constructs
- To develop C programs using arrays and strings
- To develop modular applications in C using functions
- To develop applications in C using pointers and structures
- To do input/output and file handling in C

UNIT I BASICS OF C PROGRAMMING 9

Introduction to programming paradigms – Applications of C Language - Structure of C program - C programming: Data Types - Constants – Enumeration Constants - Keywords – Operators: Precedence and Associativity - Expressions - Input/Output statements, Assignment statements – Decision making statements - Switch statement - Looping statements – Preprocessor directives - Compilation process

UNIT II ARRAYS AND STRINGS 9

Introduction to Arrays: Declaration, Initialization – One dimensional array –Two dimensional arrays - String operations: length, compare, concatenate, copy – Selection sort, linear and binary search.

UNIT III FUNCTIONS AND POINTERS 9

Modular programming - Function prototype, function definition, function call, Built-in functions (string functions, math functions) – Recursion, Binary Search using recursive functions – Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Parameter passing: Pass by value, Pass by reference.

UNIT IV STRUCTURES AND UNION 9

Structure - Nested structures – Pointer and Structures – Array of structures – Self referential structures – Dynamic memory allocation - Singly linked list – typedef – Union - Storage classes and Visibility.

UNIT V FILE PROCESSING 9

Files – Types of file processing: Sequential access, Random access – Sequential access file - Random access file - Command line arguments.

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge on C Programming constructs

CO2: Develop simple applications in C using basic constructs

CO3: Design and implement applications using arrays and strings

CO4: Develop and implement modular applications in C using functions.

CO5: Develop applications in C using structures and pointers.

CO6: Design applications using sequential and random access file processing.

TEXT BOOKS:

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.

TOTAL : **45 PERIODS**

REFERENCES:

1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, “Schaum’s Outline of Theory and Problems of Programming with C”, McGraw- Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second
5. Edition, Oxford University Press, 2013.
6. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	2	2	1	2	1	1	1	2	-	3	2	1	2	-
2	2	2	2	1	2	1	1	1	2	-	3	3	2	2	-
3	2	3	2	1	2	1	1	1	2	-	3	2	2	2	-
4	3	2	2	1	3	1	1	1	2	-	3	3	2	2	-
5	2	3	3	1	2	1	2	1	2	-	3	2	2	3	-
6	2	2	3	2	1	2	-	-	2	1	2	2	2	2	
CO	**2**	**2**	**2**	**1**	**2**	**1**	**1**	**1**	**2**	**-**	**3**	**2**	**2**	**2**	-

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

GE3152 HERITAGE OF TAMILS LT P C
1 0 0 1

UNIT I LANGUAGE AND LITERATURE 3

Language Families in India - Dravidian Languages – Tamil as aClassical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.

UNIT II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 3

Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.

UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV THINAI CONCEPT OF TAMILS 3

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.

UNIT V CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE 3

Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. *தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).*
2. *கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).*
3. *கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)*
4. *பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)*
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

GE3152 ***தமிழர் மரபு*** **LT P C**

1 0 0 1

அலகு I ***மொழி மற்றும் இலக்கியம்:*** **3**

இந்திய மொழிக் குடும்பங்கள் – திராவிட மொழிகள் – தமிழ் ஒரு செம்மொழி – தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் – திருக்குறளில் மேலாண்மைக் கருத்துக்கள் – தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் – சிற்றிலக்கியங்கள் – தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி – தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு.

அலகு II மரபு – பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை – சிற்பக் கலை: **3**

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள்– பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரிமுனையில் திருவள்ளுவர் சிலை – இசைக் கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு.

அலகு III ***நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள்:*** **3**

தெருக்கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல்பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம், தமிழர்களின் விளையாட்டுகள்.

அலகு IV ***தமிழர்களின் திணைக் கோட்பாடுகள்:*** **3**

தமிழகத்தின் தாவரங்களும், விலங்குகளும் – தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் – தமிழர்கள் போற்றிய அறக்கோட்பாடு – சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் – சங்ககால நகரங்களும் துறை முகங்களும் – சங்ககாலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி – கடல்கடந்த நாடுகளில் சோழர்களின் வெற்றி.

அலகு V ***இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு:*** **3**

இந்திய விடுதலைப்போரில் தமிழர்களின் பங்கு – இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் – சுயமரியாதை இயக்கம் – இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப்படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. *தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).*
2. *கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).*
3. *கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)*
4. *பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)*
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department ofArchaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay)

(Publishedby: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

CS3271 PROGRAMMING IN C LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

- To familiarise with C programming constructs.
- To develop programs in C using basic constructs.
- To develop programs in C using arrays.
- To develop applications in C using strings, pointers, functions.
- To develop applications in C using structures.
- To develop applications in C using file processing.

LIST OF EXPERIMENTS:

Note: The lab instructor is expected to design problems based on the topics listed. The Examination shall not be restricted to the sample experiments designed.

1. I/O statements, operators, expressions
2. decision-making constructs: if-else, goto, switch-case, break-continue
3. Loops: for, while, do-while
4. Arrays: 1D and 2D, Multi-dimensional arrays, traversal
5. Strings: operations
6. Functions: call, return, passing parameters by (value, reference), passing arrays to function.
7. Recursion
8. Pointers: Pointers to functions, Arrays,Strings, Pointers to Pointers, Array of Pointers
9. Structures: Nested Structures, Pointers to Structures, Arrays of Structures and Unions.
10. Files: reading and writing, File pointers, file operations, random access, processor directives.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Demonstrate knowledge on C programming constructs.

CO2: Develop programs in C using basic constructs.

CO3: Develop programs in C using arrays.

CO4: Develop applications in C using strings, pointers, functions.

CO5: Develop applications in C using structures.

CO6: Develop applications in C using file processing.

TEXT BOOKS:

1. ReemaThareja, “Programming in C”, Oxford University Press, Second Edition, 2016.
2. Kernighan, B.W and Ritchie,D.M, “The C Programming language”, Second Edition, Pearson Education, 2015.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “C How to Program with an Introduction to C++”, Eighth edition, Pearson Education, 2018.
2. Yashwant Kanetkar, Let us C, 17th Edition, BPB Publications, 2020.
3. Byron S. Gottfried, "Schaum's Outline of Theory and Problems of Programming with C", McGraw-Hill Education, 1996.
4. Pradip Dey, Manas Ghosh, “Computer Fundamentals and Programming in C”, Second Edition, Oxford University Press, 2013.
5. Anita Goel and Ajay Mittal, “Computer Fundamentals and Programming in C”, 1st Edition, Pearson Education, 2013.

CO’s-PO’s & PSO’s MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	1	3	3	1	1	1	-	-	2	1	2	2	2	2	
2	2	3	3	2	1	1	-	-	2	1	2	2	2	3	
3	2	2	2	1	1	2	-	-	2	-	2	2	2	2	
4	2	2	2	2	1	2	-	-	3	-	3	3	3	2	
5	2	2	3	2	3	2	-	-	3	-	3	3	3	3	
6	2	2	3	2	1	2	-	-	2	1	2	2	2	2	
Avg	2	2	3	2	1	2	-	-	2	1	2	2	2	2	

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

BS3171 PHYSICS AND CHEMISTRY LABORATORY L T P C
0 0 4 2

PHYSICS LABORATORY : (Any Seven Experiments)

COURSE OBJECTIVES:

- To learn the proper use of various kinds of physics laboratory equipment.
- To learn how data can be collected, presented and interpreted in a clear and concise manner.
- To learn problem solving skills related to physics principles and interpretation of experimental data.
- To determine error in experimental measurements and techniques used to minimize such error.
- To make the student as an active participant in each part of all lab exercises.

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.
2. Simple harmonic oscillations of cantilever.
3. Non-uniform bending - Determination of Young’s modulus
4. Uniform bending – Determination of Young’s modulus
5. Laser- Determination of the wave length of the laser using grating
6. Air wedge - Determination of thickness of a thin sheet/wire
7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle
   b) Compact disc- Determination of width of the groove using laser.
8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids.

9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids
10. Post office box -Determination of Band gap of a semiconductor.
11. Photoelectric effect
12. Michelson Interferometer.
13. Melde's string experiment
14. Experiment with lattice dynamics kit.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

Upon completion of the course, the students should be able to

CO1: Understand the functioning of various physics laboratory equipment.
CO2: Use graphical models to analyze laboratory data.
CO3: Use mathematical models as a medium for quantitative reasoning and describing physical reality.
CO4: Access, process and analyze scientific information.
CO5: Solve problems individually and collaboratively.

MAPPING OF COs WITH POs AND PSOs

CO's	PO's												PSO's		
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
2	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
3	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
4	3	3	2	1	1	-	-	-	-	-	-	-	-	-	-
5	3	2	3	1	1	-	-	-	-	-	-	-	-	-	-
Avg.	3	2.4	2.6	1	1	-	-	-	-	-	-	-	-	-	-

CHEMISTRY LABORATORY: (Any seven experiments to be conducted)

COURSE OBJECTIVES:

- To inculcate experimental skills to test basic understanding of water quality parameters, such as, acidity, alkalinity, hardness, DO, chloride and copper.
- To induce the students to familiarize with electroanalytical techniques such as, pH metry, potentiometry and conductometry in the determination of impurities in aqueous solutions.
- To demonstrate the analysis of metals and alloys.
- To demonstrate the synthesis of nanoparticles

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
- Split the first experiment into two
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of copper content of the given solution by Iodometry.
7. Estimation of TDS of a water sample by gravimetry.
8. Determination of strength of given hydrochloric acid using pH meter.
9. Determination of strength of acids in a mixture of acids using conductivity meter.

10. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)
11. Estimation of iron content of the given solution using potentiometer.
12. Estimation of sodium /potassium present in water using flame photometer.
13. Preparation of nanoparticles (TiO_2/ZnO/CuO) by Sol-Gel method.
14. Estimation of Nickel in steel
15. Proximate analysis of Coal

TOTAL : 30 PERIODS

COURSE OUTCOMES :

CO1: To analyse the quality of water samples with respect to their acidity, alkalinity, hardness and DO.
CO2: To determine the amount of metal ions through volumetric and spectroscopic techniques
CO3: To analyse and determine the composition of alloys.
CO4: To learn simple method of synthesis of nanoparticles
CO5: To quantitatively analyse the impurities in solution by electroanalytical techniques

TEXT BOOKS :

1. J. Mendham, R. C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Textbook of Quantitative Chemical Analysis (2009).

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
2	3	1	2	-	-	1	2	-	-	-	-	1	-	-	-
3	3	2	1	1	-	-	1	-	-	-	-	-	-	-	-
4	2	1	2	-	-	2	2	-	-	-	-	-	-	-	-
5	2	1	2	-	1	2	2	-	-	-	-	1	-	-	-
Avg.	2.6	1.3	1.6	1	1	1.4	1.8	-	-	-	-	1.3	-	-	-

GE3172 ENGLISH LABORATORY L T P C
0 0 2 1

COURSE OBJECTIVES:

- To improve the communicative competence of learners
- To help learners use language effectively in academic /work contexts
- To develop various listening strategies to comprehend various types of audio materials like lectures, discussions, videos etc.
- To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
- To use language efficiently in expressing their opinions via various media.

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 6

Listening for general information-specific details- conversation: Introduction to classmates - Audio / video (formal & informal); Telephone conversation; Listening to voicemail & messages; Listening and filling a form. Speaking - making telephone calls-Self Introduction; Introducing a friend; - politeness strategies-making polite requests, making polite offers, replying to polite requests and offers- understanding basic instructions(filling out a bank application for example).

UNIT II NARRATION AND SUMMATION 6

Listening - Listening to podcasts, anecdotes / stories / event narration; documentaries and interviews with celebrities. Speaking - Narrating personal experiences / events-Talking about current and temporary

situations & permanent and regular situations* - describing experiences and feelings- engaging in small talk-describing requirements and abilities.

UNIT III DESCRIPTION OF A PROCESS / PRODUCT 6

Listening - Listen to product and process descriptions; a classroom lecture; and advertisements about products. Speaking – Picture description- describing locations in workplaces- Giving instruction to use the product- explaining uses and purposes- Presenting a product- describing shapes and sizes and weights-talking about quantities(large & small)-talking about precautions.

UNIT IV CLASSIFICATION AND RECOMMENDATIONS 6

Listening – Listening to TED Talks; Listening to lectures - and educational videos. Speaking – Small Talk; discussing and making plans-talking about tasks-talking about progress- talking about positions and directions of movement-talking about travel preparations- talking about transportation-

UNITV EXPRESSION 6

Listening – Listening to debates/ discussions; different viewpoints on an issue; and panel discussions. Speaking –making predictions- talking about a given topic-giving opinions- understanding a website-describing processes

TOTAL : 30 PERIODS

LEARNING OUTCOMES:

At the end of the course, learners will be able

CO1: To listen to and comprehend general as well as complex academic information
CO2: To listen to and understand different points of view in a discussion
CO3: To speak fluently and accurately in formal and informal communicative contexts
CO4: To describe products and processes and explain their uses and purposes clearly and accurately
CO5: To express their opinions effectively in both formal and informal discussions

ASSESSMENT PATTERN

- One online / app based assessment to test listening /speaking
- End Semester **ONLY** listening and speaking will be conducted online.
- Proficiency certification is given on successful completion of listening and speaking internal test and end semester exam.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO01	PO02	PO03	PO04	PO05	PO06	PO07	PO08	PO09	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-
Avg.	3	3	3	3	1	3	3	3	3	3	3	3	-	-	-

SEMESTER II

HS3252 PROFESSIONAL ENGLISH - II L T P C
2 0 0 2

COURSE OBJECTIVES:

- To engage learners in meaningful language activities to improve their reading and writing skills
- To learn various reading strategies and apply in comprehending documents in professional context.
- To help learners understand the purpose, audience, contexts of different types of writing
- To develop analytical thinking skills for problem solving in communicative contexts
- To demonstrate an understanding of job applications and interviews for internship and placements

UNIT I MAKING COMPARISONS 6

Reading - Reading advertisements, user manuals, brochures; Writing – Professional emails, Email etiquette - Compare and Contrast Essay; Grammar – Mixed Tenses, Prepositional phrases

UNIT II EXPRESSING CAUSAL RELATIONS IN SPEAKING AND WRITING 6

Reading - Reading longer technical texts– Cause and Effect Essays, and Letters / emails of complaint, Writing - Writing responses to complaints. Grammar - Active Passive Voice transformations, Infinitive and Gerunds

UNIT III PROBLEM SOLVING 6

Reading - Case Studies, excerpts from literary texts, news reports etc. Writing – Letter to the Editor, Checklists, Problem solution essay / Argumentative Essay. Grammar – Error correction; If conditional sentences

UNIT IV REPORTING OF EVENTS AND RESEARCH 6

Reading –Newspaper articles; Writing – Recommendations, Transcoding, Accident Report, Survey Report Grammar – Reported Speech, Modals Vocabulary – Conjunctions- use of prepositions

UNIT V THE ABILITY TO PUT IDEAS OR INFORMATION COGENTLY 6

Reading – Company profiles, Statement of Purpose, (SOP), an excerpt of interview with professionals; Writing – Job / Internship application – Cover letter & Resume; Grammar – Numerical adjectives, Relative Clauses.

TOTAL : 30 PERIODS

COURSE OUTCOMES:

At the end of the course, learners will be able

CO1: To compare and contrast products and ideas in technical texts.

CO2: To identify and report cause and effects in events, industrial processes through technical texts

CO3:To analyse problems in order to arrive at feasible solutions and communicate them in the written format.

CO4: To present their ideas and opinions in a planned and logical manner

CO5:To draft effective resumes in the context of job search.

TEXT BOOKS :

1. English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University.
2. English for Science & Technology Cambridge University Press 2021.
3. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1. Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2. Improve Your Writing ed. V.N. Arora and Laxmi Chandra, Oxford Univ. Press, 2001, NewDelhi.
3. Learning to Communicate – Dr. V. Chellammal. Allied Publishers, New Delhi, 2003
4. Business Correspondence and Report Writing by Prof. R.C. Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
5. Developing Communication Skills by Krishna Mohan, Meera Bannerji- Macmillan India Ltd. 1990, Delhi.

ASSESSMENT PATTERN

Two internal assessments and an end semester examination to test students' reading and writing skills along with their grammatical and lexical competence.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
2	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	2	3	3	3	-	-	-
4	3	3	3	3	2	3	3	3	2	3	3	3	-	-	-
5	-	-	-	-	-	-	-	-	3	3	3	3	-	-	-
Avg.	3	3	3	3	2.75	3	3	3	2.2	3	3	3	-	-	-

MA3202 LINEAR ALGEBRA AND NUMERICAL METHODS L T P C
3 1 0 4

OBJECTIVES:

The basic concepts and tools of the subject covered are:

- Vector spaces and subspaces; linear independence and span of a set of vectors, basis and dimension; the standard bases for common vector spaces;
- Linear maps between vector spaces, their matrix representations, null-space and Range spaces, the Rank- Nullity Theorem;
- Inner product spaces: Cauchy-Schwarz inequality, orthonormal bases, the Gramm-Schmidt procedure, orthogonal complement of a subspace, orthogonal projection;
- Eigenvalues and eigenvectors, diagonalizability of a real symmetric matrix, canonical forms;
- Mathematical foundations of numerical techniques for solving linear systems, eigenvalue problems and generalized inverses.

UNIT I VECTOR SPACES 12

Vector spaces – Subspaces – Linear combinations - Linear Span – Linear dependence - Linear independence – Bases and Dimensions

UNIT II LINEAR TRANSFORMATIONS 12

Linear Transformation – Null space, Range space - dimension theorem - Matrix and representation of Linear Transformation – Eigenvalues Eigenvectors of linear transformation – Diagonalization of linear transformation – Application of diagonalization in linear system of differential equations.

UNIT III INNER PRODUCT SPACES 12

Inner Products and norms - Inner Product Spaces - Orthogonal vectors – Gram Schmidt orthogonalization process – Orthogonal complement – Least square Approximations

UNIT IV NUMERICAL SOLUTION OF LINEAR SYSTEM OF EQUATIONS 12

Solution of linear system of equations – Direct methods: Gauss elimination method – Pivoting, Gauss Jordan method, LU decomposition method and Cholesky decomposition method - Iterative methods: Gauss-Jacobi Method, Gauss-Seidel Method and SOR Method

UNIT V NUMERICAL SOLUTION OF EIGENVALUE PROBLEMS AND GENERALISED INVERSES 12

Eigen value Problems: Power method – Jacobi's rotation method – Conjugate gradient method – QR decomposition - Singular value decomposition method.

TOTAL:60 PERIODS

OUTCOMES:

- The students will be able to solve system of linear equations, to use matrix operations and vector spaces using algebraic methods.
- Demonstrate understanding of common numerical methods and how they are used to obtain approximate solutions.
- Apply numerical methods to obtain approximate solutions to mathematical problems.
- Derive numerical methods for various mathematical operations and tasks, such as interpolation, differentiation, integration, the solution of linear and nonlinear equations, and the solution of differential equations.
- Analyze and evaluate the accuracy of common numerical methods.

TEXT BOOKS:

1. Faires, J.D. and Burden, R., "Numerical Methods", Brooks/Cole (Thomson Publications), 4th Edition, New Delhi, 2012.
2. Friedberg, S.H., Insel, A.J. and Spence, E., "Linear Algebra", Pearson Education, 5th Edition, New Delhi, 2008.
3. Williams, G, "Linear Algebra with Applications", Jones & Bartlett Learning, First Indian Edition, New Delhi, 2019.

REFERENCES:

1. Bernard Kolman, David R. Hill, "Introductory Linear Algebra", Pearson Education, First Reprint, New Delhi, 2010.
2. Gerald, C.F, and Wheatley, P.O., "Applied Numerical Analysis", Pearson Education, 7th Edition, New Delhi, 2004.
3. Kumaresan, S., "Linear Algebra – A geometric approach", Prentice – Hall of India, Reprint, New Delhi, 2010.
4. Richard Branson, "Matrix Operations", Schaum's outline series, McGraw Hill, New York, 1989.
5. Strang, G., "Linear Algebra and its Applications", Cengage Learning, New Delhi, 2005.
6. Sundarapandian. V, "Numerical Linear Algebra", Prentice – Hall of India, New Delhi, 2008.

CP3201 PROBLEM SOLVING AND PYTHON PROGRAMMING L T P C

3 0 3 4.5

COURSE OBJECTIVES:

- To understand the basics of algorithmic problem solving.
- To learn to solve problems using Python conditionals and loops.
- To define Python functions and use function calls to solve problems.
- To use Python data structures - lists, tuples, dictionaries to represent complex data.
- To do input/output with files in Python.

UNIT I COMPUTATIONAL THINKING AND PROBLEM SOLVING 9

Fundamentals of Computing – Identification of Computational Problems -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). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string, a

nd list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.

UNIT III CONTROL FLOW, FUNCTIONS, STRINGS 9

Conditionals:Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if- elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.

UNIT IV LISTS, TUPLES, DICTIONARIES 9

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list comprehension; Illustrative programs: simple sorting, histogram, Students marks statement, Retail bill preparation.

UNIT V FILES, MODULES, PACKAGES 9

Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).

TOTAL : 90 PERIODS

EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern)
4. Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by zero error, voter's age validity, student mark range validation)
11. Exploring Pygame tool.

12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL : 90 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to

CO1: Develop algorithmic solutions to simple computational problems.
CO2: Develop and execute simple Python programs.
CO3: Write simple Python programs using conditionals and loops for solving problems.
CO4: Decompose a Python program into functions.
CO5: Represent compound data using Python lists, tuples, dictionaries etc.
CO6: Read and write data from/to files in Python programs.

TEXT BOOKS:

1. Allen B. Downey, “Think Python: How to Think like a Computer Scientist”, 2nd Edition, O’Reilly Publishers, 2016. Karl Beecher, “Computational Thinking: A Beginner's Guide to Problem Solving and Programming”, 1st Edition, BCS Learning & Development Limited, 2017.

REFERENCES:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”, 1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data”, Third Edition, MIT Press, 2021
4. Eric Matthes, “Python Crash Course, A Hands - on Project Based Introduction to Programming”, 2nd Edition, No Starch Press, 2019.
5. https://www.python.org/
6. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	3	3	3	2	-	-	-	-	-	2	2	3	3	-
2	3	3	3	3	2	-	-	-	-	-	2	2	3	-	-
3	3	3	3	3	2	-	-	-	-	-	2	-	3	-	-
4	2	2	-	2	2	-	-	-	-	-	1	-	3	-	-
5	1	2	-	-	1	-	-	-	-	-	1	-	2	-	-
6	2	2	-	-	2	-	-	-	-	-	1	-	2	-	-
Avg.	2	3	3	3	2	-	-	-	-	-	2	2	3	3	-

2.

BE3255 BASIC CIVIL AND MECHANICAL ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To provide the students an illustration of the significance of the Civil and Mechanical Engineering Profession in satisfying the societal needs.

- To help students acquire knowledge in the basics of surveying and the materials used for construction.
- To provide an insight to the essentials of components of a building and the infrastructure facilities.
- To explain the component of power plant units and detailed explanation to IC engines their working principles.
- To explain the Refrigeration & Air-conditioning system.

UNIT I PART A: OVERVIEW OF CIVIL ENGINEERING 5

Civil Engineering contributions to the welfare of Society - Specialized sub disciplines in Civil Engineering – Structural, Construction, Geotechnical, Environmental, Transportation and Water Resources Engineering – National building code – terminologists: Plinth area, Carpet area, Floor area, Buildup area, Floor space index - Types of buildings: Residential buildings, Industrial buildings.

UNIT I PART B: OVERVIEW OF MECHANICAL ENGINEERING 4

Overview of Mechanical Engineering - Mechanical Engineering Contributions to the welfare of Society –Specialized sub disciplines in Mechanical Engineering – Manufacturing, Automation, Automobile and Energy Engineering - Interdisciplinary concepts in Mechanical Engineering.

UNIT II SURVEYING AND CIVIL ENGINEERING MATERIALS 9

Surveying: Objects – Classification – Principles – Measurements of Distances and angles – Leveling – Determination of areas– Contours.

Civil Engineering Materials: Bricks – Stones – Sand – Cement – Concrete – Steel - Timber - Modern Materials, Thermal and Acoustic Insulating Materials, Decorative Panels, Water Proofing Materials. Modern uses of Gypsum, Pre-fabricated Building component (brief discussion only)

UNIT III BUILDING COMPONENTS AND INFRASTRUCTURE 9

Building plans – Setting out of a Building - Foundations: Types of foundations - Bearing capacity and settlement – Brick masonry – Stone Masonry – Beams – Columns – Lintels – Roofing – Flooring – Plastering.

Types of Bridges and Dams – Water Supply Network - Rain Water Harvesting – Solid Waste Management - Introduction to Highways and Railways - Introduction to Green Buildings.

UNIT IV INTERNAL COMBUSTION ENGINES AND POWER PLANTS 9

Classification of Power Plants- Working principle of steam, Gas, Diesel, Hydro -electric and Nuclear Power plants- Internal combustion engines as automobile power plant – Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines. Working principle of Boilers-Turbines, Reciprocating Pumps (single acting and double acting) and Centrifugal Pumps, Concept of hybrid engines. Industrial safety practices and protective devices

UNIT V REFRIGERATION AND AIR CONDITIONING SYSTEM 9

Terminology of Refrigeration and Air Conditioning. Principle of vapour compression and absorption system–Layout of typical domestic refrigerator–Window and Split type room Air conditioner. Properties of air - water mixture, concepts of psychometric and its process.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Understanding profession of Civil and Mechanical engineering.
CO2: Summarise the planning of building, infrastructure and working of Machineries.
CO3: Apply the knowledge gained in respective discipline
CO4: Illustrate the ideas of Civil and Mechanical Engineering applications.
CO5: Appraise the material, Structures, machines and energy.

TEXT BOOKS:

1. G Shanmugam, M S Palanichamy, Basic Civil and Mechanical Engineering, McGraw Hill Education; First edition, 2018

REFERENCES:

1. Palanikumar, K. Basic Mechanical Engineering, ARS Publications, 2018.
2. Ramamrutham S., "Basic Civil Engineering", Dhanpat Rai Publishing Co.(P) Ltd, 2013.
3. Seetharaman S., "Basic Civil Engineering", Anuradha Agencies, 2005.
4. Shantha Kumar SRJ., "Basic Mechanical Engineering", Hi-tech Publications, Mayiladuthurai, 2000.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	2	-	-	1	-	-	1	2	1	2	-	1	-	-	-
2	2	-	-	-	-	-	1	2	1	2	-	2	-	-	-
3	2	-	-	-	-	-	1	2	2	2	-	2	-	-	-
4	2	-	-	-	-	-	1	2	1	2	-	2	-	-	-
5	2	-	-	-	-	-	1	2	1	2	-	2	-	-	-
Avg.	2	-	-	0.2	-	-	1	2	1.2	2	-	1.8	-	-	-

GE3251 ENGINEERING GRAPHICS L T P C
2 0 4 4

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Drawing engineering curves.
2. Drawing freehand sketch of simple objects.
3. Drawing orthographic projection of solids and section of solids.
4. Drawing development of solids
5. Drawing isometric and perspective projections of simple solids.

CONCEPTS AND CONVENTIONS (Not for Examination)

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

UNIT I PLANE CURVES 6+12

Basic Geometrical constructions, 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 SURFACE 6+12

Orthographic projection- principles-Principal planes-First angle projection-projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes - Determination of true lengths and true inclinations by rotating line method and traces. Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

UNIT III PROJECTION OF SOLIDS AND FREEHAND SKETCHING 6+12

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes and parallel to the other by rotating object method. Visualization concepts and Free Hand sketching: Visualization principles — Representation of Three Dimensional objects — Layout of views- Freehand sketching of multiple views from pictorial views of objects.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT IV PROJECTION OF SECTIONED SOLIDS AND DEVELOPMENT OF SURFACES 6 +12

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other — obtaining true shape of section. Development of lateral surfaces of simple and sectioned solids — Prisms, pyramids cylinders and cones.

Practicing three dimensional modeling of simple objects by CAD Software(Not for examination)

UNIT V ISOMETRIC AND PERSPECTIVE PROJECTIONS 6+12

Principles of isometric projection — isometric scale —Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions - Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Practicing three dimensional modeling of isometric projection of simple objects by CAD Software(Not for examination)

TOTAL: (L=30+P=60) 90 PERIODS

COURSE OUTCOMES:

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

CO1: Use BIS conventions and specifications for engineering drawing.
CO2: Construct the conic curves, involutes and cycloid.
CO3: Solve practical problems involving projection of lines.
CO4: Draw the orthographic, isometric and perspective projections of simple solids.
CO5: Draw the development of simple solids.

TEXT BOOK:

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.
2. Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.
3. Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015

REFERENCES:

1. Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edition, 2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications,

Bangalore, 27th Edition,2017.
3. Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4. Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5. Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
6. Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.

Publication of Bureau of Indian Standards:
1. IS 10711 — 2001: Technical products Documentation — Size and lay out of drawing sheets.
2. IS 9609 (Parts 0 & 1) — 2001: Technical products Documentation — Lettering.
3. IS 10714 (Part 20) — 2001 & SP 46 — 2003: Lines for technical drawings.
4. IS 11669 — 1986 & SP 46 —2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) — 2001: Technical drawings — Projection Methods.

Special points applicable to University Examinations on Engineering Graphics:
1. There will be five questions, each of either or type covering all units of the syllabus.
2. All questions will carry equal marks of 20 each making a total of 100.
3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size.
4. The examination will be conducted in appropriate sessions on the same day

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
2	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
3	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
4	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
5	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-
Avg.	3	1	2	-	2	-	-	-	-	3	-	2	2	2	-

CP3202 ELECTRIC CIRCUIT ANALYSIS **L T P C**
3 0 2 4

COURSE OBJECTIVES:
- To introduce electric circuits and its analysis
- To provide key concepts to analyze and understand electrical circuits
- To impart knowledge on solving circuit equations using network theorems
- To educate on obtaining the transient response of circuits.
- To introduce the phenomenon of resonance in coupled circuits.
- To introduce Phasor diagrams and analysis of single &three phase circuits

UNIT I BASIC CIRCUITS ANALYSIS **9**

Fundamentals concepts of R, L and C elements-Energy Sources- Ohm's Law -Kirchhoff 's Laws – DC Circuits – Resistors in series and parallel circuits - A.C Circuits – Average and RMS Value – Complex Impedance – Phasor diagram - Real and Reactive Power, Power Factor, Energy -Mesh current and node voltage methods of analysis D.C and A.C Circuits.

UNIT II NETWORK REDUCTION AND THEOREMS FOR DC AND AC CIRCUITS 9

Network reduction: voltage and current division, source transformation – star delta conversion. Theorems – Superposition, Thevenin's and Norton's Theorem – Maximum power transfer theorem – Reciprocity Theorem – Millman's theorem- Tellegen's Theorem-Statement, application to DC and AC Circuits.

UNIT III TRANSIENT RESPONSE ANALYSIS 9

Introduction – Laplace transforms and inverse Laplace transforms- standard test signals - Transient response of RL, RC and RLC circuits using Laplace transform for Source free, Step input and Sinusoidal input.

UNIT IV RESONANCE AND COUPLED CIRCUITS 9

Series and parallel resonance –frequency response – Quality factor and Bandwidth – Self and mutual inductance – Coefficient of coupling – Dot rule-Analysis of coupled circuits– Single Tuned circuits.

UNIT V THREE PHASE CIRCUITS 9

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

TOTAL: 60 PERIODS

LIST OF EXPERIMENTS 30 PERIODS

Familiarization of various electrical components, sources and measuring instruments

1. Simulation and experimental verification of series and parallel electrical circuit using fundamental laws.
2. Simulation and experimental verification of electrical circuit problems using Thevenin's theorem.
3. Simulation and experimental verification of electrical circuit problems using Norton's theorem.
4. Simulation and experimental verification of electrical circuit problems using Superposition theorem.
5. Simulation and experimental verification of Maximum Power transfer theorem.
6. Simulation and Experimental validation of R-C,R-L and RLC electric circuit transients
7. Simulation and Experimental validation of frequency response of RLC electric circuit.
8. Design and implementation of series and parallel resonance circuit.
9. Simulation and experimental verification of three phase balanced and unbalanced star, delta networks circuit (Power and Power factor calculations).

COURSE OUTCOMES:

After completing this course, the students will be able to:

CO1: Explain circuit's behavior using circuit laws.

CO2: Apply mesh analysis/ nodal analysis / network theorems to determine behavior of the given DC and AC circuit

CO3: Compute the transient response of first order and second order systems to step and sinusoidal input
CO4: Compute power, line/ phase voltage and currents of the given three phase circuit
CO5: Explain the frequency response of series and parallel RLC circuits
CO6: Explain the behavior of magnetically coupled circuits.

TEXT BOOKS:

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, “Engineering Circuits Analysis”, McGraw Hill publishers, 9th edition, New Delhi, 2020.
2. Charles K. Alexander, Mathew N.O. Sadiku, “Fundamentals of Electric Circuits”, Second Edition, McGraw Hill, 2019.
3. Allan H. Robbins, Wilhelm C. Miller, “Circuit Analysis Theory and Practice”, Cengage Learning India, 2013.

REFERENCES

1. Chakrabarti A, “Circuits Theory (Analysis and synthesis), Dhanpat Rai& Sons, New Delhi, 2020.
2 Joseph A. Edminister, Mahmood Nahvi, “Electric circuits”, Schaum’s series, McGraw-Hill, First Edition, 2019.
4. M E Van Valkenburg, “Network Analysis”,Prentice-Hall of India Pvt Ltd, New Delhi, 2015.
5. Richard C. Dorf and James A. Svoboda, “Introduction to Electric Circuits”, 7th Edition, John Wiley Sons, Inc. 2018.
6. Sudhakar A and Shyam Mohan SP, “Circuits and Networks Analysis and Synthesis”, McGraHill, 2015.

MAPPING OF COs WITH POs AND PSOs

	POs												PSOs		
COs	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**P0 6**	**P0 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**	**PS 03**
CO1	3	3	3	2	2	-	2	1	-	-	-	3	3	3	3
CO2	3	3	3	3	2	-	2	1	-	-	-	3	3	3	3
CO3	3	3	3	3	2	-	2	1	-	-	-	3	3	3	3
CO4	3	3	3	3	2	-	2	1	-	-	-	3	3	3	3
CO5	3	3	3	3	2	-	2	1	-	-	-	3	3	3	3
CO6	3	3	3	3	2	-	2	1	-	-	-	3	3	3	3
Avg.	3	3	3	2.8	2	-	2	1	-	-	-	3	3	3	3

NCC Credit Course Level 1*

NX3251	(ARMY WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

NCC Credit Course Level 1*

NCC Credit Course Level 1*

		L	T	P	C
NX3252	**(NAVAL WING) NCC Credit Course Level - I**	**2**	**0**	**0**	**2**

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

NX3253	(AIR FORCE WING) NCC Credit Course Level - I	L	T	P	C
		2	0	0	2

NCC GENERAL		**6**
NCC 1	Aims, Objectives & Organization of NCC	1
NCC 2	Incentives	2
NCC 3	Duties of NCC Cadet	1
NCC 4	NCC Camps: Types & Conduct	2
NATIONAL INTEGRATION AND AWARENESS		**4**
NI 1	National Integration: Importance & Necessity	1
NI 2	Factors Affecting National Integration	1
NI 3	Unity in Diversity & Role of NCC in Nation Building	1
NI 4	Threats to National Security	1
PERSONALITY DEVELOPMENT		**7**
PD 1	Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving	2
PD 2	Communication Skills	3
PD 3	Group Discussion: Stress & Emotions	2
LEADERSHIP		**5**
L 1	Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code	3
L 2	Case Studies: Shivaji, Jhasi Ki Rani	2
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT		**8**
SS 1	Basics, Rural Development Programmes, NGOs, Contribution of Youth	3
SS 4	Protection of Children and Women Safety	1
SS 5	Road / Rail Travel Safety	1
SS 6	New Initiatives	2
SS 7	Cyber and Mobile Security Awareness	1

TOTAL : 30 PERIODS

GE3252 TAMILS AND TECHNOLOGY L T P C
1 0 0 1

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries.

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

UNIT III MANUFACTURING TECHNOLOGY 3

Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting,steel -Copper and gold- Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram.

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. *தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).*
2. *கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).*
3. *கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)*
4. *பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)*
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

GE3252 **தமிழரும் தொழில்நுட்பமும்** **L T P C**

1 0 0 1

அலகு *I* ***நெசவு மற்றும் பானைத் தொழில்நுட்பம்:*** ***3***

சங்க காலத்தில் நெசவுத் தொழில் – பானைத் தொழில்நுட்பம் - கருப்பு சிவப்பு பாண்டங்கள் – பாண்டங்களில் கீறல் குறியீடுகள்.

அலகு *II* ***வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம்:*** ***3***

சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு- சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் – சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும், கோவில்களும் – சோழர் காலத்துப் பெருங்கோயில்கள் மற்றும் பிற வழிபாட்டுத் தலங்கள் – நாயக்கர் காலக் கோயில்கள் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மதுரை மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் – செட்டிநாட்டு வீடுகள் – பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக் கலை.

அலகு *III* ***உற்பத்தித் தொழில் நுட்பம்:*** ***3***

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருக்குதல், எஃகு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள், கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத்துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

அலகு *IV* ***வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில் நுட்பம்:*** ***3***

அணை, ஏரி, குளங்கள், மதகு – சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் – கால்நடை பராமரிப்பு – கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் – வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் – கடல்சார் அறிவு – மீன்வளம் – முத்து மற்றும் முத்துக்குளித்தல் – பெருங்கடல் குறித்த பண்டைய அறிவு – அறிவுசார் சமூகம்.

அலகு *V* ***அறிவியல் தமிழ் மற்றும் கணித்தமிழ்:*** ***3***

அறிவியல் தமிழின் வளர்ச்சி –கணித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் – தமிழ் மின் நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்.

TOTAL : 15 PERIODS

TEXT-CUM-REFERENCE BOOKS

1. *தமிழக வரலாறு – மக்களும் பண்பாடும் – கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).*
2. *கணினித் தமிழ் – முனைவர் இல. சுந்தரம். (விகடன் பிரசுரம்).*
3. *கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)*
4. *பொருநை – ஆற்றங்கரை நாகரிகம். (தொல்லியல் துறை வெளியீடு)*
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - 'Sangam City C ivilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Publishedby: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text

Bookand Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

GE3271 ENGINEERING PRACTICES LABORATORY L T P C
0 0 4 2

COURSE OBJECTIVES:

The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planing; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.
4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB.

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES 15

PLUMBING WORK:

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
b) Preparing plumbing line sketches.
c) Laying pipe connection to the suction side of a pump
d) Laying pipe connection to the delivery side of a pump.
e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

WOOD WORK:

a) Sawing,
b) Planing and
c) Making joints like T-Joint, Mortise joint and Tenon joint and Dovetail joint.

Wood Work Study:

a) Studying joints in door panels and wooden furniture
b) Studying common industrial trusses using models.

PART II ELECTRICAL ENGINEERING PRACTICES 15

a) Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket
b) Staircase wiring
c) Fluorescent Lamp wiring with introduction to CFL and LED types.
d) Energy meter wiring and related calculations/ calibration

e) Study of Iron Box wiring and assembly
f) Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)
g) Study of emergency lamp wiring/Water heater

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

a) Welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.
b) Practicing gas welding.

BASIC MACHINING WORK:

a) (simple)Turning.
b) (simple)Drilling.
c) (simple)Tapping.

ASSEMBLY WORK:

a) Assembling a centrifugal pump.
b) Assembling a household mixer.
c) Assembling an airconditioner.

SHEET METAL WORK:

a) Making of a square tray

FOUNDRY WORK:

a) Demonstrating basic foundry operations.

PART IV ELECTRONIC ENGINEERING PRACTICES 15

SOLDERING WORK:

a) Soldering simple electronic circuits and checking continuity.

ELECTRONIC ASSEMBLY AND TESTING WORK:

a) Assembling and testing electronic components on a small PCB.

ELECTRONIC EQUIPMENT STUDY:

a) Study an elements of smart phone.
b) Assembly and dismantle of LED TV.
c) Assembly and dismantle of computer/ laptop

TOTAL : 60 PERIODS

COURSE OUTCOMES:

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

CO1: Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.

CO2: Wire various electrical joints in common household electrical wire work.

CO3: Weld various joints in steel plates using arc welding work; Machine various simple

processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.

CO4: Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
1	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
2	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
3	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1
Avg.	3	2	-	-	1	1	1	-	-	-	-	2	2	1	1

GE3272 COMMUNICATION LABORATORY L T P C

0 0 4 2

COURSE OBJECTIVES

- To identify varied group discussion skills and apply them to take part in effective discussions in a professional context.
- To analyse concepts and problems and make effective presentations explaining them clearly and precisely.
- To be able to communicate effectively through formal and informal writing.
- To be able to use appropriate language structures to write emails, reports and essays
- To give instructions and recommendations that are clear and relevant to the context

UNIT I

12

Speaking-Role Play Exercises Based on Workplace Contexts, - talking about competition-discussing progress toward goals-talking about experiences- talking about events in life-discussing past events-Writing: writing emails (formal & semi-formal).

UNIT II

12

Speaking: discussing news stories-talking about frequency-talking about travel problems-discussing travel procedures- talking about travel problems- making arrangements-describing arrangements-discussing plans and decisions- discussing purposes and reasons-understanding common technology terms-Writing: - writing different types of emails.

UNIT III

12

Speaking: discussing predictions-describing the climate-discussing forecasts and scenarios-talking about purchasing-discussing advantages and disadvantages- making comparisons-discussing likes and dislikes- discussing feelings about experiences-discussing imaginary scenarios Writing: short essays and reports-formal/semi-formal letters.

UNIT IV

12

Speaking: discussing the natural environment-describing systems-describing position and

movement- explaining rules-(example- discussing rental arrangements)- understanding technical instructions-Writing: writing instructions-writing a short article.

UNIT V **12**

Speaking: describing things relatively-describing clothing-discussing safety issues(making recommendations) talking about electrical devices-describing controlling actions- Writing: job application(Cover letter + Curriculum vitae)-writing recommendations.

TOTAL: 60 PERIODS

LEARNING OUTCOMES

At the end of the course, learners will be able

- Speak effectively in group discussions held in formal/semi formal contexts.
- Discuss, analyse and present concepts and problems from various perspectives to arrive at suitable solutions
- Write emails, letters and effective job applications.
- Write critical reports to convey data and information with clarity and precision
- Give appropriate instructions and recommendations for safe execution of tasks

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**P 06**	**P0 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**	**PS 03**
1	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
2	2	3	3	3	1	3	3	3	3	3	3	3	-	-	-
3	2	2	3	3	1	3	3	3	3	3	3	3	-	-	-
4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
Avg.	2.4	2.8	3	3	1.8	3	3	3	3	3	3	3	-	-	-

Assessment Pattern

- One online / app based assessment to test speaking and writing skills
- Proficiency certification is given on successful completion of speaking and writing.

SEMESTER III

MA3391 PROBABILITY AND STATISTICS L T P C

3 1 0 4

COURSE OBJECTIVES

- This course aims at providing the required skill to apply the statistical tools in engineering problems.
- To introduce the basic concepts of probability and random variables.
- To introduce the basic concepts of two dimensional random variables.
- To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
- To introduce the basic concepts of classifications of design of experiments which plays very important roles in the field of agriculture and statistical quality control.

UNIT I PROBABILITY AND RANDOM VARIABLES 9+3

Axioms of probability – Conditional probability – Baye's theorem - Discrete and continuous random variables – Moments – Moment generating functions – Binomial, Poisson, Geometric, Uniform, Exponential and Normal distributions – Functions of a random variable.

UNIT II TWO- DIMENSIONAL RANDOM VARIABLES 9+3

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

UNIT III ESTIMATION THEORY 9+3

Unbiased estimators - Efficiency - Consistency - Sufficiency - Robustness - Method of moments - Method of maximum Likelihood - Interval estimation of Means - Differences between means, variations and ratio of two variances

UNIT IV NON- PARAMETRIC TESTS 9+3

Introduction - The Sign test - The Signed - Rank test - Rank - sum tests - The U test - The H test - Tests based on Runs - Test of randomness - The Kolmogorov Tests .

UNIT V STATISTICAL QUALITY CONTROL 9+3

Control charts for measurements ($\bar{X}$ and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, students will be able to:

CO1: Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.

CO2: Understand the basic concepts of one and two dimensional random variables and apply in engineering applications.

CO3: Apply the concept of testing of hypothesis for small and large samples in real life problems.

CO4: Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.

CO5: Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

TEXT BOOKS

1. Johnson. R.A., Miller. I.R and Freund . J.E, " Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 9th Edition, 2016.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata Mc Graw Hill, 4th Edition, 2007.
3. John E. Freund, "Mathematical Statistics", Prentice Hall, 5th Edition, 1992.

REFERENCES:

1. Gupta. S.C. and Kapoor. V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
2. Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014.
3. Ross. S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 5thEdition, Elsevier, 2014.
4. Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outline of Theory and Problems of Probability and Statistics", Tata McGraw Hill Edition, 4th Edition, 2012.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 9th Edition, 2010.

CO's-PO's & PSO's MAPPING

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	0	0	0	0	0	0	2	0	0	2			
CO2	3	3	0	0	0	0	0	0	2	0	0	2			
CO3	3	3	0	0	0	0	0	0	2	0	0	2			
CO4	3	3	3	2	0	0	0	0	2	0	0	2			
CO5	3	3	2	2	0	0	0	0	2	0	0	2			
AVG	3	3	1	1	0	0	0	0	2	0	0	2			

1 - low, 2 - medium, 3 - high, '-' - no correlation

EE3301 ELECTROMAGNETIC FIELDS L T P C

3 1 0 4

COURSE OBJECTIVES:

- To introduce the basic mathematical concepts related to electromagnetic vector fields
- To impart knowledge on the concepts of
- Electrostatic fields, electric potential, energy density and their applications.
- Magneto static fields, magnetic flux density, vector potential and its applications.
- Different methods of emf generation and Maxwell's equations
- Electromagnetic waves and characterizing parameters

UNIT I ELECTROSTATICS – I 12

Sources and effects of electromagnetic fields – Coordinate Systems – Vector fields –Gradient, Divergence, Curl – theorems and applications - Coulomb's Law – Electric field intensity – Field due to discrete and continuous charges – Gauss's law and applications.

UNIT II ELECTROSTATICS – II 12

Electric potential – Electric field and equipotential plots, Uniform and Non-Uniform field, Utilization factor – Electric field in free space, conductors, dielectrics - Dielectric polarization –Dielectric strength - Electric field in multiple dielectrics – Boundary conditions, Poisson's and Laplace's equations, Capacitance, Energy density, Applications.

UNIT III MAGNETOSTATICS 12

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

UNIT IV ELECTRODYNAMIC FIELDS 12

Magnetic Circuits - Faraday's law – Transformer and motional EMF – Displacement current - Maxwell's equations (differential and integral form) – Relation between field theory and circuit theory – Applications.

UNIT V ELECTROMAGNETIC WAVES 12

Electromagnetic wave generation and equations – Wave parameters; velocity, intrinsic impedance, propagation constant – Waves in free space, lossy and lossless dielectrics, conductors- skin depth - Poynting vector – Plane wave reflection and refraction.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

Upon the successful completion of the course, students will be able to:

CO1: Visualize and explain Gradient, Divergence, and Curl operations on electromagnetic vector fields and identify the electromagnetic sources and their effects.

CO2: Compute and analyse electrostatic fields, electric potential, energy density along with their applications.

CO3: Compute and analyse magneto static fields, magnetic flux density, vector potential along with their applications.

CO4: Explain different methods of emf generation and Maxwell's equations

CO5: Explain the concept of electromagnetic waves and characterizing parameters

TEXT BOOKS:

1. Mathew N. O. Sadiku, S.V. Kulkarni 'Principles of Electromagnetics', 6th Edition, Oxford University Press Inc. Asian edition, 2015.
2. William H. Hayt and John A. Buck, 'Engineering Electromagnetics', McGraw Hill Special Indian edition, 2014.
3. Kraus and Fleish, 'Electromagnetics with Applications', McGraw Hill International Editions, Fifth Edition, 2010.

REFERENCES

1. V.V.Sarwate, 'Electromagnetic fields and waves', Second Edition, Newage Publishers, 2018.
2. J.P.Tewari, 'Engineering Electromagnetics - Theory, Problems and Applications', Second Edition, Khanna Publishers 2013.
3. Joseph. A.Edminister, 'Schaum's Outline of Electromagnetics, Fifth Edition (Schaum's Outline Series), McGraw Hill, 2018.
4. S.P.Ghosh, Lipika Datta, 'Electromagnetic Field Theory', First Edition, McGraw Hill Education(India) Private Limited, 2017.
5. K A Gangadhar, 'Electromagnetic Field Theory', Khanna Publishers; Sixteenth Edition Eighth Reprint :2015

MAPPING OF COs WITH POs AND PSOs

	POs												**PSOs**		
COs	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO 10	PO 11	PO 12	PS 01	PS 02	PS 03
CO1	3	2	-	-	-	-	3	1	-	-	-	1	3	2	1
CO2	3	2	1	2	-	-	1	1	-	-	-	1	3	2	1
CO3	3	2	1	2	-	-	1	1	-	-	-	1	3	2	1
CO4	3	2	1	2	-	-	1	1	-	-	-	1	3	2	1
CO5	3	2	1	2	-	-	1	1	-	-	-	1	3	2	1
Avg.	3	2	1	2	-	-	1.4	1	-	-	-	1	3	2	1

EC3301 ELECTRON DEVICES AND CIRCUITS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the structure of basic electronic devices.
- To be exposed to active and passive circuit elements.
- To familiarize the operation and applications of transistor like BJT and FET.
- To explore the characteristics of amplifier gain and frequency response.
- To learn the required functionality of positive and negative feedback systems.

UNIT I PN JUNCTION DEVICES 9

PN junction diode –structure, operation and V-I characteristics, diffusion and transition capacitance –Clipping & Clamping circuits - Rectifiers – Half Wave and Full Wave Rectifier– Display devices- LED, Laser diodes, Zener diode characteristics- Zener diode Reverse characteristics – Zener diode as regulator.

UNIT II TRANSISTORS AND THYRISTORS 9

BJT, JFET, MOSFET- structure, operation, characteristics and Biasing UJT, Thyristors and IGBT - Structure and characteristics.

UNIT III AMPLIFIERS 9

BJT small signal model – Analysis of CE, CB, CC amplifiers- Gain and frequency response – MOSFET small signal model– Analysis of CS and Source follower – Gain and frequency response- High frequency analysis.

UNIT IV MULTISTAGE AMPLIFIERS AND DIFFERENTIAL AMPLIFIER 9

BIMOS cascade amplifier, Differential amplifier – Common mode and Difference mode analysis – FET input stages – Single tuned amplifiers – Gain and frequency response – Neutralization methods, power amplifiers –Types (Qualitative analysis).

UNIT V FEEDBACK AMPLIFIERS AND OSCILLATORS 9

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

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

CO1: Explain the structure and operation of PN junction devices (diode, Zener diode, LED and Laser diode)

CO2: Design clipper, clamper, half wave and full wave rectifier, regulator circuits using PN junction diodes

CO3: Analyze the structure and characteristics BJT, FET, MOSFET, UJT, Thyristor and IGBT

CO4: Analyze the performance of various configurations of BJT and MOSFET based

amplifier

CO5: Explain the characteristics of MOS based cascade and differential amplifier

CO6: Explain the operation of various feedback amplifiers and oscillators

TEXT BOOKS:

1. David A. Bell , "Electronic devices and circuits", Oxford University higher education, 5th edition 2008.
2. Sedra and smith, "Microelectronic circuits",7th Edition., Oxford University Press, 2017

REFERENCES:

1. Balbir Kumar, Shail.B.Jain, "Electronic devices and circuits" PHI learning private limited, 2nd edition 2014.
2. Thomas L.Floyd, "Electronic devices" Conventional current version, Pearson prentice hall, 10th Edition, 2017.
3. Donald A Neamen, "Electronic Circuit Analysis and Design" Tata McGraw Hill, 3rd Edition, 2003.
4. Robert L. Boylestad, "Electronic devices and circuit theory", 11th edition, Pearson prentice Hall 2013.
5. Robert B. Northrop, "Analysis and Application of Analog Electronic Circuits to Biomedical Instrumentation", CRC Press, Second edition, 2012.

MAPPING OF COs WITH POs AND PSOs

	POs												PSOs		
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**P07**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**	**PS 03**
CO1	2	2	3	2	2	-	-	1	-	-	-	1	3	-	1
CO2	2	2	3	2	2	-	-	1	-	-	-	1	3	-	1
CO3	2	2	3	2	2	-	-	1	-	-	-	1	3	-	1
CO4	2	2	3	2	2	-	-	1	-	-	-	1	3	-	1
CO5	2	2	3	2	2	-	-	1	-	-	-	1	3	-	1
Avg.	2	2	3	2	2	-	-	1	-	-	-	1	3	-	1

CS3301 **DATA STRUCTURES** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To understand the concepts of ADTs.

- To Learn linear data structures – lists, stacks, and queues.
- To understand non-linear data structures – trees and graphs.
- To understand sorting, searching and hashing algorithms.
- To apply Tree and Graph structures.

UNIT I LISTS 9

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

UNIT II STACKS AND QUEUES 9

Stack ADT – Operations – Applications – Balancing Symbols – Evaluating arithmetic expressions- Infix to Postfix conversion – Function Calls – Queue ADT – Operations – Circular Queue – DeQueue – Applications of Queues.

UNIT III TREES 9

Tree ADT – Tree Traversals - Binary Tree ADT – Expression trees – Binary Search Tree ADT – AVL Trees – Priority Queue (Heaps) – Binary Heap.

UNIT IV MULTIWAY SEARCH TREES AND GRAPHS 9

B-Tree – B+ Tree – Graph Definition – Representation of Graphs – Types of Graph - Breadth-first traversal – Depth-first traversal –– Bi-connectivity – Euler circuits – Topological Sort – Dijkstra's algorithm – Minimum Spanning Tree – Prim's algorithm – Kruskal's algorithm

UNIT V SEARCHING, SORTING AND HASHING TECHNIQUES 9

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

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Define linear and non-linear data structures.
CO2: Implement linear and non–linear data structure operations.
CO3: Use appropriate linear/non–linear data structure operations for solving a given problem.
CO4: Apply appropriate graph algorithms for graph applications.
CO5: Analyze the various searching and sorting algorithms.

TEXT BOOKS:

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C, 2nd Edition, Pearson Education, 2005.
2. Kamthane, Introduction to Data Structures in C, 1st Edition, Pearson Education, 2007

REFERENCES

1. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, Pearson Education, 2015.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms", Fourth Edition, Mcgraw Hill/ MIT Press, 2022.
3. Alfred V. Aho, Jeffrey D. Ullman,John E. Hopcroft ,Data Structures and Algorithms, 1st edition, Pearson, 2002.
4. Kruse, Data Structures and Program Design in C, 2nd Edition, Pearson Education, 2006.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	3	1	2	2	1	1	-	1	2	1	3	2	1	3
2	1	2	1	2	2	-	-	-	1	1	1	2	2	2	2
3	2	3	1	2	3	-	-	-	1	1	1	2	2	1	2
4	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
5	1	2	1	2	2	1	1	-	1	2	1	3	2	2	3
AVg.	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS3351 DIGITAL PRINCIPLES AND COMPUTER ORGANIZATION L T P C
3 0 2 4

COURSE OBJECTIVES:

- To analyze and design combinational circuits.
- To analyze and design sequential circuits
- To understand the basic structure and operation of a digital computer.
- To study the design of data path unit, control unit for processor and to familiarize with the hazards.
- To understand the concept of various memories and I/O interfacing.

UNIT I COMBINATIONAL LOGIC 9

Combinational Circuits – Karnaugh Map - Analysis and Design Procedures – Binary Adder – Subtractor – Decimal Adder - Magnitude Comparator – Decoder – Encoder – Multiplexers - Demultiplexers

UNIT II SYNCHRONOUS SEQUENTIAL LOGIC 9

Introduction to Sequential Circuits – Flip-Flops – operation and excitation tables, Triggering of FF, Analysis and design of clocked sequential circuits – Design – Moore/Mealy models, state minimization, state assignment, circuit implementation - Registers – Counters.

UNIT III COMPUTER FUNDAMENTALS 9

Functional Units of a Digital Computer: Von Neumann Architecture – Operation and

Operands of Computer Hardware Instruction – Instruction Set Architecture (ISA): Memory Location, Address and Operation – Instruction and Instruction Sequencing – Addressing Modes, Encoding of Machine Instruction – Interaction between Assembly and High Level Language.

UNIT IV PROCESSOR 9

Instruction Execution – Building a Data Path – Designing a Control Unit – Hardwired Control, Microprogrammed Control – Pipelining – Data Hazard – Control Hazards.

UNIT V MEMORY AND I/O 9

Memory Concepts and Hierarchy – Memory Management – Cache Memories: Mapping and Replacement Techniques – Virtual Memory – DMA – I/O – Accessing I/O: Parallel and Serial Interface – Interrupt I/O – Interconnection Standards: USB, SATA

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Verification of Boolean theorems using logic gates.
2. Design and implementation of combinational circuits using gates for arbitrary functions.
3. Implementation of 4-bit binary adder/subtractor circuits.
4. Implementation of code converters.
5. Implementation of BCD adder, encoder and decoder circuits
6. Implementation of functions using Multiplexers.
7. Implementation of the synchronous counters
8. Implementation of a Universal Shift register.
9. Simulator based study of Computer Architecture

COURSE OUTCOMES:

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

CO1 : Design various combinational digital circuits using logic gates
CO2 : Design sequential circuits and analyze the design procedures
CO3 : State the fundamentals of computer systems and analyze the execution of an instruction
CO4 : Analyze different types of control design and identify hazards
CO5 : Identify the characteristics of various memory systems and I/O communication

TOTAL: 75 PERIODS

TEXT BOOKS:

1. M. Morris Mano, Michael D. Ciletti, “Digital Design : With an Introduction to the Verilog HDL, VHDL, and System Verilog”, Sixth Edition, Pearson Education, 2018.
2. David A. Patterson, John L. Hennessy, “Computer Organization and Design, The Hardware/Software Interface”, Sixth Edition, Morgan Kaufmann/Elsevier, 2020.

REFERENCES:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky, Naraig Manjikian, “Computer Organization and Embedded Systems”, Sixth Edition, Tata McGraw-Hill, 2012.
2. William Stallings, “Computer Organization and Architecture – Designing for Performance”, Tenth Edition, Pearson Education, 2016.
3. M. Morris Mano, “Digital Logic and Computer Design”, Pearson Education, 2016.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	2	1	1	1	1	2	3	2	3	3
2	3	3	3	3	2	1	1	1	1	1	2	3	1	2	2
3	3	3	3	3	2	2	1	1	1	1	2	3	2	3	1
4	3	3	3	3	1	1	1	1	1	1	1	2	1	3	1
5	3	3	3	3	1	2	1	1	1	1	1	2	1	2	1
AVg.	3	3	3	3	1.8	1.6	1	1	1	1	1.6	2.6	1.4	2.6	1.6

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

CS3352 FOUNDATIONS OF DATA SCIENCE L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the data science fundamentals and process.
- To learn to describe the data for the data science process.
- To learn to describe the relationship between data.
- To utilize the Python libraries for Data Wrangling.
- To present and interpret data using visualization libraries in Python

UNIT I INTRODUCTION 9

Data Science: Benefits and uses – facets of data - Data Science Process: Overview – Defining research goals – Retrieving data – Data preparation - Exploratory Data analysis – build the model– presenting findings and building applications - Data Mining - Data Warehousing – Basic Statistical descriptions of Data

UNIT II DESCRIBING DATA 9

Types of Data - Types of Variables -Describing Data with Tables and Graphs –Describing Data with Averages - Describing Variability - Normal Distributions and Standard (z) Scores

UNIT III DESCRIBING RELATIONSHIPS 9

Correlation –Scatter plots –correlation coefficient for quantitative data –computational formula for correlation coefficient – Regression –regression line –least squares regression line – Standard error of estimate – interpretation of r2 –multiple regression equations –

regression towards the mean

UNIT IV PYTHON LIBRARIES FOR DATA WRANGLING 9

Basics of Numpy arrays –aggregations –computations on arrays –comparisons, masks, boolean logic – fancy indexing – structured arrays – Data manipulation with Pandas – data indexing and selection – operating on data – missing data – Hierarchical indexing – combining datasets – aggregation and grouping – pivot tables

UNIT V DATA VISUALIZATION 9

Importing Matplotlib – Line plots – Scatter plots – visualizing errors – density and contour plots – Histograms – legends – colors – subplots – text and annotation – customization – three dimensional plotting - Geographic Data with Basemap - Visualization with Seaborn.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Define the data science process
CO2: Understand different types of data description for data science process
CO3: Gain knowledge on relationships between data
CO4: Use the Python Libraries for Data Wrangling
CO5: Apply visualization Libraries in Python to interpret and explore data

TEXT BOOKS

1. David Cielen, Arno D. B. Meysman, and Mohamed Ali, “Introducing Data Science”, Manning Publications, 2016. (Unit I)
2. Robert S. Witte and John S. Witte, “Statistics”, Eleventh Edition, Wiley Publications, 2017. (Units II and III)
3. Jake VanderPlas, “Python Data Science Handbook”, O’Reilly, 2016. (Units IV and V)

REFERENCES:

1. Allen B. Downey, “Think Stats: Exploratory Data Analysis in Python”, Green Tea Press,2014.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	-	-	-	1	1	1	2	2	2	2
2	2	1	-	1	1	-	-	-	2	1	1	2	2	3	1
3	2	2	1	2	2	1	1	-	1	2	1	3	2	2	3
4	3	2	2	1	2	-	-	-	1	1	2	2	3	3	2
5	2	2	1	2	2	-	-	-	1	1	1	2	2	2	2
AVg.	2	2	1	2	2	1	1	-	1	1	1	2	2	2	2

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

EC3311 ELECTRONIC DEVICES AND CIRCUITS LABORATORY L T P C
0 0 3 1.5

COURSE OBJECTIVES:

- To enable the students to understand the behavior of semiconductor device based on experimentation.
- Be exposed to active and passive circuit elements.
- Familiarize the operation and characteristics of transistor like BJT and FET.
- Explore the characteristics of amplifier gain and frequency response.
- Learn the required functionality of positive and negative feedback systems.

LIST OF EXPERIMENTS

1. Characteristics of Semiconductor diode, Zener diode , photo diode , and photo transistor,
2. Characteristics of NPN Transistor under common emitter , common collector and common base configurations
3. Characteristics of JFET and draw the equivalent circuit
4. Characteristics of UJT and generation of saw tooth waveforms
5. Design and frequency response characteristics of a Common Emitter amplifier
6. Characteristics of light activated relay circuit
7. Design and testing of RC phase shift and LC oscillators
8. Characteristics of Single Phase half-wave and full wave rectifiers with inductive and capacitive filters
9. Design of Differential amplifiers using FET
10. Measurement of frequency and phase angle using CRO
11. Realization of passive filters

TOTAL : 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

CO1: Analyze the characteristics of PN, Zener diode and BJT in CE,CC,CB configurations experimentally

CO2: Analyze the characteristics of JFET and UJT experimentally

CO3: Analyze frequency response characteristics of a Common Emitter amplifier experimentally

CO4: Analyze the characteristics of RC phase shift and LC oscillators experimentally

CO5: Analyze the characteristics of half-wave and full-wave rectifier with and without filters experimentally

CO6: Analyze the characteristics of FET based differential amplifier experimentally

CO7: Calculate the frequency and phase angle using CRO experimentally

CO8: Analyze the frequency response characteristics of passive filters experimentally

	MAPPING OF COs WITH POs AND PSOs												**PSOs**		
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**P07**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	-	-	-	3	3	-	-	1.5	-	-	3	-	-	3	3
CO2	-	-	3	3	3	-	-	1.5	-	-	3	-	-	3	3
CO3	-	3	2	3	-	-	-	1.5	-	-	3	-	-	3	3
CO4	-	3	3	3	-	-	-	1.5	-	-	3	-	-	3	3

CO5	-	-	-	-	3	-	-	1.5	-	-	-	-	-	3	3
CO6	-	-	-	-	3	-	-	1.5	-	-	-	-	-	3	3
CO7	-	-	-	-	3	-	-	1.5	-	-	3	-	-	3	3
CO8	-	-	-	-	3	-	-	1.5	-	-	3	-	-	3	3
Avg	-	3	2.7	3	3	-	-	1.5	-	-	3	-	-	3	3

CS3311 **DATA STRUCTURES LABORATORY** **L T P C**
0 0 3 1.5

COURSE OBJECTIVES:

- To demonstrate array implementation of linear data structure algorithms.
- To implement the applications using Stack.
- To implement the applications using Linked list
- To implement Binary search tree and AVL tree algorithms.
- To implement the Heap algorithm.
- To implement Dijkstra's algorithm.
- To implement Prim's algorithm
- To implement Sorting, Searching and Hashing algorithms.

LIST OF EXERCISES:

1. Array implementation of Stack, Queue and Circular Queue ADTs
2. Implementation of Singly Linked List
3. Linked list implementation of Stack and Linear Queue ADTs
4. Implementation of Polynomial Manipulation using Linked list
5. Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion
6. Implementation of Binary Search Trees
7. Implementation of AVL Trees
8. Implementation of Heaps using Priority Queues
9. Implementation of Dijkstra's Algorithm
10. Implementation of Prim's Algorithm
11. Implementation of Linear Search and Binary Search
12. Implementation of Insertion Sort and Selection Sort
13. Implementation of Merge Sort
14. Implementation of Open Addressing (Linear Probing and Quadratic Probing)

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1: Implement Linear data structure algorithms.
CO2: Implement applications using Stacks and Linked lists
CO3: Implement Binary Search tree and AVL tree operations.
CO4: Implement graph algorithms.
CO5: Analyze the various searching and sorting algorithms.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	2	2	1	-	-	-	-	2	1	2	2	2	2	3
2	3	3	1	1	-	-	-	-	1	1	1	3	1	2	2
3	2	1	3	1	-	-	-	-	1	1	2	3	3	3	3
4	3	1	3	3	-	-	-	-	1	2	3	3	2	1	2
5	3	2	1	1	2	-	-	-	3	3	3	1	3	1	3
AVg.	2	2	2	1	2	-	-	-	2	2	2	2	2	2	3

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS3361 **DATA SCIENCE LABORATORY** **L T P C**
0 0 4 2

COURSE OBJECTIVES:

- To understand the python libraries for data science
- To understand the basic Statistical and Probability measures for data science.
- To learn descriptive analytics on the benchmark data sets.
- To apply correlation and regression analytics on standard data sets.
- To present and interpret data using visualization packages in Python.

LIST OF EXPERIMENTS:

1. Download, install and explore the features of NumPy, SciPy, Jupyter, Statsmodels and Pandas packages.
2. Working with Numpy arrays
3. Working with Pandas data frames
4. Reading data from text files, Excel and the web and exploring various commands for doing descriptive analytics on the Iris data set.
5. Use the diabetes data set from UCI and Pima Indians Diabetes data set for performing the following:

a. Univariate analysis: Frequency, Mean, Median, Mode, Variance, Standard Deviation, Skewness and Kurtosis.
b. Bivariate analysis: Linear and logistic regression modeling
c. Multiple Regression analysis
d. Also compare the results of the above analysis for the two data sets.

6. Apply and explore various plotting functions on UCI data sets.

a. Normal curves
b. Density and contour plots
c. Correlation and scatter plots
d. Histograms
e. Three dimensional plotting

7. Visualizing Geographic Data with Basemap

TOTAL: 60 PERIODS

COURSE OUTCOMES:

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

CO1: Make use of the python libraries for data science
CO2: Make use of the basic Statistical and Probability measures for data science.
CO3: Perform descriptive analytics on the benchmark data sets.
CO4: Perform correlation and regression analytics on standard data sets
CO5: Present and interpret data using visualization packages in Python.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	-	-	-	-	1	3	3	3	1	3	2
2	3	2	2	3	1	-	-	-	3	1	3	2	1	3	3
3	3	2	1	3	1	-	-	-	2	1	1	1	3	2	3
4	2	3	1	3	-	-	-	-	2	3	2	3	3	3	1
5	1	2	3	1	1	-	-	-	2	1	3	1	1	3	3
AVg.	2	2	2	2	1	-	-	-	2	2	2	2	2	3	2

1 - low, 2 - medium, 3 - high, '-"- no correlation

SEMESTER IV

GE3451 ENVIRONMENTAL SCIENCES AND SUSTAINABILITY L T P C

2 0 0 2

COURSE OBJECTIVES:

- To introduce the basic concepts of environment, ecosystems and biodiversity and emphasize on the biodiversity of India and its conservation.
- To impart knowledge on the causes, effects and control or prevention measures of environmental pollution and natural disasters.
- To facilitate the understanding of global and Indian scenario of renewable and nonrenewable resources, causes of their degradation and measures to preserve them.
- To familiarize the concept of sustainable development goals and appreciate the interdependence of economic and social aspects of sustainability, recognize and analyze climate changes, concept of carbon credit and the challenges of environmental management.
- To inculcate and embrace sustainability practices and develop a broader understanding on green materials, energy cycles and analyze the role of sustainable urbanization.

UNIT I ENVIRONMENT AND BIODIVERSITY 6

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT II ENVIRONMENTAL POLLUTION 6

Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .

UNIT III RENEWABLE SOURCES OF ENERGY 6

Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.

UNIT IV SUSTAINABILITY AND MANAGEMENT 6

Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols - Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.

UNIT V SUSTAINABILITY PRACTICES 6

Zero waste and R concept, Circular economy, ISO 14000 Series, Material Life cycle assessment, Environmental Impact Assessment. Sustainable habitat: Green buildings, Green materials, Energy efficiency, Sustainable transports. Sustainable energy: Non-conventional Sources, Energy Cycles-carbon cycle, emission and sequestration, Green Engineering: Sustainable urbanization- Socio-economical and technological change.

TOTAL: 30 PERIODS

COURSE OUTCOMES:

- To recognize and understand the functions of environment, ecosystems and biodiversity and their conservation.
- To identify the causes, effects of environmental pollution and natural disasters and contribute to the preventive measures in the society.
- To identify and apply the understanding of renewable and non-renewable resources and contribute to the sustainable measures to preserve them for future generations.
- To recognize the different goals of sustainable development and apply them for suitable technological advancement and societal development.
- To demonstrate the knowledge of sustainability practices and identify green materials, energy cycles and the role of sustainable urbanization.

TEXT BOOKS:

1. Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2016.

3. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.
4. Allen, D. T. and Shonnard, D. R., Sustainability Engineering: Concepts, Design and Case Studies, Prentice Hall.
5. Bradley. A.S; Adebayo, A.O., Maria, P. Engineering applications in sustainable design and development, Cengage learning.
6. Environment Impact Assessment Guidelines, Notification of Government of India, 2006.
7. Mackenthun, K.M., Basic Concepts in Environmental Management, Lewis Publication, London, 1998.

REFERENCES

1. R.K. Trivedi, 'Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards', Vol. I and II, Enviro Media. 38.
2. Cunningham, W.P. Cooper, T.H. Gorhani, 'Environmental Encyclopedia', Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT. LTD, New Delhi, 2007.
4. Rajagopalan, R, 'Environmental Studies-From Crisis to Cure', Oxford University Press, 2005.
5. Erach Bharucha "Textbook of Environmental Studies for Undergraduate Courses" Orient Blackswan Pvt. Ltd. 2013.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
1	2	1	-	-	-	2	3	-	-	-	-	2	-	-	-
2	3	2	-	-	-	3	3	-	-	-	-	2	-	-	-
3	3	-	1	-	-	2	2	-	-	-	-	2	-	-	-
4	3	2	1	1	-	2	2	-	-	-	-	2	-	-	-
5	3	2	1	-	-	2	2	-	-	-	-	1	-	-	-
Avg.	2.8	1.8	1	1	-	2.2	2.4	-	-	-	-	1.8	-	-	-

EE3503 CONTROL SYSTEMS

LT P C

3 0 0 3

COURSE OBJECTIVES:

- To make the students to familiarize with various representations of systems.
- To make the students to analyze the stability of linear systems in the time domain and frequency domain.
- To make the students to analyze the stability of linear systems in the frequency domain.
- To make the students to design compensator based on the time and frequency domain specifications.
- To develop linear models: mainly state variable model and Transfer function model

UNIT I MODELING OF LINEAR TIME INVARIANT SYSTEM (LTIV) 9

Control system: Open loop and Closed loop – Feedback control system characteristics – First principle modeling: Mechanical, Electrical and Electromechanical systems – Transfer function representations: Block diagram and Signal flow graph.

UNIT II TIME DOMAIN ANALYSIS 9

Standard test inputs – Time response – Time domain specifications – Stability analysis: Concept of stability – Routh Hurwitz stability criterion – Root locus: Construction and Interpretation. Effect of adding poles and zeros

UNIT III FREQUENCY DOMAIN ANALYSIS 9

Bode plot, Polar plot and Nyquist plot: – Frequency domain specifications Introduction to closed loop Frequency Response. Effect of adding lag and lead compensators.

UNIT IV STATE VARIABLE ANALYSIS 9

State variable formulation – Non uniqueness of state space model – State transition matrix – Eigen values – Eigen vectors - Free and forced responses for Time Invariant and Time Varying Systems – Controllability – Observability

UNIT V DESIGN OF FEED BACK CONTROL SYSTEM 9

Design specifications – Lead, Lag and Lag-lead compensators using Root locus and Bode plot techniques –PID controller - Design using reaction curve and Ziegler-Nichols technique-PID control in State Feedback form.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon the successful completion of the course, students will be able to:

CO1: Represent simple systems in transfer function and state variable forms.
CO2: Analyze simple systems in time domain.
CO3: Analyze simple systems in frequency domain.
CO4: Infer the stability of systems in time and frequency domain.
CO5: Interpret characteristics of the system and find out solution for simple control problems.

TEXT BOOKS:

1. Benjamin C. Kuo, “Automatic Control Systems”, 7th edition PHI Learning Private Ltd, 2010.
2. Nagarath, I.J. and Gopal, M., “Control Systems Engineering”, New Age International Publishers 2010.

REFERENCES:

1. Richard C.Dorf and Bishop, R.H., “Modern Control Systems”, Education Pearson, 3 Impression 2009.
2. John J.D., Azzo Constantine, H. and Houpis Sttuart, N Sheldon, “Linear Control System Analysis and Design with MATLAB”, CRC Taylor& Francis Reprint 2009.

3. Katsuhiko Ogata, “Modern Control Engineering”, PHI Learning Private Ltd, 5thEdition, 2010
4. NPTEL Video Lecture Notes on “Control Engineering” by Prof.S.D.Agashe, IIT Bombay.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	3	-	-	1	-	-	-	3	3	3	3
CO2	3	3	3	3	3	-	-	1	-	-	-	3	3	3	3
CO3	3	3	3	3	3	-	-	1	-	-	-	3	3	3	3
CO4	3	3	3	3	3	-	-	1	-	-	-	3	3	3	3
CO5	3	3	3	3	3	-	-	1	-	-	-	3	3	3	3
Avg.	3	3	3	3	3	-	-	1	-	-	-	3	3	3	3

MA3354 DISCRETE MATHEMATICS L T P C
3 1 0 4

COURSE OBJECTIVES:

- To extend student’s logical and mathematical maturity and ability to deal with abstraction.
- To introduce most of the basic terminologies used in computer science courses and application of ideas to solve practical problems.
- To understand the basic concepts of combinatorics and graph theory.
- To familiarize the applications of algebraic structures.
- To understand the concepts and significance of lattices and boolean algebra which are widely used in computer science and engineering.

UNIT I LOGIC AND PROOFS 9+3

Propositional logic – Propositional equivalences - Predicates and quantifiers – Nested quantifiers – Rules of inference - Introduction to proofs – Proof methods and strategy.

UNIT II COMBINATORICS 9+3

Mathematical induction – Strong induction and well ordering – The basics of counting – The pigeonhole principle – Permutations and combinations – Recurrence relations – Solving linear recurrence relations – Generating functions – Inclusion and exclusion principle and its applications.

UNIT III GRAPHS 9+3

Graphs and graph models – Graph terminology and special types of graphs – Matrix representation of graphs and graph isomorphism – Connectivity – Euler and Hamilton paths.

UNIT IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems – Semi groups and monoids - Groups – Subgroups – Homomorphism’s –

Normal subgroup and cosets – Lagrange's theorem – Definitions and examples of Rings and Fields.

UNIT V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering – Posets – Lattices as posets – Properties of lattices - Lattices as algebraic systems – Sub lattices – Direct product and homomorphism – Some special lattices – Boolean algebra – Sub Boolean Algebra – Boolean Homomorphism.

TOTAL: 60 PERIODS

COURSE OUTCOMES:

At the end of the course, students would :

CO1: Have knowledge of the concepts needed to test the logic of a program.
CO2: Have an understanding in identifying structures on many levels.
CO3: Be aware of a class of functions which transform a finite set into another finite set which relates to input and output functions in computer science.
CO4: Be aware of the counting principles.
CO5: Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

TEXT BOOKS:

1. Rosen. K.H., "Discrete Mathematics and its Applications", 7th Edition, Tata McGraw Hill Pub. Co. Ltd., New Delhi, Special Indian Edition, 2017.
2. Tremblay. J.P. and Manohar. R, "Discrete Mathematical Structures with Applications to Computer Science", Tata McGraw Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.

REFERENCES:

1. Grimaldi. R.P. "Discrete and Combinatorial Mathematics: An Applied Introduction", 5thEdition, Pearson Education Asia, Delhi, 2013.
2. Koshy. T. "Discrete Mathematics with Applications", Elsevier Publications, 2006.
3. Lipschutz. S. and Mark Lipson., "Discrete Mathematics", Schaum's Outlines, Tata McGraw Hill Pub. Co. Ltd., New Delhi, 3rd Edition, 2010.

CO's-PO's & PSO's MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO	PS	PS	PS
1	3	3	2	-	-	-	-	-	-	-	-	2	-	-	-
2	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
3	-	3	2	-	-	2	-	-	-	3	-	-	-	-	-
4	-	2	2	2	-	-	-	-	-	-	-	-	-	-	-
5	-	2	2	2	-	-	-	-	-	2	-	-	-	-	-

AVg	**1**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**

1 - low, 2 - medium, 3 - high, '-' - no correlation

CS3391 OBJECT ORIENTED PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand Object Oriented Programming concepts and basics of Java programming language
- To know the principles of packages, inheritance and interfaces
- To develop a java application with threads and generics classes
- To define exceptions and use I/O streams
- To design and build Graphical User Interface Application using JAVAFX

UNIT I INTRODUCTION TO OOP AND JAVA 9

Overview of OOP – Object oriented programming paradigms – Features of Object Oriented Programming – Java Buzzwords – Overview of Java – Data Types, Variables and Arrays – Operators – Control Statements – Programming Structures in Java – Defining classes in Java – Constructors-Methods -Access specifiers - Static members- Java Doc comments

UNIT II INHERITANCE, PACKAGES AND INTERFACES 9

Overloading Methods – Objects as Parameters – Returning Objects –Static, Nested and Inner Classes. Inheritance: Basics– Types of Inheritance -Super keyword -Method Overriding – Dynamic Method Dispatch –Abstract Classes – final with Inheritance. Packages and Interfaces: Packages – Packages and Member Access –Importing Packages – Interfaces.

UNIT III EXCEPTION HANDLING AND MULTITHREADING 9

Exception Handling basics – Multiple catch Clauses – Nested try Statements – Java's Built-in Exceptions – User defined Exception. Multithreaded Programming: Java Thread Model– Creating a Thread and Multiple Threads – Priorities – Synchronization – Inter Thread Communication- Suspending –Resuming, and Stopping Threads –Multithreading. Wrappers – Auto boxing.

UNIT IV I/O, GENERICS, STRING HANDLING 9

I/O Basics – Reading and Writing Console I/O – Reading and Writing Files. Generics: Generic Programming – Generic classes – Generic Methods – Bounded Types – Restrictions and Limitations. Strings: Basic String class, methods and String Buffer Class.

UNIT V JAVAFX EVENT HANDLING, CONTROLS AND COMPONENTS 9

JAVAFX Events and Controls: Event Basics – Handling Key and Mouse Events. Controls: Checkbox, ToggleButton – RadioButtons – ListView – ComboBox – ChoiceBox – Text Controls – ScrollPane. Layouts – FlowPane – HBox and VBox – BorderPane – StackPane – GridPane. Menus – Basics – Menu – Menu bars – MenuItem.

COURSE OUTCOMES:

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

CO1: Apply the concepts of classes and objects to solve simple problems
CO2: Develop programs using inheritance, packages and interfaces
CO3: Make use of exception handling mechanisms and multithreaded model to solve real world problems
CO4: Build Java applications with I/O packages, string classes, Collections and generics concepts
CO5: Integrate the concepts of event handling and JavaFX components and controls for developing GUI based applications

TOTAL:45 PERIODS

TEXT BOOKS:

1. Herbert Schildt, "Java: The Complete Reference", 11 th Edition, McGraw Hill Education, New Delhi, 2019
2. Herbert Schildt, "Introducing JavaFX 8 Programming", 1 st Edition, McGraw Hill Education, New Delhi, 2015

REFERENCE:

1. Cay S. Horstmann, "Core Java Fundamentals", Volume 1, 11 th Edition, Prentice Hall, 2018.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	3	1	3	-	-	-	3	2	2	2	3	1	2
2	2	1	3	2	1	-	-	-	2	1	1	3	3	3	2
3	3	3	1	2	2	-	-	-	3	2	1	2	3	1	3
4	3	1	2	2	2	-	-	-	1	2	1	3	3	1	1
5	1	1	2	3	2	-	-	-	3	2	1	2	3	3	3
AVg.	2	1	2	2	2	-	-	-	2	2	1	2	3	2	2

1 - low, 2 - medium, 3 - high, '-"- no correlation

EE3406 ELECTRICAL MACHINES L T P C

3 1 0 4

COURSE OBJECTIVE:

To educate students on the construction and operation of DC and AC machines, including generators, motors, and transformers. This course also aims to impart knowledge of testing methods and performance analysis.

UNIT I DC GENERATOR 12

Constructional details, armature windings and types – Principle and EMF equation – Armature reaction – Commutation – OCC and load characteristics of various DC generators – Applications.

UNIT II DC MOTORS 12

Principle of operation – Back EMF significance – Torque and power equations – Speed control, starting methods and Load characteristics of various DC motors – Swinburne's test –

Applications.

UNIT III SINGLE-PHASE TRANSFORMERS 12

Construction and principle – Equivalent circuit – Phasor diagrams – Open and short circuit tests – Voltage regulation – Losses and efficiency – All-day efficiency – Applications.

Auto And Three-Phase Transformers**:** Working principle – Comparison with two-winding transformers– Three-phase transformer connections (Vector group).

UNIT IV INDUCTION MOTOR 12

Three Phase: Construction – Principle of operation – Slip and torque-slip characteristics – Equivalent circuit – Losses and efficiency – Cogging and crawling – Load, no-load and blocked rotor tests – Starters and speed control.

Single Phase: Construction – Double-field revolving theory – Equivalent circuit – Starting methods – Applications.

UNIT V SYNCHRONOUS GENERATOR 12

Construction – Winding factors – EMF equation – Armature reaction – Voltage regulation (EMF method) – Synchronization and parallel operation.

Synchronous Motor – Principle of operation – Torque equation – V and Inverted V curves – Starting methods – Hunting – Applications.

TOTAL:60 PERIODS

REFERENCES:

1. Kothari, D.P., & Nagrath, I.L., *Electric Machines*, Tata McGraw Hill, 5th Edition, 2017 & Fully Revised 2021
2. Bimbhra, P.S., *Electrical Machinery*, Khanna Publishers, 2nd Edition, 2021
3. Fitzgerald, A.E., & Kingsley, C., *Electric Machinery*, McGraw Hill, 6th Edition, 2017
4. Clayton, A.E., & Hancock, N.N., *Performance and Design of DC Machines*, CBS Publishers, 2018
5. Say, M.G., *Performance and Design of AC Machines*, CBS Publishers, 2008

E-Resource:

- NPTEL: Electrical Machines – I

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

CO1: Explain the construction and performance of DC generators and motors.
CO2: Apply testing methods and analyze characteristics of DC machines.
CO3: Analyze and evaluate transformer operation, testing, and efficiency.
CO4: Explain working and testing of synchronous machines.
CO5: Analyze the characteristics and performance of induction motors (three-phase and single-phase).

EE3404 MICROPROCESSOR AND MICROCONTROLLER L T

P C

3 0 0 3

COURSE OBJECTIVES:

- To study the addressing modes & instruction set of 8085 &8051
- To develop skills in simple program writing in assembly languages
- To introduce commonly used peripheral/interfacing ICs.
- To study and understand typical applications of micro-processors.
- To study and understand the typical applications of micro-controllers

UNIT I INTRODUCTION TO 8085 ARCHITECTURE 9

Functional block diagram – Memory interfacing–I/O ports and data transfer concepts – Timing Diagram — Interrupt structure.

UNIT II 8085 INSTRUCTION SET AND PROGRAMMING 9

Instruction format and addressing modes — Assembly language format — Data transfer, data manipulation & control instructions – Programming: Loop structure with counting & Indexing - Look up table - Subroutine instructions, stack.

UNIT III INTERFACING BASICS AND ICS 9

Study of Architecture and programming of ICs: 8255 PPI, 8259PIC, 8251USART, 8279 Keyboard display controller and 8254 Timer/Counter – Interfacing with 8085 -A/D and D/A converter interfacing.

.

UNIT IV INTRODUCTION TO 8051 MICROCONTROLLER 9

Functional block diagram - Instruction format and addressing modes – Interrupt structure – Timer – I/O ports – Serial communication, Simple programming –keyboard and display interface – Temperature control system –stepper motor control - Usage of IDE for assembly language programming.

UNIT V INTRODUCTION TO RISC BASED ARCHITECTURE 9

PIC16 /18 architecture, Memory organization – Addressing modes – Instruction set - Programming techniques – Timers – I/O ports – Interrupt programming.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students should have the:

CO1: Ability to write assembly language program for microprocessor and microcontroller
CO2: Ability to design and implement interfacing of peripheral with microprocessor and microcontroller
CO3:Ability to analyze, comprehend, design and simulate microprocessor based systems used for control and monitoring.
CO4: Ability to analyze, comprehend, design and simulate microcontroller based systems used for control and monitoring.
CO5: Ability to understand and appreciate advanced architecture evolving microprocessor field

TEXTBOOKS:

1. Ramesh S. Gaonkar, 'Microprocessor Architecture Programming and Application', Pen ram International (P)ltd., Mumbai, 6th Education, 2013.
2. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The 8051 Micro Controller and Embedded Systems', Pearson Education, Second Edition 2011.
3. Muhammad Ali Mazidi & Janice Gilli Mazidi, 'The PIC Micro Controller and Embedded Systems', 2010

REFERENCES:

1. Douglas V. Hall, "Micro-processors & Interfacing", Tata McGraw Hill 3rd Edition, 2017.
2. Krishna Kant, "Micro-processors & Micro-controllers", Prentice Hall of India, 2007.
3. Mike Predko, "8051 Micro-controllers", McGraw Hill, 2009
4. Kenneth Ayala, 'The 8051 Microcontroller', Thomson, 3rd Edition 2004.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**P0 6**	**P0 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS 01**	**PS 02**	**PS 03**
CO1	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO2	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO3	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO4	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
CO5	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3
Avg	2	1	2	3	-	-	-	1	-	-	-	3	3	1	3

NCC Credit Course Level 2*

NX3451	(ARMY WING) NCC Credit Course Level - II	L	T	P	C
		3	0	0	3

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3
LEADERSHIP		**7**
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA 1	General Knowledge	4
ARMED FORCES		**6**
AF 1	Armed Forces, Army, CAPF, Police	6
ADVENTURE		**1**
AD 1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2

TOTAL: 45 PERIODS

NCC Credit Course Level 2*

NX3452	(NAVAL WING) NCC Credit Course Level - II	L	T	P	C
		3	0	0	3

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3
LEADERSHIP		**7**
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don't's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA 1	General Knowledge	4
NAVAL ORIENTATION		**6**
AF 1	Armed Forces and Navy Capsule	3
EEZ 1	EEZ Maritime Security and ICG	3
ADVENTURE		**1**
AD 1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2

TOTAL : 45 PERIODS

NX3453	(AIR FORCE WING) NCC Credit Course Level - II	L	T	P	C
		3	0	0	3

NCC Credit Course Level 2*

PERSONALITY DEVELOPMENT		**9**
PD 3	Group Discussion: Change your mindset, Time Management, Social Skills	6
PD 5	Public Speaking	3
LEADERSHIP		**7**
L 2	Case Studies: APJ Abdul Kalam, Deepa Malik, Maharana Pratap, N Narayan Murty, Ratan Tata, Rabindra Nath Tagore, Role of NCC cadets in 1965	7
DISASTER MANAGEMENT		**13**
DM 1	Disaster Management Capsule: Organisation, Types of Disasters, Essential Services, Assistance, Civil Defence Organisation	3
DM 2	Initiative Training, Organising Skills, Do's & Don’t's, Natural Disasters, Man Made Disasters	9
DM 3	Fire Service & Fire Fighting	1
ENVIRONMENTAL AWARENESS & CONSERVATION		**3**
EA 1	Environmental Awareness and Conservation	3
GENERAL AWARENESS		**4**
GA 1	General Knowledge	4
GENERAL SERVICE KNOWLEDGE		**6**
GSK 1	Armed Forces & IAF Capsule	2
GSK 2	Modes of Entry in IAF, Civil Aviation	2
GSK 3	Aircrafts - Types, Capabilities & Role	2
ADVENTURE		**1**
AD 1	Introduction to Adventure Activities	1
BORDER & COASTAL AREAS		**2**
BCA 1	History, Geography & Topography of Border/Coastal areas	2

TOTAL : 45 PERIODS

EE3414 ELECTRICAL MACHINES LABORATORY L T P C

0 0 4 2

LIST OF EXPERIMENTS

1. Open circuit and load characteristics of DC Generator (Shunt / Series / Compound)
2. Study of starters of DC motors
3. Speed control of DC motor
4. Load test on DC motor (Shunt / Series)
5. Swinburne's test
6. Open circuit and short circuit test on single-phase transformer
7. Predetermination of regulation of three-phase alternator using EMF method.
8. Study of starters of three-phase induction motors
9. No-load and blocked rotor tests and predetermination of performance of three-phase induction motor
10. Load test on induction motor (Single Phase / Three Phase)
11. V-curves and inverted V-curves of synchronous motor

TOTAL:60 PERIODS

CS3381 OBJECT ORIENTED PROGRAMMING LABORATORY L T P C

0 0 31.5

COURSE OBJECTIVES:

- To build software development skills using java programming for real-world applications.
- To understand and apply the concepts of classes, packages, interfaces, inheritance, exception handling and file processing.
- To develop applications using generic programming and event handling

LIST OF EXPERIMENTS:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion)
2. Develop stack and queue data structures using classes and objects.

3. Develop a java application with an Employee class with Emp_name, Emp_id, Address, Mail_id, Mobile_no as members. Inherit the classes, Programmer, Assistant Professor, Associate Professor and Professor from employee class. Add Basic Pay (BP) as the member of all the inherited classes with 97% of BP as DA, 10 % of BP as HRA, 12% of BP as PF, 0.1% of BP for staff club funds. Generate pay slips for the employees with their gross and net salary.
4. Write a Java Program to create an abstract class named Shape that contains two integers and an empty method named printArea(). Provide three classes named Rectangle, Triangle and Circle such that each one of the classes extends the class Shape. Each one of the classes contains only the method printArea( ) that prints the area of the given shape.
5. Solve the above problem using an interface.
6. Implement exception handling and creation of user defined exceptions.
7. Write a java program that implements a multi-threaded application that has three threads. First thread generates a random integer every 1 second and if the value is even, the second thread computes the square of the number and prints. If the value is odd, the third thread will print the value of the cube of the number.
8. Write a program to perform file operations.
9. Develop applications to demonstrate the features of generics classes.
10. Develop applications using JavaFX controls, layouts and menus.
11. Develop a mini project for any application using Java concepts.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 : Design and develop java programs using object oriented programming concepts
CO2 : Develop simple applications using object oriented concepts such as package, exceptions
CO3: Implement multithreading, and generics concepts
CO4 : Create GUIs and event driven programming applications for real world problems
CO5: Implement and deploy web applications using Java

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	2	1	-	-	-	-	1	2	2	2	1	2	3
2	2	1	3	1	-	-	-	-	2	3	3	2	1	3	1
3	2	2	1	2	1	-	-	-	1	2	1	3	2	3	2
4	2	2	1	3	-	-	-	-	3	1	1	1	2	1	2
5	1	3	3	1	3	-	-	-	1	1	1	1	2	1	2
AVg.	2	2	2	2	2	-	-	-	2	2	2	2	2	2	2

1 - low, 2 - medium, 3 - high, '-"- no correlation

EE3413 MICROPROCESSOR AND MICROCONTROLLER LABORATORY L T P C

0 0 3 1.5

COURSE OBJECTIVES:

- To perform simple arithmetic operations using assembly language program and study the addressing modes & instruction set of 8085 & 8051
- To develop skills in simple program writing in assembly languages
- To write an assembly language program to convert Analog input to Digital output and Digital input to Analog output.
- To perform interfacing experiments with µP8085
- To perform interfacing experiments with µC8051.

PROGRAMMING EXERCISES / EXPERIMENTS WITH µP8085:

1. Simple arithmetic operations: Multi precision addition / subtraction /multiplication / division.
2. Programming with control instructions: Increment / Decrement, Ascending / Descending order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
3. Interface Experiments: A/D Interfacing. D/A Interfacing. Traffic light controller
4. Stepper motor controller interface.
5. Displaying a moving/ rolling message in the student trainer kit's output device.

PROGRAMMING EXERCISES / EXPERIMENTS WITH µC8051:

6. Simple arithmetic operations with 8051: Multi precision addition / subtraction / multiplication/ division.
7. Programming with control instructions: Increment / Decrement, Ascending / Descending. order, Maximum / Minimum of numbers, Rotate instructions, Hex / ASCII / BCD code conversions.
8. Interface Experiments: A/D Interfacing. D/A Interfacing. Traffic light controller
9. Stepper motor controller interface.
10. Displaying a moving/ rolling message in the student trainer kit's output device.
11. Programming PIC architecture with software tools.

TOTAL :45 PERIODS

COURSE OUTCOMES:

After studying the above subject, students should have the:

CO1: Ability to write assembly language program for microprocessor.
CO2: Ability to write assembly language program for microcontroller
CO3: Ability to design and implement interfacing of peripheral with microprocessor and microcontroller
CO4: Ability to analyze, comprehend, design and simulate microprocessor based systems used for control and monitoring..
CO5: Ability to analyze, comprehend, design and simulate microcontroller based systems used for control and monitoring.

MAPPING OF COs WITH POs AND PSOs

	POs												PSOs		
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**P07**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS01**	**PS02**	**PS03**
CO1	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3

CO2	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
CO3	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
CO4	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
CO5	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3
Avg	2	1	2	3	-	-	-	1.5	-	-	-	3	3	1	3

SEMESTER V

EP3501 POWER SYSTEMS I

L	T	P	C
3	0	0	3

COURSE OBJECTIVE

To provide a comprehensive understanding of electric power system components, transmission and distribution networks, power flow analysis, fault analysis, and stability studies, enabling them to model, analyze, and evaluate the performance and reliability of modern power systems under normal and fault conditions.

UNIT I MODELLING OF COMPONENTS 9

Structure of Electric Power Systems Network, Parameters of transmission Line, Typical configuration, Various effects. Transmission System- Modelling of Transmission Line, Equivalent circuits, Phasor Diagram.

UNIT II TRANSMISSION AND DISTRIBUTION SYSTEM 9

Performance of Transmission Line. Distribution System-AC and DC Distributions, Voltage and Power factor control.
Trends in Transmission and Distribution: EHVAC, HVDC and FACTS (Qualitative Treatment only).

UNIT III POWER FLOW ANALYSIS 9

Representation of power system: Single line diagram, per unit representation, Formation of Bus admittance matrix, Analysis of Power Networks – Load flow analysis – Gauss Seidel and Newton Raphson Method.

UNIT IV FAULT ANALYSIS 9

Types of faults, symmetrical fault analysis, design of circuit breaker, unsymmetrical fault analysis -LL,LG, and LLG fault.

UNIT V POWER SYSTEM STABILITY 9

Power System stability – swing equation – steady state and transient stability – equal area criterion – Critical Clearing Time-solution of swing equation.

TOTAL: 45

TEXTBOOK

1. Wadhwa C. L., “Electric Power System”, Wiley Eastern Limited, India 2007.
2. John J. Grainger and Stevenson W. D, “Power System Analysis”, McGraw Hill International, 2016.

3. Kothari D. P. and Nagrath I. J., “Modern Power System Analysis”, Tata McGraw Hill Publishing Company
4. J.B.Gupta ,”A course in power system “ , SK Kataria and sons, 2013.

REFERENCES

1. Hadi Saadat,”Power system analysis”, McGraw Hill publishing company, 2003.
2. B.R.Gupta, “Power system analysis and design”, S. Chand & Company Ltd., 2004.
3. L.L.Grigsby, “Electrical power engineering Handbook”, IEEE press, 2001.
4. Abhijith Chakrabarti, D. P.Kothari and A. K. Mukhopadhyay, “An Introduction to Reactive Power Control and Voltage Stability in Power Transmission Systems”, PHI learning private limited, India, 2010.

COURSE OUTCOMES (Cos):

After successful completion of the course, students will be able to:

CO1 Explain the structure and components of electric power systems and model transmission line parameters and equivalent circuits.

CO2 Analyze the performance of transmission and distribution systems, including voltage regulation, power factor control, and modern transmission technologies such as EHVAC, HVDC, and FACTS.

CO3 Represent power systems using single-line diagrams and per-unit systems, and formulate the bus admittance matrix for network analysis.

CO4 Apply numerical methods such as Gauss-Seidel and Newton-Raphson techniques for load flow analysis of power networks.

CO5 Evaluate symmetrical and unsymmetrical faults in power systems and perform short-circuit analysis using impedance matrix methods.

CO6 Analyze steady-state and transient stability of power systems using swing equation and equal area criterion to assess system stability under disturbances.

EE3403 MEASUREMENTS AND INSTRUMENTATION LT P C
3 0 0 3

COURSE OBJECTIVES

- To educate the fundamental concepts and characteristics of measurement and errors
- To impart the knowledge on the functional aspects of measuring instruments
- To infer the importance of various bridge circuits used with measuring instruments.
- To educate the fundamental working of sensors and transducers and their applications
- To summarize the overall measurement and instrumentation with the knowledge on digital instrumentation principles.

UNIT I CONCEPTS OF MEASUREMENTS 9

Instruments: classification, applications – Elements of a generalized measurement system - Static and dynamic characteristics - Errors in measurement -Statistical evaluation of measurement data.

UNIT II MEASUREMENT OF PARAMETERS IN ELECTRICAL SYSTEMS 9

Classification of instruments – moving coil and moving iron meters – Induction type, dynamometer type watt meters – Energy meter – Megger – Instrument transformers (CT & PT).

UNIT III AC/DC BRIDGES AND INSTRUMENTATION AMPLIFIERS 9

Wheatstone bridge, Kelvin double bridge - Maxwell, Hay, Wien and Schering bridges – Errors and compensation in A.C. bridges - Instrumentation Amplifiers.

UNIT IV TRANSDUCERS FOR MEASUREMENT OF NON- ELECTRICAL PARAMETERS 9

Classification of transducers – Measurement of pressure, temperature, displacement, flow, angular velocity – Digital transducers – Smart Sensors.

UNIT V DIGITAL INSTRUMENTATION 9

A/D converters: types and characteristics – Sampling, Errors- Measurement of voltage, Current, frequency and phase - D/A converters: types and characteristics- DSO- Data Loggers – Basics of PLC programming and Introduction to Virtual Instrumentation - Instrument standards.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students should have the:

CO1: Ability to understand the fundamental art of measurement in engineering.

CO2: Ability to understand the structural elements of various instruments.

CO3: Ability to understand the importance of bridge circuits.

CO4:Ability to understand about various transducers and their characteristics by experiments.

CO5: Ability to understand the concept of digital instrumentation and virtual instrumentation by experiments.

TEXT BOOKS:

1. A.K. Sawhney, Puneet Sawhney ‘A Course in Electrical & Electronic Measurements & Instrumentation’, Dhanpat Rai and Co, New Delhi, Edition 2011.
2. H.S. Kalsi, ‘Electronic Instrumentation’, Tata McGraw-Hill, New Delhi, 2010

REFERENCES:

1. M.M.S. Anand, ‘Electronics Instruments and Instrumentation Technology’, Prentice Hall India, New Delhi, 2009
2. J.J. Carr, ‘Elements of Electronic Instrumentation and Measurement’, Pearson Education India, New Delhi, 2011
3. W.Bolton, Programmable Logic Controllers, 6th Edition, Elseiver, 2015.
4. R.B. Northrop, ‘Introduction to Instrumentation and Measurements’, Taylor & Francis, New Delhi, 3rd Edition 2014.
5. E. O. Doebelin and D. N. Manik, “Measurement Systems – Application and Design”, Tata McGraw-Hill, New Delhi, 6th Edition 2017.
6. R. K. Rajput, “Electrical and Electronics Measurements and Instrumentation”, Chand Pub, 2016

MAPPING OF COs WITH POs AND PSOs

COs	POs	PSOs

	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PS 01	PS 02	PS 03
CO1	3	2	3	-	3	2	-	2	-	-	-	3	3	3	3
CO2	3	2	3	2	-	-	-		-	3	-	3	3	3	3
CO3	3	2	3	-	3	2	-		-	-	-	3	3	3	3
CO4	3	2	3	-	-	-	-	2	-	-	-	-	3	3	3
CO5	3	2	3	2	3	-	-		-	3	-	3	3	3	3
Avg	3	2	3	2	3	2	-	2	-	3	-	3	3	3	3

EE3402 LINEAR INTEGRATED CIRCUITS L T P C
3 0 0 3

COURSE OBJECTIVES:

To impart knowledge on the following topics

- Signal analysis using Op-amp based circuits.
- Applications of Op-amp.
- Functional blocks and the applications of special ICs like Timers, PLL circuits, regulator Circuits.
- IC fabrication procedure.

UNIT I IC FABRICATION 9

IC classification, fundamental of monolithic IC technology, epitaxial growth, masking and etching, diffusion of impurities. Realisation of monolithic ICs and packaging. Fabrication of diodes, capacitance, resistance, FETs and PV Cell.

UNIT II CHARACTERISTICS OF OPAMP 9

Ideal OP-AMP characteristics, DC characteristics, AC characteristics, differential amplifier; frequency response of OP-AMP; Voltage-shunt feedback and inverting amplifier - Voltage series feedback: and Non-Inverting Amplifier - Basic applications of op-amp –, summer, differentiator and Integrator-V/I & I/V converters.

UNIT III APPLICATIONS OF OPAMP 9

Instrumentation amplifier and its applications for transducer Bridge, Log and Antilog Amplifiers- Analog multiplier & Divider, first and second order active filters, comparators, multi vibrators, waveform generators, clippers, clampers, peak detector, S/H circuit, D/A converter (R- 2R ladder and weighted resistor types), A/D converters using OP-AMPs.

UNIT IV SPECIAL ICs 9

Functional block, characteristics of 555 Timer and its PWM application - IC-566 voltage controlled oscillator IC; 565-phase locked loop IC, AD633 Analog multiplier ICs.

UNIT V APPLICATION ICs 9

AD623 Instrumentation Amplifier and its application as load cell weight measurement - IC voltage regulators –LM78XX, LM79XX; Fixed voltage regulators its application as Linear power supply - LM317, 723 Variability voltage regulators, switching regulator- SMPS - ICL 8038 function generator IC.

TOTAL :45 PERIODS

COURSE OUTCOMES:

Upon successful completion of the course, the students will be able to:

CO1 Explain monolithic IC fabrication process

CO2 Explain the fabrication of diodes, capacitance, resistance, FETs and PV Cell.

CO3 Analyze the characteristics and basic applications (inverting/non-inverting amplifier, summer, differentiator, integrator, V/I and I/V converter) of Op-Amp

CO4 Explain circuit and applications of op-amp based instrumentation amplifier, log/antilog amplifier,analog multiplier /divider, active filters, comparators, waveform generators, A/D and D/A converters

CO5 Explain Functional blocks, characteristics and applications of Timer, PLL, analog multiplier ICs.

CO6 Explain the applications of ICs in Instrumentation amplifier, fixed and variable voltage regulator, SMPS and function generator

TEXT BOOKS:

1. David A. Bell, 'Op-amp & Linear ICs', Oxford, Third Edition, 2011
2. D. Roy Choudhary, Sheil B. Jani, 'Linear Integrated Circuits', , New Age, Fourth Edition, 2018.
3. Ramakant A.Gayakward, 'Op-amps and Linear Integrated Circuits', IV edition, Pearson Education, PHI 2021.

REFERENCES

1. Fiore,"Opamps& Linear Integrated Circuits Concepts & applications", Cengage, 2010.
2. Floyd ,Buchla,"Fundamentals of Analog Circuits, Pearson, 2013.
3. Jacob Millman, Christos C.Halkias, 'Integrated Electronics - Analog and Digital circuits system', McGraw Hill, 2nd Edition, 2017.
4. Robert F.Coughlin, Fredrick F. Driscoll, 'Op-amp and Linear ICs', Pearson, 6th edition,2012.
5. Sergio Franco, 'Design with Operational Amplifiers and Analog Integrated Circuits', McGraw Hill, 2016 – Fourth Edition.
6. Muhammad H. Rashid,' Microelectronic Circuits Analysis and Design' Cengage Learning, 2nd Edition, 2012.

MAPPING OF COs WITH POs AND PSOs

	POs												PSOs		
COs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**P06**	**P07**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PS 01**	**PS 02**	**PS 03**
CO1	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO2	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO3	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO4	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
CO5	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1
Avg	2	2	3	2	2	-	-	1	-	-	-	1	3	2	1

CS3401 ALGORITHMS **L T P C**
3 0 2 4

COURSE OBJECTIVES:

- To understand and apply the algorithm analysis techniques on searching and sorting algorithms
- To critically analyze the efficiency of graph algorithms

- To understand different algorithm design techniques
- To solve programming problems using state space tree
- To understand the concepts behind NP Completeness, Approximation algorithms and randomized algorithms.

UNIT I INTRODUCTION 9

Algorithm analysis: Time and space complexity - Asymptotic Notations and its properties Best case, Worst case and average case analysis – Recurrence relation: substitution method - Lower bounds – **searching:** linear search, binary search and Interpolation Search, **Pattern search:** The naïve string-matching algorithm - Rabin-Karp algorithm - Knuth-Morris-Pratt algorithm. **Sorting:** Insertion sort – heap sort

UNIT II GRAPH ALGORITHMS 9

Graph algorithms: Representations of graphs - Graph traversal: DFS – BFS - applications - Connectivity, strong connectivity, bi-connectivity - Minimum spanning tree: Kruskal's and Prim's algorithm- Shortest path: Bellman-Ford algorithm - Dijkstra's algorithm - Floyd-Warshall algorithm Network flow: Flow networks - Ford-Fulkerson method – Matching: Maximum bipartite matching

UNIT III ALGORITHM DESIGN TECHNIQUES 9

Divide and Conquer methodology: Finding maximum and minimum - Merge sort - Quick sort **Dynamic programming:** Elements of dynamic programming — Matrix-chain multiplication - Multi stage graph — Optimal Binary Search Trees. **Greedy Technique**: Elements of the greedy strategy - Activity-selection problem –- Optimal Merge pattern — Huffman Trees.

UNIT IV STATE SPACE SEARCH ALGORITHMS 9

Backtracking: n-Queens problem - Hamiltonian Circuit Problem - Subset Sum Problem – Graph colouring problem **Branch and Bound**: Solving 15-Puzzle problem - Assignment problem - Knapsack Problem - Travelling Salesman Problem

UNIT V NP-COMPLETE AND APPROXIMATION ALGORITHM 9

Tractable and intractable problems: Polynomial time algorithms – Venn diagram representation - NP-algorithms - NP-hardness and NP-completeness – Bin Packing problem - Problem reduction: TSP – 3-CNF problem. **Approximation Algorithms**: TSP - **Randomized Algorithms**: concept and application - primality testing - randomized quick sort - Finding k^{th} smallest number

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

Searching and Sorting Algorithms

1. Implement Linear Search. Determine the time required to search for an element. Repeat the experiment for different values of *n*, the number of elements in the list to be searched and plot a graph of the time taken versus *n*.

2. Implement recursive Binary Search. Determine the time required to search an element. Repeat the experiment for different values of *n*, the number of elements in the list to be searched and plot a graph of the time taken versus *n*.
3. Given a text txt [0...n-1] and a pattern pat [0...m-1], write a function search (char pat [ ], char txt [ ]) that prints all occurrences of pat [ ] in txt [ ]. You may assume that n > m.
4. Sort a given set of elements using the Insertion sort and Heap sort methods and determine the time required to sort the elements. Repeat the experiment for different values of *n*, the number of elements in the list to be sorted and plot a graph of the time taken versus *n*.

Graph Algorithms

1. Develop a program to implement graph traversal using Breadth First Search
2. Develop a program to implement graph traversal using Depth First Search
3. From a given vertex in a weighted connected graph, develop a program to find the shortest paths to other vertices using Dijkstra's algorithm.
4. Find the minimum cost spanning tree of a given undirected graph using Prim's algorithm.
5. Implement Floyd's algorithm for the All-Pairs- Shortest-Paths problem.
6. Compute the transitive closure of a given directed graph using Warshall's algorithm.

Algorithm Design Techniques

1. Develop a program to find out the maximum and minimum numbers in a given list of *n* numbers using the divide and conquer technique.
2. Implement Merge sort and Quick sort methods to sort an array of elements and determine the time required to sort. Repeat the experiment for different values of *n*, the number of elements in the list to be sorted and plot a graph of the time taken versus *n*.

State Space Search Algorithms

1. Implement N Queens problem using Backtracking.

Approximation Algorithms Randomized Algorithms

1. Implement any scheme to find the optimal solution for the Traveling Salesperson problem and then solve the same problem instance using any approximation algorithm and determine the error in the approximation.
2. Implement randomized algorithms for finding the k^{th} smallest number.
   The programs can be implemented in C/C++/JAVA/ Python.

TOTAL:75 PERIODS

COURSE OUTCOMES:

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

CO1: Analyze the efficiency of algorithms using various frameworks

CO2: Apply graph algorithms to solve problems and analyze their efficiency.

CO3: Make use of algorithm design techniques like divide and conquer, dynamic programming and greedy techniques to solve problems

CO4: Use the state space tree method for solving problems.

CO5: Solve problems using approximation algorithms and randomized algorithms

TEXT BOOKS:

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest and Clifford Stein, "Introduction to Algorithms", 3rd Edition, Prentice Hall of India, 2009.
2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran "Computer Algorithms/C++" Orient Blackswan, 2nd Edition, 2019.

REFERENCES:

1. Anany Levitin, “Introduction to the Design and Analysis of Algorithms”, 3rd Edition, Pearson Education, 2012.
2. Alfred V. Aho, John E. Hopcroft and Jeffrey D. Ullman, "Data Structures and Algorithms", Reprint Edition, Pearson Education, 2006.
3. S. Sridhar, “Design and Analysis of Algorithms”, Oxford university press, 2014.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	-	-	-		1	-	-	-	-	1	-	1	-
2	2	3	-	-	-	-	1	-	-	-	-	1	-	1	-
3	1	2	3	1	-	-	2	-	-	-	-	-	-	1	1
4	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
AVg.	2.67	1.8	3	1	-	-	1.33	-	-	-	-	1	-	1	1

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

CS3492 DATABASE MANAGEMENT SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

- To learn the fundamentals of data models, relational algebra and SQL
- To represent a database system using ER diagrams and to learn normalization techniques
- To understand the fundamental concepts of transaction, concurrency and recovery processing
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
- To have an introductory knowledge about the Distributed databases, NOSQL and database security

UNIT I RELATIONAL DATABASES 10

Purpose of Database System – Views of data – Data Models – Database System Architecture – Introduction to relational databases – Relational Model – Keys – Relational Algebra – SQL fundamentals – Advanced SQL features – Embedded SQL– Dynamic SQL

UNIT II DATABASE DESIGN 8

Entity-Relationship model – E-R Diagrams – Enhanced-ER Model – ER-to-Relational Mapping – Functional Dependencies – Non-loss Decomposition – First, Second, Third Normal Forms, Dependency Preservation – Boyce/Codd Normal Form – Multi-valued Dependencies and Fourth Normal Form – Join Dependencies and Fifth Normal Form

UNIT III TRANSACTIONS 9

Transaction Concepts – ACID Properties – Schedules – Serializability – Transaction support

in SQL – Need for Concurrency – Concurrency control –Two Phase Locking- Timestamp – Multiversion – Validation and Snapshot isolation– Multiple Granularity locking – Deadlock Handling – Recovery Concepts – Recovery based on deferred and immediate update – Shadow paging – ARIES Algorithm

UNIT IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records in Files – Data dictionary Storage – Column Oriented Storage– Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for Selection, Sorting and join operations – Query optimization using Heuristics - Cost Estimation.

UNIT V ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing, Query processing and optimization – NOSQL Databases: Introduction – CAP Theorem – Document Based systems – Key value Stores – Column Based Systems – Graph Databases. Database Security: Security issues – Access control based on privileges – Role Based access control – SQL Injection – Statistical Database security – Flow control – Encryption and Public Key infrastructures – Challenges

TOTAL:45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

CO1: Construct SQL Queries using relational algebra

CO2: Design database using ER model and normalize the database

CO3: Construct queries to handle transaction processing and maintain consistency of the database

CO4: Compare and contrast various indexing strategies and apply the knowledge to tune the performance of the database

CO5: Appraise how advanced databases differ from Relational Databases and find a suitable database for the given requirement.

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, “Database System Concepts”, Seventh Edition, McGraw Hill, 2020.
2. Ramez Elmasri, Shamkant B. Navathe, “Fundamentals of Database Systems”, Seventh Edition, Pearson Education, 2017

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, “An Introduction to Database Systems”, Eighth Edition, Pearson Education, 2006.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	3	2	1	-	-	-	2	1	1	1	2	1	3
2	3	1	1	1	1	-	-	-	2	3	3	3	3	1	2
3	3	2	3	2	1	-	-	-	2	1	1	2	2	3	3

4	1	2	3	2	-	-	-	-	3	2	3	3	1	2	3
5	1	1	3	3	2	-	-	-	1	3	3	1	2	2	2
AVg.	2	2	3	2	1	-	-	-	2	2	2	2	2	2	3

1 - low, 2 - medium, 3 - high, '-"- no correlation

CS3481 DATABASE MANAGEMENT SYSTEMS LABORATORY L T P C
0 0 3 1.5

COURSE OBJECTIVES:

- To learn and implement important commands in SQL.
- To learn the usage of nested and joint queries.
- To understand functions, procedures and procedural extensions of databases.
- To understand design and implementation of typical database applications.
- To be familiar with the use of a front end tool for GUI based application development.

LIST OF EXPERIMENTS:

1. Create a database table, add constraints (primary key, unique, check, Not null), insert rows, update and delete rows using SQL DDL and DML commands.
2. Create a set of tables, add foreign key constraints and incorporate referential integrity.
3. Query the database tables using different 'where' clause conditions and also implement aggregate functions.
4. Query the database tables and explore sub queries and simple join operations.
5. Query the database tables and explore natural, equi and outer joins.
6. Write user defined functions and stored procedures in SQL.
7. Execute complex transactions and realize DCL and TCL commands.
8. Write SQL Triggers for insert, delete, and update operations in a database table.
9. Create View and index for database tables with a large number of records.
10. Create an XML database and validate it using XML schema.
11. Create Document, column and graph based data using NOSQL database tools.
12. Develop a simple GUI based database application and incorporate all the above-mentioned features
13. Case Study using any of the real life database applications from the following list
    a) Inventory Management for a EMart Grocery Shop
    b) Society Financial Management
    c) Cop Friendly App – Eseva
    d) Property Management – eMall
    e) Star Small and Medium Banking and Finance
    - Build Entity Model diagram. The diagram should align with the business and functional goals stated in the application.
    - Apply Normalization rules in designing the tables in scope.
    - Prepared applicable views, triggers (for auditing purposes), functions for enabling enterprise grade features.
    - Build PL SQL / Stored Procedures for Complex Functionalities, ex EOD Batch Processing for calculating the EMI for Gold Loan for each eligible Customer.

- Ability to showcase ACID Properties with sample queries with appropriate settings

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1: Create databases with different types of key constraints.

CO2: Construct simple and complex SQL queries using DML and DCL commands.

CO3: Use advanced features such as stored procedures and triggers and incorporate in GUI based application development.

CO4: Create an XML database and validate with meta-data (XML schema).

CO5: Create and manipulate data using NOSQL database.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	-	-	-	-	3	1	3	2	2	3	2
2	2	2	3	2	2	-	-	-	1	2	3	3	2	1	2
3	3	3	2	1	1	-	-	-	1	1	1	3	2	3	3
4	1	3	3	3	1	-	-	-	1	1	3	2	3	1	3
5	3	2	1	1	1	-	-	-	2	2	3	1	3	1	2
AVg.	2	3	2	2	1	-	-	-	2	1	3	2	2	2	2

1 - low, 2 - medium, 3 - high, '-"- no correlation

SEMETER VI

EP3601	**POWER SYSTEMS II**	**L T P C**
		3 0 0 3

Course Objective:

To impart knowledge on power system operation and control, including frequency and voltage regulation, protective relaying, circuit interruption techniques, and overvoltage protection methods, enabling students to analyze, design, and ensure secure, stable, and reliable operation of modern electrical power systems.

UNIT I REAL POWER- FREQUENCY CONTROL 9

Introduction- Power scenario in Indian grid – National and Regional load dispatching centres – Requirements of good power system – Necessity of voltage and frequency regulation- Basics of speed governing mechanisms and modelling – Speed regulation of two generators in parallel Load Frequency Control (LFC) of single area system – Static and dynamic analysis

UNIT II REACTIVE POWER- VOLTAGE CONTROL 9

Generation and absorption of reactive power – Basics of reactive power control – Automatic Voltage Regulator (AVR) – Block diagram representation of AVR loop-static and dynamic analysis – Stability compensation – Voltage drop in transmission line – Methods of reactive power injection – Tap changing transformer, SVC and STATCOM for voltage control.

UNIT III PROTECTION SCHEMES AND RELAYS 9

Introduction-Significance and need for protective schemes Relays- Operating principles of relays –Universal torque equation - R-X diagram –Electromagnetic Relays – Over current and Distance relays.
Equipment Protection- Protection of transformer, generator, motor, bus bars and transmission line.

UNIT IV CIRCUIT BREAKERS 9

Physics of arcing phenomenon and arc interruption – DC and AC circuit breaking – re-striking voltage and recovery voltage - rate of rise of recovery voltage - current chopping - interruption of capacitive current - resistance switching - Types of circuit breakers – air blast, oil, SF6 and vacuum circuit breakers

UNIT-V OVER VOLTAGES AND PROTECTION AGAINST OVER VOLTAGE 9

Introduction-Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages - protection against over voltages-Insulation Coordination. Power system Grounding and Methods of Grounding.

Total 45

TEXTBOOKS:

1. Allen. J. Wood and Bruce F. Wollen berg, 'Power Generation, Operation and Control', John nWiley & Sons, Inc., 3rd edition, 2013.
2. B.Rabindranath and N.Chander, 'Power System Protection and Switchgear', New Age International (P) Ltd., Second Edition, 2018.
3. M.S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.

REFERENCE BOOKS:

1. Kothari D.P. and Nagrath I.J., 'Power System Engineering', Tata McGraw– Hill Education,Second Edition, Reprint 2018.
2. Kundur P., 'Power System Stability and Control, McGraw Hill Education Pvt. Ltd., New Delhi,12th reprint, 2015.
3. Abhijit Chakrabarti and Sunita Halder, 'Power System Analysis Operation and Control', PHIlearning Pvt. Ltd., New Delhi, Fourth Edition, 2018.
4. Badri Ram ,B.H. Vishwakarma, 'Power System Protection and Switchgear', New AgeInternational Pvt Ltd Publishers, Second Edition 2011.
5. Y.G.Paithankar and S.R.Bhide, 'Fundamentals of power system protection', Second Edition,Prentice Hall of India Pvt. Ltd., New Delhi, 2013.
6. L.Wadhwa, High voltage Engineering, New Age International Publishers, Fourth Edition, 2020.

Course Outcomes (Cos):

After successful completion of the course, students will be able to:

CO1 Model and analyse the control actions that are implemented to meet the minute-tominute variation of system real power demand.

CO2 Model and analyze the compensators for reactive power control and various devices used for voltage control.

CO3 Design a suitable protective scheme for specific faults in generator and transformers
CO4 Discuss various types of circuit breakers and Design circuit breakers for a given requirement
CO5 Discuss various overvoltages and its effects on power systems.

CS3451 INTRODUCTION TO OPERATING SYSTEMS

L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the basics and functions of operating systems.
- To understand processes and threads
- To analyze scheduling algorithms and process synchronization.
- To understand the concept of deadlocks.
- To analyze various memory management schemes.
- To be familiar with I/O management and file systems.
- To be familiar with the basics of virtual machines and Mobile OS like iOS and Android**.**

UNIT I INTRODUCTION 7

Computer System - Elements and organization; Operating System Overview - Objectives and Functions - Evolution of Operating System; Operating System Structures – Operating System Services - User Operating System Interface - System Calls – System Programs - Design and Implementation - Structuring methods.

UNIT II PROCESS MANAGEMENT 11

Processes - Process Concept - Process Scheduling - Operations on Processes - Inter-process Communication; CPU Scheduling - Scheduling criteria - Scheduling algorithms: Threads - Multithread Models – Threading issues; Process Synchronization - The Critical-Section problem - Synchronization hardware – Semaphores – Mutex - Classical problems of synchronization - Monitors; Deadlock - Methods for handling deadlocks, Deadlock prevention, Deadlock avoidance, Deadlock detection, Recovery from deadlock.

UNIT III MEMORY MANAGEMENT 10

Main Memory - Swapping - Contiguous Memory Allocation – Paging - Structure of the Page Table - Segmentation, Segmentation with paging; Virtual Memory - Demand Paging – Copy on Write - Page Replacement - Allocation of Frames –Thrashing.

UNIT IV STORAGE MANAGEMENT 10

Mass Storage system – Disk Structure - Disk Scheduling and Management; File-System Interface - File concept - Access methods - Directory Structure - Directory organization - File system mounting - File Sharing and Protection; File System Implementation - File System

Structure - Directory implementation - Allocation Methods - Free Space Management; I/O Systems – I/O Hardware, Application I/O interface, Kernel I/O subsystem.

UNIT V VIRTUAL MACHINES AND MOBILE OS 7

Virtual Machines – History, Benefits and Features, Building Blocks, Types of Virtual Machines and their Implementations, Virtualization and Operating-System Components; Mobile OS - iOS and Android.

TOTAL:45 PERIODS

COURSE OUTCOMES:

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

CO1 : Analyze various scheduling algorithms and process synchronization.
CO2 : Explain deadlock prevention and avoidance algorithms.
CO3 : Compare and contrast various memory management schemes.
CO4 : Explain the functionality of file systems, I/O systems, and Virtualization
CO5 : Compare iOS and Android Operating Systems.

TEXT BOOKS:

1. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, “Operating System Concepts”ll, 10th Edition, John Wiley and Sons Inc., 2018.
2. Andrew S Tanenbaum, "Modern Operating Systems", Pearson, 5th Edition, 2022 New Delhi.

REFERENCES:

1. Ramaz Elmasri, A. Gil Carrick, David Levine, “ Operating Systems – A Spiral Approach”, Tata McGraw Hill Edition, 2010.
2. William Stallings, "Operating Systems: Internals and Design Principles", 7th Edition, Prentice Hall, 2018.
3. Achyut S.Godbole, Atul Kahate, “Operating Systems”, McGraw Hill Education, 2016.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	1	2	2	-	-	-	-	3	2	3	1	1	2	2
2	2	2	3	1	1	-	-	-	2	1	1	2	2	1	2
3	1	3	2	2	1	-	-	-	2	2	1	1	1	2	2
4	1	3	3	3	-	-	-	-	1	2	1	2	1	3	2
5	3	1	2	1	1	-	-	-	3	2	3	2	2	2	1
AVg.	2	2	2	2	1	-	-	-	2	2	2	2	1	2	2

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

EE3591 POWER ELECTRONICS

LT P C

3

0 0 3

COURSE OBJECTIVES:

- To understand the various applications of power electronic devices for conversion, control and conditioning of the electrical power and to get an overview of different types of power semiconductor devices and their dynamic characteristics.

- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basic topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations of AC voltage controller.

UNIT I SWITCHING POWER SUPPLIES 9

MOSFET dynamic behavior - driver and snubber circuits - low power high switching frequency switching Power supplies, buck, boost, buck-boost converters – Isolated topologies – resonant converters - switching loss calculations and thermal design.

UNIT II INVERTERS 9

IGBT: Static and dynamic behavior - single phase half bridge and full bridge inverters - VSI :(1phase and three phase inverters square wave operation) - Voltage control of inverters single, multi pulse, sinusoidal, space vector modulation techniques– various harmonic elimination techniques-CSI

UNIT III UNCONTROLLED RECTIFIERS 9

Power Diode – half wave rectifier – mid-point secondary transformer based full wave rectifier – bridge rectifier – voltage doubler circuit – distortion factor – capacitor filter for low power rectifiers – LC filters – Concern for power quality – three phase diode bridge.

UNIT IV CONTROLLED RECTIFIERS 9

SCR-Two transistor analogy based turn- ON – turn ON losses – thermal protection – controlled converters (1 pulse, 2 pulse, 3 pulse, 6 pulse) - displacement factor – ripple and harmonic factor - power factor mitigation, performance parameters – effect of source inductance - inverter angle limit.

UNIT V AC PHASE CONTROLLERS 9

TRIAC triggering concept with positive and negative gate pulse triggering, TRIAC based phase controllers - various configurations for SCR based single and three phase controllers.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon the successful completion of the course, students will be able to:

CO1: Understand the operation of semiconductor devices and dynamic characteristics and to design &analyze the low power SMPS

CO2: Analyze the various uncontrolled rectifiers and design suitable filter circuits

CO3: Analyze the operation of the n-pulse converters and evaluate the performance parameters

CO4: Understand various PWM techniques and apply voltage control and harmonic elimination methods to inverter circuits.

CO5: Understand the operation of AC voltage controllers and its applications.

TEXT BOOKS:

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

2. Rashid M.H., Power Electronics Circuits, Devices and Applications, Prentice Hall India, 3rd Edition, New Delhi, 2004.

REFERENCES:

1. Cyril. W.Lander, Power Electronics, McGraw Hill International, Third Edition, 1993.
2. P.S.Bimbhra, Power Electronics, Khanna Publishers, Third Edition 2003
3. Philip T.Krein, Elements of Power Electronics, Oxford University Press, 2013.
4. P.C.Sen, Power Electronics, Tata McGraw-Hill, 30th reprint, 2008.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	3	-	-	2	1	-	-	3	3	3	3	3
CO2	3	3	3	3	-	-		1	-	-	-	-	3	3	3
CO3	3	3	3	3	-	-	2	1	-	-	2	-	3	3	3
CO4	3	3	3	3	-	-	1	1	-	-	2	3	3	3	3
CO5	3	3	3	3	-	-	1	1	-	-	2	3	3	3	3
Avg.	3	3	3	3	-	-	1.5	1	-	-	2.25	3	3	3	3

EP3611 COMPUTER AIDED ELECTRICAL SYSTEMS LABORATORY

L T P C

0

0 4 2

POWER SYSTEMS

1. Formation of bus admittance matrix by direct inspection method and singular transformation method

2. Analysis of Gauss-Seidal methods for solving the power flow equation

3. Analysis of Newton-Raphson methods for solving the power flow equation

4. Symmetrical and unsymmetrical fault analysis in Power System

5. Analysis of Transient Stability in Power System

CONTROL SYSTEMS

1. Stability analysis using Pole zero maps and Routh Hurwitz Criterion in simulation platform.

2. Root Locus based analysis in simulation platform.

3. Determination of transfer function of a physical system using frequency response and Bode's asymptotes.

4 .Design of Lag, lead compensators and evaluation of closed loop performance.

5. Design of PID controllers and evaluation of closed loop performance.

COURSE OUTCOME

Upon the successful completion of the course, students will be able to:

CO1 Analyze the performance of direct inspection and singular transformation methods for determining Y-bus matrix of the given system using simulation software / suitable Programming

CO2 Analyse the performance the given power system using Gauss-Seidel method using simulation software / suitable Programming

CO3 Analyse the performance the given power system using Newton-Raphson method using simulation software / suitable Programming

CO4 Calculate the fault current for various symmterical and unsymmetrical faults on the given power system using simulation software / suitable Programming

CO5 Analyze the transient stability of the power system by applying different fault clearing time to the circuit breaker using simulation software

CO6 To design and implement simple controllers in standard forms.

CO7 To design compensators based on time and frequency domain specifications.

SEMESTER VII

EP3701	**CLIMATE CHANGE AND SUSTAINABILITY**	**L T P C**
		2 0 0 2

COURSE OBJECTIVES:

- To provide technical competence in understanding the Earth's climate system and the science of radiative forcing.
- To analyse the drivers of climate change and its multi-sectoral impacts on water, agriculture, and urban infrastructure.
- To explore the specific role of electronics and communication systems in climate mitigation and adaptation strategies.
- To familiarise students with global sustainability goals (SDGs), climate governance, and the carbon economy.

UNIT I CLIMATE SCIENCE AND RADIATIVE FORCING 9

Components of the Earth's climate system; Greenhouse effect and Earth's energy balance. Major GHGs (CO_2, CH_4, N_2O) and their lifetimes. Radiative forcing and global warming potential (GWP).

UNIT II DRIVERS AND SECTORAL IMPACTS 9

Natural vs. anthropogenic climate forcings. Impacts on water resources: hydrological

cycle responses and flood/drought risks. Impacts on urban infrastructure: Urban Heat Island (UHI) effect and drainage stress.

UNIT III SUSTAINABILITY AND GLOBAL GOVERNANCE 9

The three pillars of sustainability; history and implementation of the 17 SDGs. International frameworks: UNFCCC, Paris Agreement, and Senai Framework (SFDRR). National (NAPCC) and State (SAPCC) policy architecture.

UNIT IV TECHNOLOGICAL SOLUTIONS IN ECE 9

Role of ECE in climate action: Energy-efficient VLSI design and green electronics. Remote Sensing and GIS for environmental monitoring. IoT and AI/ML applications in early warning systems and smart energy management.

UNIT V CARBON ECONOMY AND CIRCULARITY 9

Introduction to carbon markets: cap-and-trade and carbon foot-printing (Scope 1-3). Principles of the Circular Economy: material flow and "designing out waste".

TOTAL: 45 PERIODS

REFERENCES:

1. Dessler, A. E. (2021). *Introduction to Modern Climate Change* (3rd ed.). Cambridge University Press.
2. Jadhav, A., Raut, P., & Mondal, S. (2025). *Climate Change and Sustainable Development: Current Perspective and Technological Solutions*. CRC Press.
3. Abbott, J. (2025). *Climate Change: The Facts 2025*. Non-fiction.
4. Hawken, P. (2025). *Carbon: The Book of Life.* Penguin Random House.
5. Klein, E., & Thompson, D. (2025). *Abundance: Moving Beyond a Liberalism that Preserves to a Liberalism that Builds*. Penguin Random House.

COURSE OUTCOME

CO1 Understand and explain the Earth's climate system dynamics, radiative forcing science, and the greenhouse effect.

CO2 Identify and analyze the multi-sectoral impacts of climate change on water, agriculture, and urban infrastructure using research and sustainability principles.

CO3 Design conceptual ECE-based solutions for climate monitoring (e.g., IoT sensor networks) and energy-efficient systems for mitigation.

CO4 Evaluate global sustainability goals (SDGs), climate governance architecture, and the ethical/legal implications of environmental policies.

CO5 Demonstrate the ability to conduct investigations into emerging green technologies and communicate climate-resilient strategies effectively in reports and presentations.

CS3491 ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING L T P C
3 0 2 4

COURSE OBJECTIVES:

The main objectives of this course are to:

- Study about uninformed and Heuristic search techniques.
- Learn techniques for reasoning under uncertainty
- Introduce Machine Learning and supervised learning algorithms
- Study about ensembling and unsupervised learning algorithms
- Learn the basics of deep learning using neural networks

UNIT I PROBLEM SOLVING 9

Introduction to AI - AI Applications - Problem solving agents – search algorithms – uninformed search strategies – Heuristic search strategies – Local search and optimization problems – adversarial search – constraint satisfaction problems (CSP)

UNIT II PROBABILISTIC REASONING 9

Acting under uncertainty – Bayesian inference – naïve bayes models. Probabilistic reasoning – Bayesian networks – exact inference in BN – approximate inference in BN – causal networks.

UNIT III SUPERVISED LEARNING 9

Introduction to machine learning – Linear Regression Models: Least squares, single & multiple variables, Bayesian linear regression, gradient descent, Linear Classification Models: Discriminant function – Probabilistic discriminative model - Logistic regression, Probabilistic generative model – Naive Bayes, Maximum margin classifier – Support vector machine, Decision Tree, Random forests

UNIT IV ENSEMBLE TECHNIQUES AND UNSUPERVISED LEARNING 9

Combining multiple learners: Model combination schemes, Voting, Ensemble Learning - bagging, boosting, stacking, Unsupervised learning: K-means, Instance Based Learning: KNN, Gaussian mixture models and Expectation maximization

UNIT V NEURAL NETWORKS 9

Perceptron - Multilayer perceptron, activation functions, network training – gradient descent optimization – stochastic gradient descent, error backpropagation, from shallow networks to deep networks –Unit saturation (aka the vanishing gradient problem) – ReLU, hyperparameter tuning, batch normalization, regularization, dropout.

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Implementation of Uninformed search algorithms (BFS, DFS)
2. Implementation of Informed search algorithms (A*, memory-bounded A*)
3. Implement naïve Bayes models
4. Implement Bayesian Networks
5. Build Regression models
6. Build decision trees and random forests
7. Build SVM models
8. Implement ensembling techniques
9. Implement clustering algorithms
10. Implement EM for Bayesian networks
11. Build simple NN models

12. Build deep learning NN models

COURSE OUTCOMES:

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

CO1: Use appropriate search algorithms for problem solving
CO2: Apply reasoning under uncertainty
CO3: Build supervised learning models
CO4: Build ensembling and unsupervised models
CO5: Build deep learning neural network models

TOTAL:75 PERIODS

TEXT BOOKS:

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.
2. Ethem Alpaydin, “Introduction to Machine Learning”, MIT Press, Fourth Edition, 2020.

REFERENCES:

1. Dan W. Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Pearson Education,2007
2. Kevin Night, Elaine Rich, and Nair B., “Artificial Intelligence”, McGraw Hill, 2008
3. Patrick H. Winston, "Artificial Intelligence", Third Edition, Pearson Education, 2006
4. Deepak Khemani, “Artificial Intelligence”, Tata McGraw Hill Education, 2013 (http://nptel.ac.in/)
5. Christopher M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2006.
6. Tom Mitchell, “Machine Learning”, McGraw Hill, 3rd Edition,1997.
7. Charu C. Aggarwal, “Data Classification Algorithms and Applications”, CRC Press, 2014
8. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, “Foundations of Machine Learning”, MIT Press, 2012.
9. Ian Goodfellow, Yoshua Bengio, Aaron Courville, “Deep Learning”, MIT Press, 2016

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	3	3	-	-	-	-	1	3	3	3	1	2	2
2	1	1	1	3	1	-	-	-	1	2	1	3	2	3	2
3	2	1	2	1	1	-	-	-	2	1	1	3	1	1	1
4	3	1	3	1	-	-	-	-	2	1	2	1	2	2	2
5	3	1	1	2	2	-	-	-	3	1	2	3	2	1	2
AVg.	2	1	2	2	1	-	-	-	2	2	2	3	2	2	2

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

CS3691 EMBEDDED SYSTEMS AND IOT L T P C
3 0 2 4

COURSE OBJECTIVES:

- To learn the internal architecture and programming of an embedded processor.
- To introduce interfacing I/O devices to the processor.
- To introduce the evolution of the Internet of Things (IoT).
- To build a small low-cost embedded and IoT system using Arduino/Raspberry Pi/ open platform.
- To apply the concept of Internet of Things in real world scenario.

UNIT I 8-BIT EMBEDDED PROCESSOR 9

8-Bit Microcontroller – Architecture – Instruction Set and Programming – Programming Parallel Ports – Timers and Serial Port – Interrupt Handling.

UNIT II EMBEDDED C PROGRAMMING 9

Memory And I/O Devices Interfacing – Programming Embedded Systems in C – Need For RTOS – Multiple Tasks and Processes – Context Switching – Priority Based Scheduling Policies.

UNIT III IOT AND ARDUINO PROGRAMMING 9

Introduction to the Concept of IoT Devices – IoT Devices Versus
Computers – IoT Configurations – Basic Components – Introduction to Arduino – Types of Arduino – Arduino Toolchain – Arduino Programming Structure – Sketches – Pins – Input/Output From Pins Using Sketches – Introduction to Arduino Shields – Integration of Sensors and Actuators with Arduino.

UNIT IV IOT COMMUNICATION AND OPEN PLATFORMS 9

IoT Communication Models and APIs – IoT Communication Protocols – Bluetooth – WiFi – ZigBee – GPS – GSM modules – Open Platform (like Raspberry Pi) – Architecture – Programming – Interfacing – Accessing GPIO Pins – Sending and Receiving Signals Using GPIO Pins – Connecting to the Cloud.

UNIT V APPLICATIONS DEVELOPMENT 9

Complete Design of Embedded Systems – Development of IoT Applications – Home Automation – Smart Agriculture – Smart Cities – Smart Healthcare.

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Write 8051 Assembly Language experiments using simulator.
2. Test data transfer between registers and memory.
3. Perform ALU operations.
4. Write Basic and arithmetic Programs Using Embedded C.
5. Introduction to Arduino platform and programming
6. Explore different communication methods with IoT devices (Zigbee, GSM, Bluetooth)
7. Introduction to Raspberry PI platform and python programming
8. Interfacing sensors with Raspberry PI
9. Communicate between Arduino and Raspberry PI using any wireless medium
10. Setup a cloud platform to log the data

11. Log Data using Raspberry PI and upload to the cloud platform
12. Design an IOT based system

COURSE OUTCOMES:

CO1: Explain the architecture of embedded processors.
CO2: Write embedded C programs.
CO3: Design simple embedded applications.
CO4: Compare the communication models in IOT
CO5: Design IoT applications using Arduino/Raspberry Pi /open platform.

TOTAL :75 PERIODS

TEXTBOOKS

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, "The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2014
2. Robert Barton, Patrick Grossetete, David Hanes, Jerome Henry, Gonzalo Salgueiro, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", CISCO Press, 2017.

REFERENCES

1. Michael J. Pont, "Embedded C", Pearson Education, 2007.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer System Design", Elsevier, 2006.
3. Andrew N Sloss, D. Symes, C. Wright, "Arm System Developer's Guide", Morgan Kauffman/ Elsevier, 2006.
4. Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	-	-	-	-	1	2	3	3	2	1	3
2	2	1	3	2	2	-	-	-	1	2	2	3	3	1	3
3	3	1	3	3	1	-	-	-	1	2	1	1	1	3	3
4	3	2	3	2	1	-	-	-	1	2	2	3	2	2	1
5	2	3	3	2	2	-	-	-	1	3	3	2	3	1	3
AVg.	2.6	2	3	2.4	1.5	-	-	-	1	2.2	2.2	2.4	2.2	1.6	2.6

1 - low, 2 - medium, 3 - high, '-"- no correlation

EP3702 PROJECT MANAGEMENT L T P C
2 0 0 2

COURSE OBJECTIVES:

- To introduce the fundamental concepts, principles, and life cycle of project management in engineering.
- To develop skills in project planning, scheduling, cost estimation, and resource allocation for engineering projects.
- To familiarize students with project risk management, quality management, procurement, and stakeholder communication.
- To enable students to use project management tools and techniques for successful execution and monitoring of electrical and computer engineering projects.

UNIT I INTRODUCTION TO PROJECT MANAGEMENT 6

Introduction to projects and project management. Project characteristics and objectives. Project life cycle. Project management process groups. Role and responsibilities of the project manager. Organizational structures for project management.

UNIT II PROJECT PLANNING AND SCHEDULING 6

Project scope management. Work Breakdown Structure (WBS). Activity sequencing. Network diagrams. Critical Path Method (CPM). Program Evaluation and Review Technique (PERT). Gantt charts and milestone planning.

UNIT III COST, RESOURCE, AND RISK MANAGEMENT 6

Project cost estimation and budgeting. Resource planning and allocation. Resource leveling. Risk identification, assessment, and mitigation. Introduction to Earned Value Management (EVM).

UNIT IV QUALITY, PROCUREMENT, AND STAKEHOLDER MANAGEMENT 6

Project quality planning, quality assurance, and quality control. Procurement process and contract management. Stakeholder identification and communication planning. Team leadership, conflict management, and project ethics.

UNIT V PROJECT MONITORING AND DIGITAL TOOLS 6

Project monitoring and control. Change management. Project documentation and closure. Introduction to project management software (Microsoft Project/OpenProject). Agile project management concepts and Scrum overview. Applications in Electrical and Computer Engineering projects.

TOTAL: 30 PERIODS

REFERENCES:

1. Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Harold Kerzner, 13th Edition, John Wiley & Sons, 2022.
2. Project Management: The Managerial Process, Erik W. Larson and Clifford F. Gray, 9th Edition, McGraw-Hill Education, 2020.

3. A Guide to the Project Management Body of Knowledge (PMBOK Guide), Project Management Institute (PMI), 7th Edition, Project Management Institute, 2021.
4. Effective Project Management: Traditional, Agile, Extreme, Robert K. Wysocki, 8th Edition, John Wiley & Sons, 2022.
5. Project Management, K. Nagarajan, 8th Edition, New Age International Publishers, 2021.

COURSE OUTCOMES

CO1 Understand the concepts, life cycle, and organizational aspects of project management.

CO2 Develop project plans using Work Breakdown Structure (WBS), CPM, PERT, and Gantt charts.

CO3 Apply cost estimation, resource allocation, and risk management techniques in engineering projects.

CO4 Evaluate quality, procurement, stakeholder communication, and team management practices for project success.

CO5 Apply project monitoring, control techniques, Agile concepts, and project management software in Electrical and Computer Engineering projects.

EP3811	**PROJECT WORK / INTERNSHIP**	**L**	**T**	**P**	**C**
		0	**0**		
		20	**10**		

COURSE OBJECTIVES:

The student should be made to learn methodology to select a good project and able to work in a team leading to development of hardware/software product.prepare a good technical report. Gain Motivation to present the ideas behind the project with clarity.

A Project topic must be selected either from research literature or the students themselves may propose suitable topics in consultation with their guides. The aim of the project work is to deepen Comprehension of principles by applying them to a new problem which may be the design /fabrication of any power component / circuit / sensor / Activator / Controller, a research investigation, a computer or management project or a design problem. The progress of the project is evaluated based on a minimum of two reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated jointly by external and internal examiners constituted by the Head of the Department based on oral presentation and the project report.

TOTAL : 300 PERIODS

COURSE OUTCOMES:

CO1 Ability to identify, formulate, design, interprete,analyze and provide solutions to complex engineering and societal issues by applying knowledge gained on basics of science and Engineering.

CO2 Ability to choose, conduct and demonstrate a sound technical knowledge of their selected project topics in the field of electrical and computer engineering by exploring suitable engineering and IT tools.

CO3 Ability to understand, formulate and propose new learning algorithms to solve engineering and societal problems of moderate complexity through multidisciplinary projects understanding commitment towards sustainable development.

CO4 Ability to demonstrate, prepare reports, communicate and work in a team as a member/leader by adhering to ethical responsibilities.

CO5 Ability to acknowledge the value of continuing education for oneself and to stay up with technology advancements.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	-	-	-	-	-	-	3	3	3
CO2	-	-	-	-	3	3	-	-	-	-	-	-	3	-	-
CO3	-	-	-	-	-	-	3	-	3	-	-	-	-	-	3
CO4	-	-	-	-	-	-	-	3	3	3	3	-	-	-	3
CO5	-	-	-	-	-	-	-	-	-	-	-	3	3	3	3
Avg.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1-low, 2-medium, 3-high, '-"- no correlation

VERTICAL I-Power and Energy Engineering

EE3002 UNDERGROUND CABLE ENGINEERING

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

To impart knowledge on the following topics

- Understanding Power Cable Characteristics and Applications.
- Cable Manufacturing.
- Installation of underground power cables
- Underground cable System Fault Locating.
- Testing and maintenance of Underground cable system.
- Cable Performance and Field Assessment of Power Cables

UNIT I INTRODUCTION TO ELECTRICAL POWER CABLES (7+2 SKILL) 9

Development of Underground Cables - Electric Lighting- Distribution of Energy for Lighting- - Paper Insulated Cables - Underground Residential Distribution Systems- Underground Residential Distribution Systems- Medium Voltage Cable Development.

UNIT II CABLE ARCHITECHTURE, DIELECTRIC THEORY AND CABLE CHARACTERISTICS (7+2 SKILL) 9

Architecture of Underground Cabling System - Basic Dielectric Theory of Cable – Conductors -Armour and Protective Finishes - Cable Characteristics: Electrical- Fundamentals of Electrical Insulation Materials - Electrical Properties of Cable Insulating Materials - Cable Standards and Quality Assurance - Cable design parameters- Current Carrying Capacity - Short-circuit Ratings.

UNIT III SUPPLY DISTRIBUTION SYSTEMS AND CABLES(7+2 SKILL) 9

Supply Distribution Systems - Distribution Cable Types, Design and Applications - Paper Insulated Distribution Cables - PVC Insulated Cables - Polymeric Insulated Distribution Cables for 6-30 kV - Manufacture of Distribution Cables - Joints and Terminations for Distribution Cables - Testing of Distribution Cables.

.

UNIT IV TRANSMISSION SYSTEMS AND CABLES(7+2 SKILL) 9

Basic Cable Types for A.C. Transmission - Self-contained Fluid-filled Cables - Gas Pressure Cables - High Pressure Fluid-filled Pipe Cables - Polymeric Insulated Cables for Transmission Voltages - Techniques for Increasing Current Carrying Capacity - Transmission Cable Accessories and Jointing for Pressure-assisted and Polymeric Cables.

UNIT V CABLE INSTALLATION, TESTING, MAINTENANCE(7+2 SKILL) 9

Installation of Transmission Cables -Splicing, Terminating, and Accessories - Sheath Bonding and Grounding-Testing of Transmission Cable Systems - Underground System Fault Locating - Field Assessment of Power Cable Systems- Condition monitoring tests – PD measurements.

TOTAL : 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (GROUP SEMINAR/ MINI PROJECT/ ASSIGNMENT/ CONTENT PREPARATION/ QUIZ/ SURPRISE TEST /SOLVING GATE QUESTIONS /ETC. 10

1. Demonstration of cable architecture with cable samples of all types.
2. Understanding the cable manufacturing process through factory visit.
3. Familiarization of the cable laying procedure through field visits.
4. Familiarization of cable jointing / end termination techniques.
5. Understanding and familiarization of cable fault locating techniques through field visit to local distribution company or inhouse laboratory.
6. Understanding testing procedures and condition monitoring tests.

COURSE OUTCOMES:

CO1 Ability to understand the fundamental of underground cable system.

CO2 Ability to gain knowledge on the architecture of UG cable and physical and electrical characteristics of the UG cable.

CO3 Ability to understand different types of cable used in distribution system.

CO4 Ability to acquire knowledge on Underground cables used in transmission system

CO5 Ability to understand the cable installations procedures and practices.

CO6 Ability to understand the theory / methodology of cable fault detection and rectification, testing and maintenance.

TEXT BOOKS:

1. William Thue, ‘Electrical Power Cable Engineering’, CRC Press Taylor & Francis Group., 6000 Broken Sound Parkway NW, Suite 300Boca Raton, FL 33487-2742, 3rd Edition 2017.

2. G. F. Moore, ‘Electric Cables Handbook’ -Third edition, Blackwell Science Ltd, 9600 Garsington Road, Oxford OX4 2DQ, UK., January 2017.

REFERENCES:

1. Leonard L. Grigsby, 'Electrical Power Cable Engineering' - CRC Press, Marcel Dekker, 3rd Edition 2012.
2. Christian Flytkjaer Jensen, Online Location of Faults on AC Cables in Underground Transmission Systems (Springer Theses), 2014, March.
3. https://kafactor.com/content/technical-resources/kerite-underground-cable-engineering-handbook.pdf
4. Handbook on Cable Fault Localization (April 2020) https://rdso.indianrailways.gov.in/works/uploads/File/Handbook%20on%20Cable%20Fault%20Localization(2).pdf
5. K. H. Ali et al.: Industry Practice Guide for Underground Cable Fault-Finding in the LVDN: https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=9807279, June 2022.
6. R. W. Deltenre, J. J. Schwarz, and H. J. Wagnon, ''Underground cable fault location: A handbook to TD-153,'' BDM Corp., Albuquerque, NM, USA, Final Rep. EPRI EL-363, 1977. [Online]. Available: https://www.osti.gov/servlets/purl/7233049, doi: 10.2172/7233049, January 1997.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	2	1	-	3	2	-	3	-	3
CO2	3	2	-	-	-	-	2	1	-	3	2	-	3	-	3
CO3	3	2	-	-	-	-	2	1	-	3	2	-	3	-	3
CO4	3	2	-	-	-	-	2	1	-	3	2	-	3	-	3
CO5	3	2	3	-	-	-	2	1	-	3	2	-	3	3	3
CO6	3	3	-	3	-	-	2	1	-	3	2	-	3	3	3
Avg	3	2.1	3	3	-	-	2	1	-	3	2	-	3	3	3

EE3701 HIGH VOLTAGE ENGINEERING L T P C

3 0 0 3

COURSE OBJECTIVES:

- Various types of over voltages in power system and protection methods.
- Generation of over voltages in laboratories.
- Measurement of over voltages.
- Nature of Breakdown mechanism in solid, liquid and gaseous dielectrics.
- Testing of power apparatus and insulation coordination.

UNIT I OVER VOLTAGES IN ELECTRICAL POWER SYSTEMS 9

Causes of over voltages and its effects on power system – Lightning, switching surges and temporary over voltages – Reflection and Refraction of Travelling waves- protection against over voltages_ Insulation Coordination.

UNIT II DIELECTRIC BREAKDOWN 9

Properties of Dielectric materials - Gaseous breakdown in uniform and non-uniform fields – Corona discharges – Vacuum breakdown – Conduction and breakdown in pure and commercial liquids, Maintenance of oil Quality – Breakdown mechanisms in solid and composite dielectrics- Applications of insulating materials in electrical equipment.

UNIT III GENERATION AND MEASUREMENTS OF HIGH VOLTAGES AND HIGH CURRENTS 9

Generation of High DC, AC, impulse voltages and currents - Analysis of DC/AC and Impulse generator circuits - Tripping and control of impulse generators**,** Measurement of High voltages and High currents – High Resistance with series ammeter – Dividers - Resistance, Capacitance and Mixed dividers - Peak Voltmeter, Generating Voltmeters, Electrostatic Voltmeters – Sphere Gaps, High current shunts- Digital techniques in high voltage measurement.

UNIT IV HIGH VOLTAGE TESTING & INSULATION COORDINATION 9

High voltage testing of electrical power apparatus- International and Indian standards – Power frequency, impulse voltage and DC testing of Insulators, circuit breakers, bushing, isolators and transformers - Insulation Coordination.

UNIT V APPLICATION IN INDUSTRY 9

Introduction – electrostatic applications- electrostatic precipitation, separation, painting / coating, spraying, imaging, printing, Transport of materials – manufacturing of sand paper – Smoke particle detector – Electrostatic spinning, pumping, propulsion – Ozone generation – Biomedical applications.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon the successful completion of the course, students will be able to:

CO1: Explain various overvoltage's and its effects on power systems.

CO2: Understand the breakdown phenomena in different medium under uniform and non-uniform fields.

CO3: Explain the methodsof generating and measuring High DC, AC, Impulse voltage and currents.

CO4: Suggest and Conduct suitable HV testing of Electrical power apparatus as per Standards

CO5: Explain the Industrial Applications of Electrostatic Fields.

TEXT BOOKS

1. M.S.Naidu and V. Kamaraju, 'High Voltage Engineering', Tata McGraw Hill, Fifth Edition, 2013.
2. E. Kuffel and W.S. Zaengl, J.Kuffel, 'High voltage Engineering fundamentals' Newnes Second Edition, Elsevier , New Delhi, 2005.
3. C.L. Wadhwa, 'High voltage Engineering', New Age International Publishers, Fourth Edition, 2020.

REFERENCES

1. L.L.Alston, High Voltage Technology, Oxford University Press, First Indian Edition 2006.
2. C.L.Wadhwa, High voltage Engineering, New Age International Publishers, Fourth Edition, 2020
3. Mazen Abdel – Salam, Hussein Anis, Ahdab A-Morshedy, RoshdayRadwan, High Voltage Engineering – Theory &Practice,Second Edition, Taylor & Francis Gourp, 2019
4. Subir Ray." An Introduction to High Voltage Engineering "PHI Learning Private Limited, New Delhi, Second Edition-2011

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PSO 2	PS O3
CO1	2	2	-	-	-	-	-	-	-	-	-	-	3	2	-
CO2	3	2	-	1	-	-	-	-	-	-	-	-	3		-
CO3	2	2	3	1	-	-	-	-	-	-	2	3	3	2	-
CO4	1	2	3	1	-	-	-	1	1	-		3	3	2	-
CO5	2	2	1	-	-	2	-	-	-	-	2	-	3		2
Avg.	2	2	2.33	1	-	2	-	1	1	-	2	3	3	2	2

EE3001 UTILIZATION AND CONSERVATION OF ELECTRICAL ENERGY LT P C 3 0 0 3

COURSE OBJECTIVES:

- To know various electric drives and traction motors with applications
- To introduce the energy saving concept by different ways of illumination.
- To understand the different methods of electric heating and electric welding.
- To know the conversion of solar and wind energies into electrical energy for different applications.
- To study the domestic utilization of electrical energy.

UNIT I ELECTRIC DRIVES AND TRACTION (7+2 Skill) 9

Fundamentals of electric drive - choice of an electric motor - application of motors for particular services traction generator set, traction motors, power transformers - characteristic features of traction motor - systems of railway electrification - electric braking - train movement and energy consumption - traction motor control - track equipment and collection gear.

UNIT II ILLUMINATION (7+2 Skill) 9

Introduction - definition and meaning of terms used in illumination engineering - classification of light sources - incandescent lamps, sodium vapour lamps, mercury vapour lamps, fluorescent lamps – design of illumination systems - indoor lighting schemes - factory lighting halls - outdoor lighting schemes - flood lighting - street lighting - energy saving lamps, LED

UNIT III HEATING AND WELDING (7+2 Skill) 9

Introduction - advantages of electric heating – modes of heat transfer - methods of electric heating -resistance heating - arc furnaces - induction heating - dielectric heating - electric welding – types -resistance welding - arc welding - power supply for arc welding - radiation welding.

Unit IV ENERGY CONSERVATION AND ITS IMPORTANCE (7+2 Skill) 9

Energy conservation act 2001 and its Features-Review of Industrial Energy Conservation-Energy conservation in electrical Industries-Simulation study of energy conservation using power factor controller. (Three phase circuit simulation with and without capacitor)

UNIT V DOMESTIC UTILIZATION OF ELECTRICAL ENERGY (7+2 Skill) 9

House wiring - working principle of air conditioning system, Induction based appliances, Onlin and OFF line UPS, Batteries - Power quality aspects – nonlinear and domestic loads Earthing system for Domestic, Industrial and Substation.

TOTAL: 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Conter Preparation/Quiz/Surprise Test/Solving Problems) 1

1. Choosing electrical motors for drives and traction applications.
2. A general design procedure for lighting schemes.
3. Design of heating element and study of welding methods.
4. Practical case studies of energy conservation.
5. Power requirement for different domestic appliances.

COURSE OUTCOMES:

At the end of the course, students should have the:

CO1 Ability to choose suitable electric drives for different applications
CO2 Ability to design the illumination systems for energy saving
CO3 Ability to demonstrate the utilization of electrical energy for heating and weldin purposes
CO4 Ability to know the effective usage of solar and wind energies for electrical applicatior
CO5 Ability to do electric connection for any domestic appliance like refrigerator, batter charging circuit for a specific household application.
CO6 To illustrate the need for energy conservation and to simulate three phase powe control.

TEXT BOOKS:

1. N.V. Suryanarayana, “Utilisation of Electric Power”, Wiley Eastern Limited, New Ag International Limited, 1994 & Second Edition 2017 Feb.
2. J.B.Gupta, “Utilisation Electric power and Electric Traction”, S.K.Kataria and sons, 200(2012th Edition, 2013, January.
3. G.D.Rai,”Non-Conventional Energy sources”,Khanna publications Ltd.,New Delhi 1998
4. D.P.Kothari, K.C.Singal, Rakesh Ranjan, “Renewable Energy Sources and Emergin Technologies”, PHI Learing Private Limited, 3rd Edition 2022.
5. Industrial Energy Conservation, Volume I-II, S C Bhatia, Sarvesh Devraj, Energy conservation and Managment by Akshay A pujara1st edition, June 2018.

REFERENCES:

1. R.K.Rajput, Utilisation of Electric Power, Laxmi publications 2nd Edition 2016.
2. H.Partab, Art and Science of Utilisation of Electrical Energy”, Edition, Dhanpat Rai an Co.,

New Delhi-2004.
3. C.L.Wadhwa, “Generation, Distribution and Utilisation of Electrical Energy”, New Ag international Pvt.Ltd., 3rd Edition, 2015 January.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS 01	PS 02	PS 03
CO1	3	3	2	1	-	1	-	1.5	-	-	-	-	3	-	-
CO2	2	1	3	-	-	-	-	1.5	-	-	-	-	3	-	-
CO3	3	2	2	-	-	1	-	1.5	-	-	-	-	3	-	-
CO4	1	2	3	-	-	-	-	1.5	-	-	-	-	3	-	-
CO5	1	1	3	-	-	1	-	1.5	-	-	-	-	3	3	2
CO6	3	3	3	-	-	-	-	1.5	-	-	-	-	3	3	3
Avg	2.2	2	2.6	1	-	1	-	1.5	-	-	-	-	3	3	2.5

EE3009 SPECIAL ELECTRICAL MACHINES L T P C
2 0 2 3

COURSE OBJECTIVES:

- To understand the working of special machines like stepper motor, switched reluctance motor, BLDC motor & PMSM
- To derive torque equation and study the characteristics of special machines
- To design the controller for special machines
- To study the working principle of synchronous reluctance motor
- To simulate closed loop operation of BLDC motor

UNIT I STEPPER MOTORS 6

Constructional features –Principle of operation –Types – Torque predictions – Linear and Non-linear analysis – Characteristics – Drive circuits – Closed loop control –Applications

UNIT II SWITCHED RELUCTANCE MOTORS 6

Constructional features –Principle of operation- Torque prediction–Characteristics-Power controllers – Control of SRM drive- Speed control-current control-design procedures-Sensor less operation of SRM – Current sensing-rotor position measurement and estimation methods- sensor less rotor position estimation-inductance based estimation –applications.

UNIT III PERMANENT MAGNET BRUSHLESS DC MOTORS 6

Fundamentals of Permanent Magnets- Types- Principle of operation- Magnetic circuit analysis EMF and Torque equations- Characteristics- Controller design-Transfer function – Machine, Load and Inverter-Current and Speed Controller.

UNIT IV PERMANENT MAGNET SYNCHROUNOUS MOTORS 6

Permanent Magnet ac Machines, Machine Configurations, PMSM - Principle of operation – EMF and Torque equations - Phasor diagram - Torque speed characteristics –evaluation of control characteristics- design of current and speed controllers- Constructional features, operating principle and characteristics of synchronous reluctance motor.

UNIT V STUDY OF OTHER SPECIAL ELECTRICAL MACHINES 6

Principle of operation and characteristics of Hysteresis motor – AC series motors – Linear motor – Applications.

30 PERIODS

LAB COMPONENT: 30 PERIODS

Using electromagnetic software

1) Simulation of BLDC motor
2) Simulation of SRM motor
3) Simulation of stepper motor
4) Simulation of PMSM motor
5) Simulation of any other special machines

TOTAL: 30+30 = 60 PERIODS

OURSE OUTCOMES:

CO1 Ability to model and analyze power electronic systems and equipment using computational software.

CO2 Ability to optimally design magnetics required in special machines based drive systems using FEM based software tools.

CO3 Ability to analyse the dynamic performance of special electrical machines

CO4 Ability to understand the operation and characteristics of other special electrical machines.

CO5 Ability to design and conduct experiments towards research.

REFERENCES:

1. Jacek F. Gieras, Dr. Rong-Jie Wang, Professor Maarten J. Kamper - Axial Flux Permanent Magnet Brushless Machines-Springer Netherlands 2008.
2. Bilgin, Berker Emadi, Ali Jiang, James Weisheng - Switched reluctance motor drives: fundamentals to applications-CRC 2019.
3. Ramu Krishnan - Permanent Magnet Synchronous and Brushless DC Motor Drives -CRC Press, Marcel Applications -CRC Press 2009
4. T.Kenjo, ‘ Stepping motors and their microprocessor controls’, Oxford University press, New Delhi, 2000 Dekker 2009
5. T.J.E. Miller, ‘Brushless magnet and Reluctance motor drives’, Clarendon press, London, 1989
6. R. Krishnan - Switched Reluctance Motor Drives Modeling, Simulation, Analysis, Design, and Applications -CRC Press 2017.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	-	-	-	-	-	-	1	-	1	-	1	3	2	1
CO2	3	3	3	3	-	-	2	1	-	2	-	3	3	3	3
CO3	3	-	-	-	-	-	-	1	-	1	-	1	3	3	3
CO4	3	3	3	3	-	-	-	1	-	3	-	3	3	3	3
CO5	3	3	3	3	-	-	3	1	-	3	-	3	3	3	3
CO6	3	3	3	3	3	-	-	1	-	3	-	3	3	3	3
Avg	3	3	3	3	3	-	2.5	1	-	2.2	-	2.3	3	2.8	2.6

EE3012 ELECTRICAL DRIVES L T P C
2 0 2 3

COURSE OBJECTIVES:

At the end of the course, students should have the:

- To understand steady state operation and transient dynamics of a motor load system.
- To study and analyze the operation of the converter / chopper fed dc drive, both qualitatively and quantitatively.
- To study and understand the operation and performance of AC Induction motor drives.
- To study and understand the operation and performance of AC Synchronous motor drives.
- To analyze and design the current and speed controllers for a closed loop solid state DC motor drives.

UNIT I DRIVE CHARACTERISTICS 6

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

UNIT II CONVERTER / CHOPPER FED DC MOTOR DRIVE 6

Steady state analysis of the single and three phase converter fed separately excited DC motor drive – continuous and discontinuous conduction – Time ratio and current limit control – 4 quadrant operation of converter / chopper fed drive.

UNIT III INDUCTION MOTOR DRIVES 6

Stator voltage control – energy efficient drive – v/f control – constant air gap flux – field weakening mode – voltage / current fed inverter – closed loop control,

UNIT IV SYNCHRONOUS MOTOR DRIVES 6

V/f control and self-control of synchronous motor: Margin angle control and power factor control – permanent magnet synchronous motor.

UNIT V DESIGN OF CONTROLLERS FOR DRIVES 6

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

30 PERIODS

LAB COMPONENT: **30 PERIODS**

1. Simulation of converter and chopper fed DC drive
2. Simulation of closed loop operation of stator voltage control of induction motor drive
3. Simulation of closed loop operation of v/f control of induction motor drive
4. Simulation of synchronous motor drive

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

After completion the above subject, students will be able to
CO1: Understand the basic requirements of motor selection for different load profiles.
CO2: Analyse the steady state behavior and stability aspects of drive systems.
CO3: Analyse the dynamic performance of the DC drive using converter and chopper control.
CO4: Simulate the AC drive.
CO5: Design the controller for electrical drives.

TEXTBOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, 2nd Edition January 2010.
2. Bimal K.Bose. Modern Power Electronics and AC Drives, Pearson Education, 2002 1st Edition.

REFERENCES:

1. S.K.Pillai, A First course on Electrical Drives, Wiley Eastern Limited, 3rd Edition 2012.
2. Murphy J.M.D and Turnbull, Thyristor Control of AC Motor, Pergamon Press, Oxford 1988, 1st Edition.
3. Gopal K.Dubey, Power semiconductor controlled Drives, Prentice Hall Inc., New Jersey,1989, 1st Edition.
4. R.Krishnan, Electric Motor & Drives: Modeling, Analysis and Control, Prentice hall of India, 2001, 1st Edition.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	-	-	1	-	-	-	2	3	3	2
CO2	3	2	2	3	3	-	-	1	-	-	-	2	3	3	2
CO3	3	2	2	3	3	-	-	1	-	-	-	2	3	3	3
CO4	3	2	2	3	3	-	-	1	-	-	-	2	3	3	3
CO5	3	2	2	3	3	-	-	1	-	-	-	2	3	3	3
CO6	3	2	2	3	3	-	-	1	-	-	-	2	3	3	3

Avg	3	2	2	3	3	-	-	1	-	-	-	2	3	3	2

EE3024 DIGITAL SIGNAL PROCESSING SYSTEM DESIGN L T P C
2 0 2 3

COURSE OBJECTIVES:

- To introduce the concept of analyzing discrete time signals & systems in the time and frequency domain through mathematical representation.
- To study the various time to frequency domain transformation techniques.
- To Understand the computation algorithmic steps for Fourier Transform.
- To study about filters and their design for digital implementation.
- To introduce the programmable digital signal processor & its application.

UNIT I INTRODUCTION 6

Classification of systems: Continuous, discrete, linear, causal, stable, dynamic, recursive, time variance; classification of signals: continuous and discrete, energy and power; mathematical representation of signals; spectral density; sampling techniques, quantization, quantization error, Nyquist rate, aliasing effect. Digital signal representation.

UNIT II DISCRETE TIME SYSTEM ANALYSIS 6

Z-transform and its properties, inverse z-transforms; difference equation – Solution by z-transform, application to discrete systems - Stability analysis, frequency response – Convolution – Introduction to Fourier Transform– Discrete time Fourier transform.

UNIT III DISCRETE FOURIER TRANSFORM & COMPUTATION 6

DFT properties, magnitude and phase representation - Computation of DFT using FFT algorithm – DIT & DIF - FFT using radix 2 – Butterfly structure.

UNIT IV DESIGN OF DIGITAL FILTERS 6

FIR & IIR filter realization – Parallel & cascade forms. FIR design: Windowing Techniques – Need and choice of windows – Linear phase characteristics. IIR design: Analog filter design - Butterworth and Chebyshev approximations; digital design using impulse invariant and bilinear transformation - Warping, prewarping -Frequency transformation.

UNIT V DIGITAL SIGNAL PROCESSORS 6

Introduction – Architecture of one DSP processor for motor control – Features – Addressing Formats– Functional modes - Introduction to Commercial Processors

30 PERIODS

LAB COMPONENTS: 30 PERIODS

1. Laboratory exercise : Use any DSP processor/MATLAB/open source platform to give hands on training on basic concepts of Digital Signal Processing
   a) To determine impulse and step response of two vectors
   b) To perform convolution between two vectors .
   c) To compute DFT and IDFT of a given sequence.
   d) To perform linear convolution of two sequence using DFT
   e) Design and Implementation of FIR Filter
   f) Design and Implementation of IIR Filter
   g) To determine z-transform from the given transfer function and its ROC

2. Assignment : Implementation of FIR/IIR filter with FPGA.
3. DSP processors based Mini project.

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will have the ability to

CO1: Explain the concepts of digital signal processing
CO2: Illustrate the system representation using transforms
CO3: Learn the transformation techniques for time to frequency conversion
CO4: Design suitable digital FIR, IIR algorithm for the given specification
CO5: Use digital signal processor for application development

TEXTBOOKS:

1. J.G. Proakis and D.G. Manolakis, 'Digital Signal Processing Principles, Algorithms and Applications', Pearson Education, New Delhi, 4th Edition 2007.
2. Robert J.Schilling & Sandra L.Harris ,' Introduction to Digital Signal Processing using MATLAB', Cengage Learning, 2nd Edition 2013.

REFERENCES:

1. Emmanuel C Ifeachor and Barrie W Jervis ,"Digital Signal Processing – A Practical approach" Pearson Education, Second edition, 2002.
2. Alan V. Oppenheim, Ronald W. Schafer and John R. Buck, 'Discrete – Time Signal Processing', Pearson Education, New Delhi, 2nd Edition 2012.
3. SenM.kuo, Woonseng…s.gan, "Digital Signal Processors, Architecture, Implementations & Applications, Pearson, 1st Edition 2004.
4. S.K. Mitra, 'Digital Signal Processing – A Computer Based Approach', Tata McGraw Hill, New Delhi, 4th Edition 2013.
5. B. Venkataramani, M. Bhaskar, 'Digital Signal Processors, Architecture, Programming and Applications', Tata McGraw Hill, New Delhi, 2003, 1st Edition.

List of Open Source Software/ Learning website:

1. https://nptel.ac.in/courses/117102060
2. https://www.tutorialspoint.com/digital_signal_processing/index.htm
3. https://www.elprocus.com/digital-signal-processor/
4. https://www.sciencedirect.com/topics/computer-science/digital-signal-processing-algorithm#:~:text=Digital%20signal%20processing%20algorithms%20are,known%20as%20operations%20or%20ops.
5. https://www.electronicshub.org/introduction-to-fpga/

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	3	2	2	1	-	-	-	-	-	-	-	1	2	1
CO2	2	3	3	2	2	-	-	-	-	-	-	-	2	3	1
CO3	3	3	3	3	3	-	-	-	-	-	-	-	2	2	2
CO4	3	3	3	3	3	-	-	-	-	-	-	-	2	2	3

CO5	3	3	3	2	1	-	-	-	1	-	-	-	2	2	3
Avg	2.4	3	2.8	2.4	2	-	-	-	1	-	-	-	1.8	2.2	2

EE3014 POWER ELECTRONICS FOR RENEWABLE ENERGY SYSTEMS **L T P C 2 0 2 3**

COURSE OBJECTIVES:

- To learn the various types of renewable sources of energy.
- To understand the electrical machines to be used for wind energy conversion systems.
- To learn the principles of power converters used in solar PV system.
- To study the principle of power converters used in Wind system.
- To simulate the AC-DC, AC-AC Converters, Matrix Converters and PWM Inverters.

UNIT I INTRODUCTION TO RENEWABLE ENERGY SYSTEMS 6

Classification of Energy Sources – Importance of Non-conventional energy sources – Advantages and disadvantages of conventional energy sources - Environmental aspects of energy - Impacts of renewable energy generation on the environment - Qualitative study of renewable energy resources: Ocean energy, Biomass energy, Hydrogen energy, - Solar Photovoltaic (PV), Fuel cells: Operating principles and characteristics, Wind Energy: Nature of wind, Types, control strategy, operating area.

UNIT II ELECTRICAL MACHINES FOR WIND ENERGY CONVERSION SYSTEMS (WECS) 6

Construction, Principle of operation and analysis: Squirrel Cage Induction Generator (SCIG), Doubly Fed Induction Generator (DFIG) - Permanent Magnet Synchronous Generator (PMSG).

UNIT III POWER CONVERTERS AND ANALYSIS OF SOLAR PV SYSTEMS 6

Power Converters: Line commutated converters (inversion-mode) - Boost and buck-boost converters- selection of inverter, battery sizing, array sizing. Simulation of line commutated converters, buck/boost converters. Analysis: Block diagram of the solar PV systems - Types of Solar PV systems: Stand-alone PV systems, Grid integrated solar PV Systems - Grid Connection Issues.

UNIT IV POWER CONVERTERS FOR WIND SYSTEMS 6

Power Converters: Three-phase AC voltage controllers- AC-DC-AC converters: uncontrolled rectifiers, PWM Inverters, Grid-Interactive Inverters - Matrix converter.

UNIT V HYBRID RENEWABLE ENERGY SYSTEMS 9

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

30 PERIODS

LAB COMPONENT: **30 PERIODS**

1. Simulation on modelling of Solar PV System- V I Characteristics
2. Simulation on Modelling of fuel cell- V I Characteristics
3. Simulation of self- excited Induction Generator.
4. Simulation of DFIG/ PMSG based Wind turbine.
5. Simulation on Grid integration of RES.

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

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

CO1: Examine the available renewable energy sources.

CO2: Demonstrate the working principles of electrical machines and power converters used for wind energy conversion system

CO3: Demonstrate the principles of power converters used for solar PV systems

CO4: Examine the available hybrid renewable energy systems.

CO5: Simulate AC-DC converters, buck/boost converters, AC-AC converters and PWM inverters.

REFERENCES:

1. S.N.Bhadra, D. Kastha, & S. Banerjee "Wind Electrical Systems", Oxford University Press, 2009, 7th impression.
2. Rashid .M. H "Power electronics Hand book", Academic press,2nd Edition, 2006 4th Edition, 2017
3. Rai. G.D, "Non-conventional energy sources", Khanna publishers, 6th Edition, 2017.
4. Rai. G.D," Solar energy utilization", Khanna publishers, 5th Edition, 2008.
5. Gray, L. Johnson, "Wind energy system", prentice hall of india, 2nd Edition, 2006.
6. H.Khan "Non-conventional Energy sources ",Tata McGraw-hill Publishing Company, New Delhi, 2017, 3rd Edition.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	-	-	2	-	2	3	3	3
CO2	3	-	2	-	-	-	-	-	-	2	-	2	3	3	3
CO3	3	-	2	-	-	-	-	-	-	2	-	2	3	3	3
CO4	3	-	3	-	-	-	-	-	-	2	-	2	3	3	3
CO5	3	3	2.25	3	3	-	-	3	-	2	-	3	3	3	3
Avg	3	3	2	3	3	-	-	3	-	2	-	2.2	3	3	3

VERTICAL II- DATA SCIENCE AND AI

AD3501 **DEEP LEARNING** **L T P C**

3 0 0 3

COURSE OBJECTIVES:

- To understand and need and principles of deep neural networks
- To understand CNN and RNN architectures of deep neural networks
- To comprehend advanced deep learning models
- To learn the evaluation metrics for deep learning models

UNIT I DEEP NETWORKS BASICS 9

Linear Algebra: Scalars -- Vectors -- Matrices and tensors; Probability Distributions -- Gradient-based Optimization – Machine Learning Basics: Capacity -- Overfitting and underfitting --Hyperparameters and validation sets -- Estimators -- Bias and variance -- Stochastic gradient descent -- Challenges motivating deep learning; Deep Networks: Deep feedforward networks; Regularization -- Optimization.

UNIT II CONVOLUTIONAL NEURAL NETWORKS 9

Convolution Operation -- Sparse Interactions -- Parameter Sharing -- Equivariance -- Pooling -- Convolution Variants: Strided -- Tiled -- Transposed and dilated convolutions; CNN Learning: Nonlinearity Functions -- Loss Functions -- Regularization -- Optimizers --Gradient Computation.

UNIT III RECURRENT NEURAL NETWORKS 10

Unfolding Graphs -- RNN Design Patterns: Acceptor -- Encoder --Transducer; Gradient Computation -- Sequence Modeling Conditioned on Contexts -- Bidirectional RNN -- Sequence to Sequence RNN – Deep Recurrent Networks -- Recursive Neural Networks -- Long Term Dependencies; Leaky Units: Skip connections and dropouts; Gated Architecture: LSTM.

UNIT IV MODEL EVALUATION 8

Performance metrics -- Baseline Models -- Hyperparameters: Manual Hyperparameter -- Automatic Hyperparameter -- Grid search -- Random search -- Debugging strategies.

UNIT V AUTOENCODERS AND GENERATIVE MODELS 9

Autoencoders: Undercomplete autoencoders -- Regularized autoencoders -- Stochastic encoders and decoders -- Learning with autoencoders; Deep Generative Models: Variational autoencoders – Generative adversarial networks.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After the completion of this course, students will be able to:

CO1: Explain the basics in deep neural networks

CO2: Apply Convolution Neural Network for image processing

CO3: Apply Recurrent Neural Network and its variants for text analysis

CO4: Apply model evaluation for various applications

CO5: Apply autoencoders and generative models for suitable applications

TEXT BOOK

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, ``Deep Learning'', MIT Press, 2016.
2. Andrew Glassner, “Deep Learning: A Visual Approach”, No Starch Press, 2021.

REFERENCES

1. Salman Khan, Hossein Rahmani, Syed Afaq Ali Shah, Mohammed Bennamoun, ``A Guide to Convolutional Neural Networks for Computer Vision'', Synthesis Lectures on Computer Vision, Morgan & Claypool publishers, 2018.

2. Yoav Goldberg, ``Neural Network Methods for Natural Language Processing'', Synthesis Lectures on Human Language Technologies, Morgan & Claypool publishers, 2017.
3. Francois Chollet, ``Deep Learning with Python'', Manning Publications Co, 2018.
4. Charu C. Aggarwal, ``Neural Networks and Deep Learning: A Textbook'', Springer International Publishing, 2018.
5. Josh Patterson, Adam Gibson, ``Deep Learning: A Practitioner's Approach'', O'Reilly Media, 2017.

CO's- PO's & PSO's MAPPING

	PO's												PSO's		
CO's	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
1	3	2	2	3	1	-	-	-	2	3	1	2	3	3	3
2	2	2	2	3	3	-	-	-	1	2	2	3	1	1	3
3	3	3	3	3	3	-	-	-	2	1	1	2	2	1	3
4	3	3	1	1	1	-	-	-	1	3	1	3	2	1	1
5	3	2	2	2	3	-	-	-	2	3	2	2	2	3	3
AVG	2.8	2.4	2	2.4	2.2	-	-	-	1.6	2.4	1.4	2.4	2	1.8	2.6

1 - low, 2 - medium, 3 - high, '-' - no correlation

AL3501 NATURAL LANGUAGE PROCESSING L T P C
3 0 2 4

COURSE OBJECTIVES:

- To learn the fundamentals of natural language processing.
- To learn the word level analysis methods .
- To explore the syntactic analysis concepts.
- To understand the semantics and pragmatics.
- To learn to analyze discourses and Lexical Resources.

UNIT I INTRODUCTION 9

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

UNIT II WORD LEVEL ANALYSIS 9

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

UNIT III SYNTACTIC ANALYSIS 9

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, DynamicProgramming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK,Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

UNIT IV SEMANTICS AND PRAGMATICS 9

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

UNIT V DISCOURSE ANALYSIS AND LEXICAL RESOURCES 9

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

45 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Word Analysis
2. Word Generation
3. Morphology
4. N-Grams
5. N-Grams Smoothing
6. POS Tagging: Hidden Markov Model
7. POS Tagging: Viterbi Decoding
8. Building POS Tagger
9. Chunking
10. Building Chunker

COURSE OUTCOMES:

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

CO1: tag a given text with basic Language features

CO2 implement a rule based system to tackle morphology/syntax of a language

CO3: design a tag set to be used for statistical processing for real-timeapplications.

CO4: compare and contrast the use of different statistical approaches for different types of NLP applications.

CO5: use tools to process natural language and design innovative NLP applications.

TOTAL:75 PERIODS

TEXT BOOKS:

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, O‘Reilly Media, 2009.

REFERENCES:

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.
2. Richard M Reese, —Natural Language Processing with Javall, O‘Reilly Media, 2015.
3. Nitin Indurkhya and Fred J. Damerau, —Handbook of Natural Language Processing, Second Edition, Chapman and Hall/CRC Press, 2010.

4. Tanveer Siddiqui, U.S. Tiwary, “Natural Language Processing and Information Retrieval”, Oxford University Press, 2008.

CO’s- PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
1	2	3	3	2	3	3	-	1	-	-	-	1	3	3
2	2	3	3	2	3	3	-	1	-	-	-	1	3	3
3	2	3	3	2	3	3	-	1	-	-	-	1	3	3
4	2	3	3	2	3	3	-	1	-	-	-	1	3	3
5	2	3	3	2	3	3	-	1	-	-	-	1	3	3
AVg.	2	3	3	2	3	3	-	1	-	-	-	1	3	3

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

CS3001 GENERATIVE AI L T P C

3 0 0 3

UNIT I INTRODUCTION TO GEN AI 9

Historical Overview of Generative Modeling – Difference between Gen AI and Discriminative Modeling – Importance of Generative Models in AI and Machine Learning – Types of Generative Models – GANs, VAEs, Autoregressive Models and Vector Quantized Diffusion Models – Understanding of Probabilistic Modeling and Generative Process – Challenges of Generative Modeling – Future of Gen AI – Ethical Aspects of AI – Responsible AI – Use Cases.

UNIT II GENERATIVE MODELS FOR TEXT 12

Language Models Basics – Building Blocks of Language Models – Transformer Architecture – Encoder and Decoder – Attention Mechanisms – Generation of Text – Models like BERT and GPT Models – Generation of Text – Autoencoding – Regression Models – Exploring ChatGPT – Prompt Engineering – Designing Prompts– Revising Prompts using Reinforcement Learning from Human Feedback (RLHF) – Retrieval Augmented Generation – Multimodal LLM – Issues of LLM like hallucination.

UNIT III GENERATION OF IMAGES 9

Introduction to Generative Adversarial Networks – Adversarial Training Process – Nash Equilibrium – Variational Autoencoders – Encoder– Decoder Architectures – Stable Diffusion Models – Introduction to Transformer based Image Generation – CLIP – Visual Transformers ViT– Dall– E2 and Dall– E3, GPT-4V – Issues of Image Generation Models like Mode Collapse and Stability.

UNIT IV GENERATION OF PAINTING, MUSIC, AND PLAY 6

Variants of GAN – Types of GAN – Cyclic GAN – Using Cyclic GAN to Generate Paintings – Neural Style Transfer – Style Transfer – Music Generating RNN – MuseGAN – Autonomous

agents – Deep Q Algorithm – Actor-Critic Network.

UNIT V OPEN SOURCE MODELS AND PROGRAMMING FRAMEWORKS 9

Training and Fine-tuning of Generative Models – GPT4All – Transfer Learning and Pre-trained Models – Training Vision Models – Google Copilot – Programming LLM – LangChain – Open Source Models – Llama – Programming for TimeSformer – Deployment – Hugging Face.

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO 1. Understand the concepts of Generative Modeling.
CO 2. Apply Gen AI to Generating Texts.
CO 3. Understand and Apply Gen AI for generating video.
CO 4. Apply Gen AI for Video, painting, and Music Generation.
CO 5. Apply Open Source Tools for solving problems using Gen AI.

TEXT BOOKS:

1. Denis Rothman, Transformers for Natural Language Processing and Computer Vision – Third Edition, Packt Books, 2024

REFERENCES:

1. Generative Deep Learning, David Foster, O'Reily Books, 2024.
2. Generative AI for Everyone – Altaf Rehmani – BlueRose One – 2024.

CO	Program Outcomes (POs) & Program Specific Outcomes (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**	**PS O1**	**PS O2**	**PS O3**
CO1	3	3	3	1	2	2	–	1	2	–	–	2	3	3	3
CO2	3	3	3	1	2	2	–	1	2	–	–	2	3	3	3
CO3	3	3	3	1	2	2	–	1	2	–	–	2	3	3	3
CO4	3	3	3	1	2	2	–	1	2	–	–	2	3	3	3
CO5	3	3	3	1	2	2	–	1	2	–	–	2	3	3	3
AVG	**3**	3	3	**1**	2	2	**–**	1	2	**–**	**–**	2	**3**	**3**	**3**

CS3002 RESPONSIBLE AI L T P C

3 0 0 3

UNIT – I INTRODUCTION TO RESPONSIBLE AI 9

Overview of AI – Common misconception of AI – Introduction to Responsible AI – Characteristics of Responsible AI – Key principles of responsible AI – Challenges in implementing responsible AI – ELSI Framework and AI – Safety and Alignment – Fairness and Privacy.

UNIT – II FAIRNESS AND BIAS 9

Human Bias – Types of biases – Effects of biases on different demographics – Bias vs Fairness – Sources of Biases – Exploratory data analysis – Bias Mitigation Techniques – Pre– processing techniques – In– processing techniques – Post– processing techniques – Bias detection tools – Overview of fairness in AI – Demographic parity – Equalized odds – Simpson's paradox and the risks of multiple testing – Group fairness and Individual fairness – Counterfactual fairness – Fairness metrics – – Bias and disparity mitigation with Fairlearn.

UNIT – III EXPLAINABILITY & INTERPRETABILITY 9

Importance of Explainability and Interpretability – Challenges – Interpretability through simplification and visualization – Intrinsic interpretable methods – Post Hoc interpretability – Interpretability Evaluation methods – Explainability through causality – Model agnostic Interpretation – LIME (Local Interpretable Model– agnostic Explanations) – SHAP (SHapley Additive exPlanations).

UNIT – IV SAFETY, SECURITY, AND PRIVACY 9

Overview of safety – security – privacy – resilience – Taxonomy of AI safety and Security – Adversarial attacks and mitigation – Model and data security – The ML life cycle – Adopting an ML life cycle MLOps and ModelOps – Model drift – Data drift – Concept drift – Privacy–preserving AI techniques– Differential privacy – Federated learning.

UNIT – V CASE STUDIES 9

COMPAS Algorithm – Google Photos Tagging Controversy – ProPublica's Analysis of Recidivism Predictions – Amazon's AI Recruiting Tool – Facial Recognition Technology Misidentification – AI in Healthcare: Predictive Analytics in Patient Care – Tesla Autopilot and Ethical Implications of Autonomous Vehicles.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. State the aspects of Responsible AI, such as fairness, bias, privacy etc.
1. Enforce fairness in models and mitigate bias in data.
2. Understand the importance of explainability and interpretability in AI systems.
3. Implement strategies to manage safety, security and privacy in AI systems.
4. Evaluate the societal impact of AI applications.

REFERENCES:

1. Virginia Dignum, "Responsible Artificial Intelligence: How to Develop and Use AI in a Responsible Way", 2019.
2. Adnan Masood, Heather Dawe, "Responsible AI in the Enterprise", 2023.
3. Beena Ammanath, "Trustworthy AI", O' Reilly, 2022.
4. Christoph Molnar "Interpretable Machine Learning", 1st edition, 2019.
5. Jochen Schiller, "Mobile Communications", Pearson Education, Second Edition, 2012.
6. Silja Voeneky, Philipp Kellmeyer et. al, "The Cambridge Handbook of Responsible Artificial Intelligence", Cambridge University Press, 2022.
7. I Almeida, "Responsible AI in the Age of Generative Models: Governance, Ethics and Risk Management", 2024.

COURSE OUTCOMES	Program Outcomes (POs) & Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3

CO1	2	2	2	2	2	–	–	–	–	–	2	2	3	3	3
CO2	3	3	3	3	3	–	–	–	2	–	2	2	3	2	3
CO3	3	3	3	2	3	–	–	–	2	–	2	2	3	2	3
CO4	3	3	3	2	3	–	–	–	2	–	2	2	3	2	3
CO5	2	2	2	2	3	–	–	–	2	–	2	2	2	2	2

1– low, 2– medium, 3– high, '– "– no correlation

CS3003	BIOINFORMATICS	L	T	P	C
		3	0	0	3

UNIT – I INTRODUCTION TO BIO– MOLECULAR STRUCTURES 9

Molecules and super– molecules structure, DNA and RNA structures, Proteins:Amino acids, Protein folding and interaction, protein structure determination , Polysaccharides, Lipids, Genomics: DNA Sequencing, Gene Identification, Extrinsic methods and Intrinsic Methods, Proteomics: Transcriptomics, Proteomic analysis, protein identification, Protein microarrays, Protein Expression pattern.

UNIT – II BIOLOGICAL DATA SEARCH AND RETRIEVAL 9

Biological Database: Introduction, Databases: sequence, molecular visualization, Genome mapping database, GENBANK:Flatflile, Pairwise alignment, sequence alignment, progressive alignment, database similarity searching, working with FASTA, working with BLAST, comparison of FASTA and BLAST.

UNIT – III PREDICTIVE METHODS 9

GENE PREDICTION: Gene introduction– gene sequencing– sequence assembly problem– gene pattern recognition, gene prediction using bioinformatics tools, Gene expression, DNA Microarrays, Sanger sequencing, RNA PREDICTION: methods of RNA structure prediction, ncRNA prediction, PROTEIN STRUCTURE PREDICTION: protein folding problem, protein structure prediction methods, predicting transmembrane proteins.

UNIT – IV DRUG DISCOVERY: TECHNOLOGIES and STRATEGIES 9

Drug discovery: introduction– areas influencing drug discovery, drug discovery parameters, drug discovery technologies, drug target identification strategy, drug target validation, predicting functional important structure regions, validation of targets, Drug Design: Biomarkers: classification, combinatorial biomarkers, biomarkers in drug development, drug identification, databases for compound identification and prediction, computer aided drug design.

UNIT – V DEEP LEARNING IN BIOINFORMATICS 9

Deep learning and bioinformatics– Convolutional Neural Networks for bioinformatics, Recurrent Neural Networks (RNN) for bioinformatics, Long Short Term Memory (LSTM) networks in bioinformatics, Python libraries for bioinformatics.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

1. Understanding the basics of molecular structure.
1. Understanding biological databases and searching biological data.
2. Understanding and predicting the structures of GENE, RNA and protein structures.
3. Studying about drugs– discovery, design, and testing.
4. Applying Deep Learning techniques and python libraries for the field of bioinformatics.

REFERENCES:

1. Jeremy Ramsden," Bioinformatics – An Introduction", Springer Publications, 2009
1. Harisha, "Fundamentals of Bioinformatics", IK International House, 2007.
2. SC Rastogi, Parag Rastogi, and Namita Mendiratta "Bioinformatics – Methods and Applications, Genomics, Proteomics and Drug Discovery", 5th edition, PHI, 2022.
3. Habib Izadkhah, "Deep Learning in Bioinformatics', 1st edition, Elsevier, 2022.
4. Sushmita Mitra, Sujay Datta, Theodore Perkins, George Michailidis ,"Introduction to Machine Learning and Bioinformatics", CRC Computer Science & Data Analysis, 2019.
5. Faheem Masoodi, Mohammad Quasim, Syed Bukhari, Sarvottam Dixit, Shadab Alam "Applications of Machine Learning and Deep Learning on Biological Data", CRC Press, 2023.

CO-PO Mapping

COURSE OUTCOMES	Program Outcomes (POs) & Program Specific Outcomes (PSOs)														
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	1	–	2	1	–	2	–	–	1	1	2	2
CO2	2	2	2	2	1	2	–	–	1	–	1	1	2	2	2
CO3	3	2	2	2	2	2	–	–	1	–	1	1	2	2	2
CO4	3	3	3	2	2	3	2	2	–	2	1	2	1	1	3
CO5	3	2	2	2	2	2	–	–	2	1	2	2	3	2	3
AVG	**2.6**	**2**	**2**	**1.8**	**1.4**	**2.2**	**0.6**	**0.4**	**1.2**	**0.6**	**0.8**	**1.4**	**1.8**	**1.8**	**2.4**

1– low, 2– medium, 3– high, '– "– no correlation

CCS334 BIG DATA ANALYTICS L T P C
2 0 2 3

COURSE OBJECTIVES:

- To understand big data.
- To learn and use NoSQL big data management.
- To learn mapreduce analytics using Hadoop and related tools.
- To work with map reduce applications
- To understand the usage of Hadoop related tools for Big Data Analytics

UNIT I UNDERSTANDING BIG DATA 5

Introduction to big data – convergence of key trends – unstructured data – industry examples of big data – web analytics – big data applications– big data technologies – introduction to Hadoop – open source technologies – cloud and big data – mobile business intelligence – Crowd sourcing analytics – inter and trans firewall analytics.

UNIT II NOSQL DATA MANAGEMENT 7

Introduction to NoSQL – aggregate data models – key-value and document data models – relationships – graph databases – schemaless databases – materialized views – distribution models – master-slave replication – consistency - Cassandra – Cassandra data model – Cassandra examples – Cassandra clients

UNIT III MAP REDUCE APPLICATIONS 6

MapReduce workflows – unit tests with MRUnit – test data and local tests – anatomy of MapReduce job run – classic Map-reduce – YARN – failures in classic Map-reduce and YARN – job scheduling – shuffle and sort – task execution – MapReduce types – input formats – output formats.

UNIT IV BASICS OF HADOOP 6

Data format – analyzing data with Hadoop – scaling out – Hadoop streaming – Hadoop pipes – design of Hadoop distributed file system (HDFS) – HDFS concepts – Java interface – data flow – Hadoop I/O – data integrity – compression – serialization – Avro – file-based data structures - Cassandra – Hadoop integration.

UNIT V HADOOP RELATED TOOLS 6

Hbase – data model and implementations – Hbase clients – Hbase examples – praxis.
Pig – Grunt – pig data model – Pig Latin – developing and testing Pig Latin scripts.
Hive – data types and file formats – HiveQL data definition – HiveQL data manipulation – HiveQL queries.

30 PERIODS

COURSE OUTCOMES:

After the completion of this course, students will be able to:

CO1:Describe big data and use cases from selected business domains.
CO2: Explain NoSQL big data management.
CO3: Install, configure, and run Hadoop and HDFS.
CO4: Perform map-reduce analytics using Hadoop.
CO5: Use Hadoop-related tools such as HBase, Cassandra, Pig, and Hive for big data analytics.

LIST OF EXPERIMENTS: 30 PERIODS

1. Downloading and installing Hadoop; Understanding different Hadoop modes. Startup scripts, Configuration files.
2. Hadoop Implementation of file management tasks, such as Adding files and directories, retrieving files and Deleting files
3. Implement of Matrix Multiplication with Hadoop Map Reduce
4. Run a basic Word Count Map Reduce program to understand Map Reduce Paradigm.
5. Installation of Hive along with practice examples.
7. Installation of HBase, Installing thrift along with Practice examples
8. Practice importing and exporting data from various databases.

Software Requirements:

Cassandra, Hadoop, Java, Pig, Hive and HBase.

TOTAL:60 PERIODS

TEXT BOOKS:

1. Michael Minelli, Michelle Chambers, and AmbigaDhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
2. Eric Sammer, "Hadoop Operations", O'Reilley, 2012.
3. Sadalage, Pramod J. “NoSQL distilled”, 2013

REFERENCES:

1. E. Capriolo, D. Wampler, and J. Rutherglen, "Programming Hive", O'Reilley, 2012.

2. Lars George, "HBase: The Definitive Guide", O'Reilley, 2011.
3. Eben Hewitt, "Cassandra: The Definitive Guide", O'Reilley, 2010.
4. Alan Gates, "Programming Pig", O'Reilley, 2011.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	3	-	-	-	2	2	3	1	1	3	3
2	3	3	2	3	2	-	-	-	2	2	3	3	2	3	2
3	3	3	3	2	3	-	-	-	2	2	1	2	2	3	3
4	2	3	3	3	3	-	-	-	2	2	3	2	3	3	2
5	3	3	3	3	3	-	-	-	3	1	3	2	3	2	3
AVg.	2.8	3	2.8	2.8	2.8	-	-	-	2.2	1.8	2.6	2	2.2	2.8	2.6

1 - low, 2 - medium, 3 - high, '-' - no correlation

CS3004 VIBE CODING L T P C

3 0 0 3

COURSE OBJECTIVE:

This course introduces the basics of AI-assisted coding and Vibe Coding. Participants will learn to use AI tools, build simple applications, and understand the roles and ethics involved. By the end, they will create their own AI-powered projects.

UNIT I INTRODUCTION TO VIBE CODING AND HUMAN–AI COLLABORATION 9

Introduction to Vibe Coding – Evolution of AI-assisted Software Development – Basic Prompting Techniques for Coding Tasks – Human–AI Collaboration – Roles and Responsibilities of AI Assistant, Prompt Engineer and Developer – AI-generated Code and Developer Feedback – Designing AI-Augmented Workflows – Applications of Vibe Coding in Embedded Systems, IoT and Electrical Engineering.

UNIT II AI CODING TOOLS, PLATFORMS AND DEVELOPMENT ENVIRONMENTS 9

Overview of AI-Assisted Coding Tools – Cursor – GitHub Copilot – Bolt – v0 – Replit AI – Features and Engineering Use Cases – Setting up AI Coding Platforms – AI-assisted Programming in Python, C/C++ and JavaScript – Building Simple Web and IoT Applications – Workflow Prototyping Using AI Tools.

UNIT III PROMPT ENGINEERING, CODE QUALITY AND RESPONSIBLE AI 9

Vibe Coder's Toolkit – Prompt Design – Context Engineering – Prompt Optimization Techniques – Human Oversight of AI-generated Code – Code Review and Debugging Using AI – Refactoring AI-generated Code – Documentation Strategies – Ethical and Responsible AI Usage – Security, Privacy, Reliability and Best Practices in AI-Augmented Development.

UNIT IV AI-AUGMENTED SOFTWARE DEVELOPMENT AND ENGINEERING APPLICATIONS **9**

Changing Role of Software Developers in the AI Era – AI Integration across the Software Development Life Cycle – Human–AI Collaboration in Design, Coding, Testing and Deployment – AI-assisted Embedded Programming – Smart Energy Monitoring – IoT Applications – Predictive Maintenance – Sensor Data Processing – Automation Applications – Engineering Documentation.

UNIT V AI PROJECT DEVELOPMENT, DEPLOYMENT AND FUTURE OF VIBE CODING **9**

Planning AI-assisted Projects – Workflow Mapping from Idea to Deployment – Integration of Front-end, Back-end and AI Services – Testing and Deployment of AI Applications – AI-powered Engineering Applications – Smart Task Manager – Resume Builder – Intelligent Note-taking – AI-powered Technical Assistant – Security and Accountability – Continuous Improvement – Future Trends in AI-assisted Software Engineering.

References:

1. Ted Winston, *Mastering Vibe Coding: Build, Debug, and Ship Software with AI Assistants like Cursor, Replit, and GPT*, Kindle Edition, April 25, 2025.
2. Ethan Voss, *Vibe Coding: Build & Sell Apps Without Coding Experience: How to Use AI to Create Profitable Apps Even If You've Never Written a Line of Code*, Kindle Edition, 26 March 2025.
3. Amit Iyer, *Beginner's Guide to Vibe Coding: Exploring Features, Use Cases and Understanding Vibe Coding*, Paperback, 19 March 2025.
4. Gene Kim, Steve Yegge, *Vibe Coding: Building Production-grade Software With GenAI, Chat, Agents, and Beyond*, Paperback, 21 October 2025.
5. Addy Osmani, *Beyond Vibe Coding*, O'Reilly Media, Inc., August 2025. ISBN: 9798341634756

COURSE OUTCOMES

Upon successful completion of the course, the student will be able to:

CO1: Explain the concepts of Vibe Coding and AI-assisted software development.

CO2: Apply AI coding assistants and prompt engineering techniques for software development.

CO3: Evaluate, debug and improve AI-generated code using software engineering principles.

CO4: Develop AI-assisted applications for Electrical and Computer Engineering using modern AI tools.

CO5: Deploy secure, reliable and ethical AI-assisted software solutions for real-world engineering problems.

VERTICAL III - COMPUTER TECHNOLOGIES

CS3591 COMPUTER NETWORKS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the division of network functionality into layers
- To familiarize the functions and protocols of each layer in the TCP/IP protocol suite
- To visualize end– to– end flow of information
- To understand the components required to build different types of networks
- To learn concepts related to the network addressing and routing

UNIT I INTRODUCTION/ APPLICATION LAYER 9

Building a network, Network edge and core – Layered Architecture, ISO/OSI Model, Internet Architecture (TCP/IP) –) Networking Devices: Hubs, Bridges, Switches, Routers, and Gateways – Performance Metrics – Application Layer protocols – HTTP – FTP – Email – DNS

UNIT II TRANSPORT LAYER 9

Introduction – Connectionless Transport: User Datagram Protocol – Principles of Reliable Data Transfer (GBN, SR) – Connection– Oriented Transport – TCP – Connection establishment and teardown – Triggering transmission – Flow Control – Congestion Control

UNIT III NETWORK LAYER 9

Inside a Router – Internet Protocols – IPV4, IPV6, IP Addressing and NAT – Subnetting – Variable Length Subnet Mask (VLSM) – Classless Inter– Domain Routing (CIDR)

UNIT IV ROUTING PROTOCOLS 9

Distance Vector Routing – Link State Routing – RIP – OSPF – BGP – ICMP – DHCP – Introduction to Quality of Services (QoS)

UNIT V LINK LAYER 9

Introduction – Link Layer Framing, Addressing – Error Detection/ Correction Techniques – Switched Local Area Networks (ARP, Ethernet, VLAN) – Wireless LAN (802.11)

Total: 45 Periods

TEXT BOOKS

1. James F. Kurose, Keith W. Ross, “Computer Networking: A Top– Down Approach”, Eighth Edition, Pearson Education, 2022.
2. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Sixth Edition, Morgan Kaufmann Publishers Inc., 2021.

REFERENCES

1. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2017.
2. Ying– Dar Lin, Ren– Hung Hwang, Fred Baker, " Computer Networks: An Open Source Approach", 1st Edition, McGraw Hill, 2011

CS3005 COMPILER DESIGN L T P C
3 0 0 3

COURSE OBJECTIVES:

- To learn the various parsing techniques and different levels of translation
- To learn and understand design issues for all the phases of a compiler
- To learn how to obtain specific object code from source language
- To learn how to optimize the code and schedule for optimal performance
- To learn to parallelize and optimize compilers

UNIT I FRONT END OF COMPILERS 10

The Structure of Compiler – Lexical Analysis: Role of Lexical Analyzer, Specification and Recognition of Tokens, Syntax Analysis: Top Down Parsing, Bottom up Parsing, LR Parsers: SLR, CLR, and LALR.

UNIT II INTERMEDIATE CODE GENERATION 9

Syntax Directed Definitions, Evaluation Orders for Syntax Directed Definitions, Syntax Directed Translation Schemes, Intermediate Languages: Syntax Tree, Three Address Code, Postfix Code, Declarations, Translation of Expressions, Type Checking, Back Patching.

UNIT III RUNTIME AND OBJECT CODE GENERATION 9

Storage Organization, Stack Allocation Space, Access to Non-local Data on the Stack, Heap Management - Issues in Code Generation - Design of Code Generator - Register Allocation and Assignment – Instruction Selection by Tree Rewriting – Optimal Code Generation for Expressions – Dynamic Programming Code Generation.

UNIT IV CODE OPTIMIZATION 9

Basic Blocks and Flow Graphs – Optimization of Basic Blocks – Principal Sources of Optimizations – Data Flow Analysis – Constant Propagation – Partial Redundancy Elimination – Peephole Optimizations.

UNIT V SCHEDULING AND OPTIMIZING FOR PARALLELISM 8

Code Scheduling Constraints – Basic Block Scheduling – Global Code Scheduling - Basic Concepts in Parallelization – Parallelizing Matrix Multiplication – Iteration Spaces – Affine Array Indexes.

Total : 45 PERIODS

COURSE OUTCOMES:

On Completion of the course, the students should be able to:

CO1: Design the various compiler phases from language specification and Identify the issues in different phases
CO2: Analyze the design issues and identify the intermediate code generation that need to be adopted
CO3: Analyze and design the code generators for the specified machine'
CO4: Apply the various code optimization techniques and prove the code produced from basic block is optimal
CO5: Analyze the optimization technique for parallelism

TEXT BOOK:

1. Alfred V. Aho, Monica S. Lam, Ravi Sethi, Jeffrey D. Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2009.

REFERENCES

1. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence based Approach, Morgan Kaufmann Publishers, 2002.
2. Steven S. Muchnick, Advanced Compiler Design and Implementation‖, Morgan Kaufmann Publishers - Elsevier Science, India, Indian Reprint 2003.
3. Keith D Cooper and Linda Torczon, Engineering a Compiler‖, Morgan Kaufmann Publishers Elsevier Science, 2004.
4. V. Raghavan, Principles of Compiler Design‖, Tata McGraw Hill Education Publishers, 2010.
5. Allen I. Holub, Compiler Design in C‖, Prentice-Hall Software Series, 1993.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	3	-	-	-	-	3	3	1	3	2	3	2
2	3	3	3	3	3	-	-	-	3	2	3	2	2	1	2
3	3	3	2	2	3	-	-	-	3	1	1	1	2	2	3
4	3	2	2	1	1	-	-	-	2	3	2	3	1	2	1
5	3	3	3	2	1	-	-	-	2	1	1	3	2	1	2
AVg.	3.00	2.80	2.60	2.20	2.00	-	-	-	2.60	2.00	1.60	2.40	1.80	1.80	2.00

1 - low, 2 - medium, 3 - high, '-"- no correlation

IT3501 FULL STACK WEB DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

- To understand the various components of full stack development
- To learn Node.js features and applications
- To develop applications with MongoDB
- To understand the role of Angular and Express in web applications
- To develop simple web applications with React

UNIT I BASICS OF FULL STACK 9

Understanding the Basic Web Development Framework - User - Browser – Webserver - Backend Services – MVC Architecture - Understanding the different stacks –The role of Express – Angular – Node – Mongo DB – React

UNIT II NODE JS 9

Basics of Node JS – Installation – Working with Node packages – Using Node package manager – Creating a simple Node.js application – Using Events – Listeners –Timers - Callbacks – Handling Data I/O – Implementing HTTP services in Node.js

UNIT III MONGO DB 9

Understanding NoSQL and MongoDB – Building MongoDB Environment – User accounts – Access control – Administering databases – Managing collections – Connecting to MongoDB from Node.js – simple applications

UNIT IV EXPRESS AND ANGULAR 9

Implementing Express in Node.js - Configuring routes - Using Request and Response objects - Angular - Typescript - Angular Components - Expressions - Data binding - Built-in directives

UNIT V REACT 9

MERN STACK – Basic React applications – React Components – React State – Express REST APIs - Modularization and Webpack - Routing with React Router – Server-side rendering

COURSE OUTCOMES:

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

CO1: Understand the various stacks available for web application development
CO2: Use Node.js for application development
CO3: Develop applications with MongoDB
CO4: Use the features of Angular and Express
CO5: Develop React applications

TOTAL:45 PERIODS

TEXT BOOKS

1. Brad Dayley, Brendan Dayley, Caleb Dayley, ‘Node.js, MongoDB and Angular Web Development’, Addison-Wesley, Second Edition, 2018
2. Vasan Subramanian, ‘Pro MERN Stack, Full Stack Web App Development with Mongo, Express, React, and Node’, Second Edition, Apress, 2019.

REFERENCES

1. Chris Northwood, ‘The Full Stack Developer: Your Essential Guide to the Everyday Skills Expected of a Modern Full Stack Web Developer’, Apress; 1st edition, 2018
2. Kirupa Chinnathambi, ‘Learning React: A Hands-On Guide to Building Web Applications Using React and Redux’, Addison-Wesley Professional, 2nd edition, 2018
3. https://www.tutorialspoint.com/the_full_stack_web_development/index.asp
4. https://www.coursera.org/specializations/full-stack-react
5. https://www.udemy.com/course/the-full-stack-web-development/

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	0	0	0	0	0	0	1	1	1	1	1	1	0
2	3	3	3	3	2	1	0	0	2	0	2	3	2	2	1
3	3	3	2	2	2	2	0	0	2	2	2	3	2	2	1
4	3	3	2	2	2	1	0	0	1	1	2	2	2	1	1
5	3	3	3	3	3	1	0	0	0	0	2	2	2	2	1
AVg.	3	3	2	2	2	1	0	0	1	1	2	2	2	2	1

1 - low, 2 - medium, 3 - high, '-"- no correlation

CB3491 CRYPTOGRAPHY AND CYBER SECURITY L T P C

3 0 0 3

COURSE OBJECTIVES:

- Learn to analyze the security of in-built cryptosystems.
- Know the fundamental mathematical concepts related to security.
- Develop cryptographic algorithms for information security.
- Comprehend the various types of data integrity and authentication schemes
- Understand cyber crimes and cyber security.

UNIT I INTRODUCTION TO SECURITY 9

Computer Security Concepts – The OSI Security Architecture – Security Attacks – Security Services and Mechanisms – A Model for Network Security – Classical encryption techniques: Substitution techniques, Transposition techniques, Steganography – Foundations of modern cryptography: Perfect security – Information Theory – Product Cryptosystem – Cryptanalysis.

UNIT II SYMMETRIC CIPHERS 9

Number theory – Algebraic Structures – Modular Arithmetic - Euclid's algorithm – Congruence and matrices – Group, Rings, Fields, Finite Fields

SYMMETRIC KEY CIPHERS: SDES – Block Ciphers – DES, Strength of DES – Differential and linear cryptanalysis – Block cipher design principles – Block cipher mode of operation – Evaluation criteria for AES – Pseudorandom Number Generators – RC4 – Key distribution.

UNIT III ASYMMETRIC CRYPTOGRAPHY 9

MATHEMATICS OF ASYMMETRIC KEY CRYPTOGRAPHY: Primes – Primality Testing – Factorization – Euler's totient function, Fermat's and Euler's Theorem – Chinese Remainder Theorem – Exponentiation and logarithm

ASYMMETRIC KEY CIPHERS: RSA cryptosystem – Key distribution – Key management – Diffie Hellman key exchange -– Elliptic curve arithmetic – Elliptic curve cryptography.

UNIT IV INTEGRITY AND AUTHENTICATION ALGORITHMS 9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function: HMAC, CMAC – SHA – Digital signature and authentication protocols – DSS – Schnorr Digital Signature Scheme – ElGamal cryptosystem – Entity Authentication:

Biometrics, Passwords, Challenge Response protocols – Authentication applications – Kerberos

MUTUAL TRUST: Key management and distribution – Symmetric key distribution using symmetric and asymmetric encryption – Distribution of public keys – X.509 Certificates.

UNIT V CYBER CRIMES AND CYBER SECURITY 9

Cyber Crime and Information Security – classifications of Cyber Crimes – Tools and Methods – Password Cracking, Keyloggers, Spywares, SQL Injection – Network Access Control – Cloud Security – Web Security – Wireless Security

TOTAL:45 PERIODS

COURSE OUTCOMES:

CO1: Understand the fundamentals of networks security, security architecture, threats and vulnerabilities

CO2: Apply the different cryptographic operations of symmetric cryptographic algorithms

CO3: Apply the different cryptographic operations of public key cryptography

CO4: Apply the various Authentication schemes to simulate different applications.

CO5: Understand various cyber crimes and cyber security.

TEXT BOOKS

1. William Stallings, "Cryptography and Network Security - Principles and Practice", Seventh Edition, Pearson Education, 2017.
2. Nina Godbole, Sunit Belapure, “Cyber Security: Understanding Cyber crimes, Computer Forensics and Legal Perspectives”, First Edition, Wiley India, 2011.

REFERENCES

1. Behrouz A. Ferouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, Tata Mc Graw Hill, 2015.
2. Charles Pfleeger, Shari Pfleeger, Jonathan Margulies, "Security in Computing", Fifth Edition, Prentice Hall, New Delhi, 2015.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	2	2	-	-	-	1	-	-	1	2	3	3
2	3	3	3	3	3	-	-	-	2	-	-	1	3	3	3
3	3	3	3	3	3	-	-	-	2	-	-	1	3	3	3
4	3	3	3	3	3	-	-	-	2	-	-	1	3	3	3
5	3	2	3	2	3	-	-	-	3	-	-	2	3	2	3
AVg.	3	2.6	2.6	2.6	2.8	-	-	-	2	-	-	1.2	2.8	2.8	3

1 - low, 2 - medium, 3 - high, ‘-“- no correlation

CCS344 **ETHICAL HACKING** **L T P C**
2 0 2 3

COURSE OBJECTIVES:

- To understand the basics of computer based vulnerabilities.
- To explore different foot printing, reconnaissance and scanning methods.
- To expose the enumeration and vulnerability analysis methods.
- To understand hacking options available in Web and wireless applications.
- To explore the options for network protection.
- To practice tools to perform ethical hacking to expose the vulnerabilities.

UNIT I INTRODUCTION 6

Ethical Hacking Overview - Role of Security and Penetration Testers .- Penetration-Testing Methodologies- Laws of the Land - Overview of TCP/IP- The Application Layer - The Transport Layer - The Internet Layer - IP Addressing .- Network and Computer Attacks - Malware - Protecting Against Malware Attacks.- Intruder Attacks - Addressing Physical Security

UNIT II FOOT PRINTING, RECONNAISSANCE AND SCANNING NETWORKS6

Footprinting Concepts - Footprinting through Search Engines, Web Services, Social Networking Sites, Website, Email - Competitive Intelligence - Footprinting through Social Engineering - Footprinting Tools - Network Scanning Concepts - Port-Scanning Tools - Scanning Techniques - Scanning Beyond IDS and Firewall

UNIT III ENUMERATION AND VULNERABILITY ANALYSIS 6

Enumeration Concepts - NetBIOS Enumeration – SNMP, LDAP, NTP, SMTP and DNS Enumeration - Vulnerability Assessment Concepts - Desktop and Server OS Vulnerabilities - Windows OS Vulnerabilities - Tools for Identifying Vulnerabilities in Windows- Linux OS Vulnerabilities- Vulnerabilities of Embedded Oss

UNIT IV SYSTEM HACKING 6

Hacking Web Servers - Web Application Components- Vulnerabilities - Tools for Web Attackers and Security Testers Hacking Wireless Networks - Components of a Wireless Network – Wardriving- Wireless Hacking - Tools of the Trade -

UNIT V NETWORK PROTECTION SYSTEMS 6

Access Control Lists. - Cisco Adaptive Security Appliance Firewall - Configuration and Risk Analysis Tools for Firewalls and Routers - Intrusion Detection and Prevention Systems - Network-Based and Host-Based IDSs and IPSs - Web Filtering - Security Incident Response Teams – Honeypots.

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Install Kali or Backtrack Linux / Metasploitable/ Windows XP
2. Practice the basics of reconnaissance.
3. Using FOCA / Search Diggity tools, extract metadata and expanding the target list.
4. Aggregates information from public databases using online free tools like Paterva's Maltego.
5. Information gathering using tools like Robtex.
6. Scan the target using tools like Nessus.
7. View and capture network traffic using Wireshark.
8. Automate dig for vulnerabilities and match exploits using Armitage

FOCA : http://www.informatica64.com/foca.aspx.
Nessus : http://www.tenable.com/products/nessus.
Wireshark : http://www.wireshark.org.
Armitage : http://www.fastandeasyhacking.com/.
Kali or Backtrack Linux, Metasploitable, Windows XP

COURSE OUTCOMES:

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

CO1: To express knowledge on basics of computer based vulnerabilities

CO2: To gain understanding on different foot printing, reconnaissance and scanning methods.

CO3 To demonstrate the enumeration and vulnerability analysis methods

CO4: To gain knowledge on hacking options available in Web and wireless applications.

CO5: To acquire knowledge on the options for network protection.

CO6: To use tools to perform ethical hacking to expose the vulnerabilities.

TOTAL:60 PERIODS

TEXTBOOKS

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

CO's- PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	3	2	1	-	-	-	1	2	2	1	1	2	3
2	1	2	1	2	1	-	-	-	2	2	1	1	1	2	2
3	2	2	3	3	1	-	-	-	1	2	1	2	2	3	1
4	2	1	1	2	1	-	-	-	1	3	3	3	3	2	1
5	2	3	1	1	2	-	-	-	2	1	1	1	1	1	3
AVg.	1.8	2	1.8	2	1.2	-	-	-	1.4	2	1.6	1.6	1.6	2	2

1 - low, 2 - medium, 3 - high, '-' - no correlation

CCS335 CLOUD COMPUTING L T P C

2 0 2 3

COURSE OBJECTIVES:

- To understand the principles of cloud architecture, models and infrastructure.
- To understand the concepts of virtualization and virtual machines.
- To gain knowledge about virtualization Infrastructure.
- To explore and experiment with various Cloud deployment environments.
- To learn about the security issues in the cloud environment.

UNIT I CLOUD ARCHITECTURE MODELS AND INFRASTRUCTURE 6

Cloud Architecture: System Models for Distributed and Cloud Computing – NIST Cloud Computing Reference Architecture – Cloud deployment models – Cloud service models; Cloud Infrastructure: Architectural Design of Compute and Storage Clouds – Design Challenges

UNIT II VIRTUALIZATION BASICS 6

Virtual Machine Basics – Taxonomy of Virtual Machines – Hypervisor – Key Concepts – Virtualization structure – Implementation levels of virtualization – Virtualization Types: Full Virtualization – Para Virtualization – Hardware Virtualization – Virtualization of CPU, Memory and I/O devices.

UNIT III VIRTUALIZATION INFRASTRUCTURE AND DOCKER 7

Desktop Virtualization – Network Virtualization – Storage Virtualization – System-level of Operating Virtualization – Application Virtualization – Virtual clusters and Resource Management – Containers vs. Virtual Machines – Introduction to Docker – Docker Components – Docker Container – Docker Images and Repositories.

UNIT IV CLOUD DEPLOYMENT ENVIRONMENT 6

Google App Engine – Amazon AWS – Microsoft Azure; Cloud Software Environments – Eucalyptus – OpenStack.

UNIT V CLOUD SECURITY 5

Virtualization System-Specific Attacks: Guest hopping – VM migration attack – hyperjacking. Data Security and Storage; Identity and Access Management (IAM) - IAM Challenges - IAM Architecture and Practice.

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Install Virtualbox/VMware/ Equivalent open source cloud Workstation with different flavours of Linux or Windows OS on top of windows 8 and above.
2. Install a C compiler in the virtual machine created using a virtual box and execute Simple Programs
3. Install Google App Engine. Create a hello world app and other simple web applications using python/java.
4. Use the GAE launcher to launch the web applications.
5. Simulate a cloud scenario using CloudSim and run a scheduling algorithm that is not present in CloudSim.
6. Find a procedure to transfer the files from one virtual machine to another virtual machine.
7. Install Hadoop single node cluster and run simple applications like wordcount.

8. Creating and Executing Your First Container Using Docker.
9. Run a Container from Docker Hub

COURSE OUTCOMES:

CO1: Understand the design challenges in the cloud.
CO2: Apply the concept of virtualization and its types.
CO3: Experiment with virtualization of hardware resources and Docker.
CO4: Develop and deploy services on the cloud and set up a cloud environment.
CO5: Explain security challenges in the cloud environment.

TOTAL :60 PERIODS

TEXT BOOKS

1. Kai Hwang, Geoffrey C Fox, Jack G Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
2. James Turnbull, "The Docker Book", O'Reilly Publishers, 2014.
3. Krutz, R. L., Vines, R. D, "Cloud security. A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing, 2010.

REFERENCES

1. James E. Smith, Ravi Nair, "Virtual Machines: Versatile Platforms for Systems and Processes", Elsevier/Morgan Kaufmann, 2005.
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, "Cloud Security and Privacy: an enterprise perspective on risks and compliance", O'Reilly Media, Inc., 2009.

CO's-PO's & PSO's MAPPING

CO's	PO's												PSO's		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	1	-	-	-	2	3	1	3	2	1	3
2	3	1	2	2	1	-	-	-	1	2	1	3	2	2	1
3	2	3	2	3	1	-	-	-	3	1	1	3	1	1	1
4	1	2	3	3	3	-	-	-	3	3	1	2	1	3	3
5	2	3	3	1	3	-	-	-	2	2	1	2	2	2	3
AVg.	2.2	2.2	2.2	2	1.8	-	-	-	2.2	2.2	1	2.6	1.6	1.8	2.2

1 - low, 2 - medium, 3 - high, '-' - no correlation

IT3001 BLOCK CHAIN TECHNOLOGIES L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the foundational principles of blockchain technology.
- To explore the architecture and consensus mechanisms of distributed ledgers.
- To design and develop smart contracts and decentralized applications.
- To evaluate real-world use cases and security issues in blockchain networks.

UNIT I BLOCKCHAIN AND DISTRIBUTED LEDGER TECHNOLOGIES

Centralized vs. Decentralized systems- Blockchain fundamentals: blocks, chains, hash

functions, Merkle trees- Types of blockchain: Public, Private, Consortium-Consensus mechanisms: PoW, PoS, PBFT-Key challenges: scalability, privacy, interoperability.

UNIT II CRYPTOGRAPHIC FOUNDATIONS AND CONSENSUS

Cryptographic hash functions- Digital signatures and public-key cryptography-Mining and proof-of-work in Bitcoin- Byzantine fault tolerance and proof-of-stake mechanisms-Tokenomics and incentive structures.

UNIT III SMART CONTRACTS AND ETHEREUM PLATFORM

Ethereum architecture and EVM- Solidity programming language-Smart contract design and development-Gas optimization and security best practices-Deployment and interaction with contracts.

UNIT IV BLOCKCHAIN PLATFORMS AND APPLICATIONS

Hyperledger Fabric and enterprise blockchains-Corda and permissioned networks-Decentralized Finance (DeFi) and NFTs-Blockchain in supply chain, healthcare, identity, and voting-Interoperability solutions (Polkadot, Cosmos).

UNIT V CHALLENGES, TRENDS, AND RESEARCH DIRECTIONS:

Security and privacy in blockchain systems-Legal, regulatory, and ethical considerations-Scalability solutions: Layer-1 vs Layer-2-Blockchain and IoT Integration-Future trends: zk-SNARKs, DAGs, CBDCs.

References:

1. Arvind Narayanan et al., Bitcoin and Cryptocurrency Technologies, Princeton University Press, 2016.
2. Imran Bashir, Mastering Blockchain, Packt Publishing, 3rd Edition, 2020.
3. Andreas M. Antonopoulos, Mastering Bitcoin, O'Reilly Media
4. Melanie Swan, Blockchain: Blueprint for a New Economy, O’Reilly Media

COURSE OUTCOMES

CO1 Describe the fundamental concepts, architectures, and principles of blockchain technologies and their applications in decentralized systems.

CO2 Analyze blockchain protocols, consensus mechanisms, and distributed ledger models to understand security, scalability, and performance.

CO3 Evaluate blockchain platforms, smart contract frameworks, and deployment strategies to assess their effectiveness for real-world applications.

CO4 Design blockchain-based solutions by selecting appropriate architectures, consensus protocols, and smart contract models for practical use cases.

EE3025	**ELECTRIC VEHICLE ARCHITECTURE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

COURSE OBJECTIVES:

- To learn the structure of Electric Vehicle, Hybrid Electric Vehicle
- To study about the EV conversion components
- To know about the details and specifications for Electric Vehicles
- To understand the concepts of Plug-in Hybrid Electric Vehicle
- To model and simulate all types of DC motors

UNIT I VEHICLE ARCHITECTURE and SIZING (7+2 Skill) 9

Electric Vehicle History, and Evolution of Electric Vehicles. Series, Parallel and Series parallel Architecture, Micro and Mild architectures. Mountain Bike - Motorcycle- Electric Cars and Heavy Duty EVs. -Details and Specifications.

UNIT II VEHICLE MECHANICS (7+2 Skill) 9

Vehicle mechanics- Roadway fundamentals, Laws of motion, Vehicle Kinetics, Dynamics of vehicle motion, propulsion power, velocity and acceleration, Tire –Road mechanics, Propulsion System Design.

UNIT III POWER COMPONENTS AND BRAKES (7+2 Skill) 9

Power train Component sizing- Gears, Clutches, Differential, Transmission and Vehicle Brakes. EV power train sizing, HEV Powertrain sizing, Example.

UNIT IV HYBRID VEHICLE CONTROL STRATEGY (7+2 Skill) 9

Vehicle supervisory controll, Mode selection strategy, Modal Control strategies.

UNIT V PLUG-IN HYBRID ELECTRIC VEHICLE (7+2 Skill) 9

Introduction-History-Comparison with electrical and hybrid electrical vehicle-Construction and working of PHEV-Block diagram and components-Charging mechanisms-Advantages of PHEVs.

TOTAL : 45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / etc) Basics of MATLAB simulation 10

1. Variables and Expressions Formats, Vectors and Matrices,
2. Arrays, Vectors,
3. Matrices, Built-in functions, Trigonometric functions,
4. Data types and Plotting.
5. Simulation of drive cycles.

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

CO1: Summarize the History and Evolution of EVs, Hybrid and Plug-In Hybrid EVs
CO2: Describe the various EV components
CO3: Describe the concepts related in the Plug-In Hybrid Electric Vehicles
CO4: Analyse the details and Specifications for the various EVs developed.
CO5: Describe the hybrid vehicle control strategy.

REFERENCES:

1. Mehrdad Ehsani, YiminGao, Sebastian E. Gay, Ali Emadi, 'Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design', CRC Press, 2004.
2. Build Your Own Electric Vehicle,Seth Leitman , Bob Brant, McGraw Hill, Third Edition 2013.
3. Advanced Electric Drive Vehicles, Ali Emadi, CRC Press, First edition 2017.
4. The Electric Vehicle Conversion Handbook: How to Convert Cars, Trucks, Motorcycles, and Bicycles -- Includes EV Components, Kits, and Project Vehicles Mark Warner, HP Books, 2011.

5. Heavy-duty Electric Vehicles from Concept to Reality, Shashank Arora, Alireza Tashakori Abkenar, Shantha Gamini Jayasinghe, Kari Tammi, Elsevier Science, 2021
6. Electric Vehicles Modern Technologies and Trends, Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, Jens Bo Holm-Nielsen Springer, 2020
7. Hybrid Electric Vehicles: A Review of Existing Configurations and Thermodynamic Cycles, Rogelio León , Christian Montaleza , José Luis Maldonado , Marcos Tostado-Véliz and Francisco Jurado, Thermo, 2021, 1, 134–150. https://doi.org/10.3390/thermo1020010.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	-	2	-	-	-	-	1	-	-	-	2	3	-	-
CO2	3	-	2	-	-	-	-	1	-	-	-	2	3	3	3
CO3	3	-	2	-	-	-	-	1	-	-	-	2	3	-	-
CO4	3	-	2	-	-	-	-	1	-	-	-	2	3	-	-
CO5	3	-	3	3	3	-	-	1	-	-	-	2	3	3	3
Avg	3	-	2.2	3	3	-	-	1	-	-	-	2	3	3	3

EE3026 DESIGN OF MOTOR AND POWER CONVERTERS FOR ELECTRIC VEHICLES

L T P C
2 0 2 3

COURSE OBJECTIVES:

- To review the drive cycles and requirements of EVs
- To know the working of motors used in Electric Vehicle
- To analyze and model the buck/boost converter operation and to design the same
- To learn the simulation basics of control systems
- To derive transfer functions for DC-DC converters

UNIT I ELECTRIC VEHICLE DYNAMICS **6**

Standard drive cycles-Dynamics of Electric Vehicles-Tractive force-Maximum speed, torque, power, energy requirements of EVs.

UNIT II MOTORS FOR ELECTRIC VEHICLES 6

Introduction – Speed And Torque control of above and below rated speed-Speed control of EV in the constant power region of electric motors. DC Motors, Induction Motor, Permanent Magnet Synchronous Motors (PMSM), Brushless DC Motors, Switched Reluctance Motors (SRMs). Synchronous Reluctance Machines-Choice of electric machines for EVs.

UNIT III BASICS OF SIMULATION IN CONTROL SYSTEMS 6

Transfer Function-How to build transfer function, identify Poles, zeros, draw time response plots, bode plot (Bode Plots for Multiplication Factors, Constant, Single and Double Integration Functions, Single and Double Differentiation Functions, Single Pole and Single Zero Functions, RHP Pole and RHP Zero Functions), state space modelling-transfer function from state space Model.

UNIT IV MODELING OF DC-DC CONVERTERS 6

Overview of PWM Converter Modelling -Power Stage Modelling - PWM Block Modelling - Voltage Feedback Circuit and Small-Signal Model of PWM Converter - Averaging Power Stage Dynamics - Average Models for buck/boost Converter - Small-Signal Model of Converter Power Stage - Frequency Response of Converter

UNIT V POWER STAGE TRANSFER FUNCTIONS OF DC – DC CONVERTERS 6

Power Stage Transfer Functions of buck-boost Converter in CCM Operation, Input-to-Output Transfer Function, Duty Ratio-to-Output Transfer Function, Load Current-to-Output Transfer Function.

30 PERIODS

LAB COMPONENT: 30 PERIODS

1. Simple simulation exercises of basic control systems
2. Bode plots and calculation of Gain margin and Phase margin for power stage transfer function via simulation.
3. Design of buck converter
4. Design of boost converter
5. Simulation of buck, boost and buck boost converter-open loop (With power circuit and Transfer function).

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

CO1: To use appropriate electric machine for electric vehicle application
CO2: To compute transfer function with factors such as constant, integral, differential, first order factor and second order factor (both numerators & denominators)
CO3: To compute transfer function from state models
CO4: To design buck, boost and buck-boost converter.
CO5: To compute a power stage transfer functions for DC-DC converters
CO6: To simulate DC-DC converters and to obtain gain margin and phase margin.

REFERENCES:

1. Power Electronic Converters, Teuvo Suntio, Tuomas Messo, Joonas Puukko, First Edition 2017.
2. Fundamentals of Power Electronics with MATLAB, Randall Shaffer, 2nd Edition, 2013, Lakshmi publications
3. Feedback Control problems using MATLAB and the Control system tool box, Dean Frederick and Joe Cho, 2000, 1st Edition, Cengage learning.
4. Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005,1st Edition.
5. Electrical Machine Fundamentals with Numerical Simulation using MATLAB/SIMULINK, Atif Iqbal, Shaikh Moinoddin, Bhimireddy Prathap Reddy, Wiley,2021, 1st Edition.
6. Emerging Power Converters for Renewable Energy and Electric Vehicles Modeling, Design, and Control, Md. Rabiul Islam,Md. Rakibuzzaman Shah, Mohd. Hasan Ali, CRC Press,2021, 1st Edition.
7. Iqbal Hussain, "Electric and Hybrid Vehicles: Design Fundamentals, Second Edition" CRC Press, Taylor & Francis Group, Third Edition 2021.

MAPPING OF COs WITH POs AND PSOs

COs	POs												COs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3		3	-	-	-	-	1	-	3	-	3	3	-	1
CO2	3	3	3	3	3	-	-	1	-	3	-	3	3	3	3
CO3	3	3	3	3	3	-	-	1	-	3	-	3	3	3	3
CO4	3	3	3	3	3	-	-	1	-	3	-	3	3	3	3
CO5	3	3	3	3	3	-	-	1	-	3	-	3	3	3	3
CO6	3	3	3	3	3	-	-	1	-	3	-	3	3	3	3
Avg	3	3	3	3	3	-	-	1	-	3	-	3	3	3	2.6

AU3002 BATTERIES AND MANAGEMENT SYSTEM L T P C

3 0 0 3

COURSE OBJECTIVES:

The objective of this course is to make the students to understand the working and characteristics of different types of batteries and their management .

UNIT I ADVANCED BATTERIES 9

Li-ion Batteries-different formats, chemistry, safe operating area, efficiency, aging. Characteristics- SOC,DOD, SOH. Balancing-Passive Balancing Vs Active Balancing. Other Batteries-NCM and NCA Batteries. *NCR18650B* specifications.

UNIT II BATTERY PACK 9

Battery Pack- design, sizing, calculations, flow chart, real and simulation Model.Peak power – definition, testing methods-relationships with Power, Temperature and ohmic Internal Resistance. Cloud based and Local Smart charging.

UNITIII BATTERY MODELLING 9

Battery Modelling Methods-Equivalent Circuit Models, Electrochemical Model, Neural Network Model. ECM Comparisons- Rint model, Thevenin model, PNGV model. State space Models- Introduction. Battery Modelling software/simulation frameworks

UNIT IV BATTERY STATE ESTIMATION 9

SOC Estimation- Definition, importance, single cell Vs series batteries SOC. Estimation Methods- Load voltage, Electromotive force, AC impedance, Ah counting, Neural networks, Neuro-fuzzy forecast method, Kalman filter. Estimation Algorithms.

UNIT V BMS ARCHITECTURE AND REAL TIME COMPONENTS 9

Battery Management System- need, operation, classification. BMS ASIC-bq76PL536A-Q1 Battery Monitor IC- CC2662R-Q1 Wireless BMS MCU. Communication Modules- CAN Open-Flex Ray- CANedge1 package.ARBIN Battery Tester. BMS Development with Modeling software and Model-Based Design.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

1. Acquire knowledge of different Li-ion Batteries performance.
2. Design a Battery Pack and make related calculations.
3. Demonstrate a BatteryModel or Simulation.
4. Estimate State-of-Charges in a Battery Pack.
5. Approach different BMS architectures during real world usage.

TEXT BOOKS

1. Jiuchun Jiang and Caiping Zhang, “Fundamentals and applications of Lithium-Ion batteriesin Electric Drive Vehicles’’, Wiley, 2015.
2. Davide Andrea ,“Battery Management Systems for Large Lithium-Ion Battery Packs” ARTECH House, 2010.

REFERENCE BOOKS

1. Developing Battery Management Systems with Simulink and Model-Based Design-whitepaper
2. Panasonic *NCR18650B- DataSheet*
3. bq76PL536A-Q1- IC DataSheet
4. CC2662R-Q1- IC DataSheet

EP3001 EV CHARGING INFRASTRUCTURE L T P C
2 0 2 3

COURSE OBJECTIVES:

- To learn and understand the Battery parameters and Charging Concepts
- To learn and understand the charging station requirements and standards
- To learn and understand the Charging Protocols
- To learn and understand the need for APFC and design Concepts
- To learn the concepts of Resonant Power Converters in Charging
- To learn and understand the Wireless Power Transfer Concepts

UNIT I BASICS OF EV CHARGING 6

Units of Battery Capacity – AH and KWH, Lead Acid and Li Ion - Cell Voltage and C rating of Charge and Discharge, CC and CV Charging, CCCV Battery Charging, OBC and Off Board Charger, Components of EV Off Board AC Charging Systems - Residual Current Device and other Protections, Metering, OCPP, Components of EV Off Board DC Charging Systems – Power Module, System Controller, SECC for Charger-EV Communication, DC Earth Leakage

detection, Protections, Metering, OCPP, CMS and Mobile App for Authentication and Payment, Classification of Chargers and Charging in terms of Level, Modes and Type.

UNIT II CONTROL PILOT AND CHARGING PROTOCOLS 6

SAE J1772 standard and Control Pilot based AC Charging, Introduction to CAN, Standard and Extended Identifiers, PDU and SPN, Coining Identifier from SPN, Transfer Protocol for transmitting multiple frames, Charge Communication Protocols for DC Charging – CHAdeMO ((IEC 61851-23), GB/T, Digital interlocks and Charging sequence, Protocol for DC Charging – CCS(DIN 70121 and ISO 15118), PLC and OSI Model for CCS EV Charging, Control Pilot and Charge Sequence, V2G, V2H, V2L.

UNIT III POWER FACTOR CORRECTION FOR ON BOARD AND OFF BOARD CHARGERS 6

Brief Specification of ON Board and OFF Board Chargers, Modularity and Scalability, Harmonics and Power Factor in Offline SMPS, Need for APFC, Boost Rectifier for Single Phase PFC, Operation and control for input current shaping, Boost Inductor Calculation, Current and Power loss Calculations, Three Phase PFC Topologies.

UNIT IV ISOLATED DC-DC CONVERTERS 6

Switching Loss, Effect of Switching Loss on Efficiency and EMI, Need for Resonant DC/DC Converters, Operation of PSFB, LLC Converters, Isolated Bidirectional Converter DAB and control methodology.

UNIT V WIRELESS POWER TRANSFER 6

Introduction - Inductive, Capacitive and Resonant WPT. Wireless Chargers for Electric Vehicles - Benefits of WPT. - WPT Operation Modes - Standards for EV Wireless Chargers, SAE J2954, IEC 61980. ISO 19363

30 PERIODS

LAB COMPONENT: 30 PERIODS

1. Simulation and analysis for Bi-directional charging V2G and G2V.
2. Design and demonstrate an AC EV charging station.
3. Simulate and infer Wireless Power Transfer for EV charging.
4. Simulation of Boost Rectifier based Power Factor Correction.

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

CO1: To illustrate CC, CV modes of charging and to define the Charge Parameters based on Battery Chemistry
CO2: To design and develop an AC Charger
CO3: To develop firmware for SECC based on the Standards
CO4: To design and simulate Boost Rectifier based Power Factor Correction.
CO5: To design and simulate Resonant Power Conversion
CO6: To demonstrate the principles of Wireless Power Transfer.
CO7: To analyze and compare various standards Conductive and Wireless Charging

REFERENCES:

1. Mobile Electric Vehicles Online Charging and Discharging, Miao Wang Ran Zhang Xuemin (Sherman) Shen, Springer 2016, 1st Edition.
2. Alicia Triviño-Cabrera, José M. González-González, José A. Aguado, Wireless Power Transferor Electric Vehicles: Foundations and Design Approach, Springer Publisher 1st Edition. 2020.
3. Nil Patel, Akash Kumar Bhoi, Sanjeevikumar Padmanaban, Jens Bo Holm-Nielsen, Electric Vehicles Modern Technologies and Trends. Springer Publisher 1st Edition, 2021.
4. Cable Based and Wireless Charging Systems for Electric Vehicles, Technology and control, management and grid integration, Rajiv Singh, Sanjeevikumar Padmanaban, Sanjeet Dwivedi, Marta Molinas and Frede Blaabjerg, IET 2021, 1st Edition.
5. Electric and Hybrid Electric Vehicles, James D Halderman, Pearson, 2022, 1st Edition.
6. Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005.
7. Open Charge Alliance https://openchargealliance.org>protocols>open-charg
8. Thandapani. T, Power Electronics for EV Charging and Communication Protocols

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3	-	-	2	2	-	3	-	3	3	--	-
CO2	3	3	3	3	-	-	2	2	-	3	-	3	3	3	3
CO3	3				-	-			-		-		3	3	3
CO4	3	3	3	3	-	-	2	2	-	2	-	1	3	3	3
CO5	3	-	-	-	-	-	-	-	-	-	-	-	3	3	3
CO6	3	3	3	3	3	-	2	2	-	3	-	2	3	3	3
Avg	3	3	3	3	3	-	2	2	-	2.75	-	2.25	3	3	3

EP3002 SAFETY AND TESTING OF ELECTRIC VEHICLES

L	T	P	C
2	0	2	3

COURSE OBJECTIVES:

- To understand EV architecture and safety fundamentals
- To learn the testing procedures for EV & HEV components
- To know the functional safety and EMC
- To realize the effect of EMC in EVs
- To study the effect of EMI in motor drives and in DC-DC converter system

UNIT I ELECTRIC VEHICLE ARCHITECTURE AND SAFETY FUNDAMENTALS **6**

Overview of Electric Vehicle Architecture - Key components of Battery Electric Vehicle: Battery, Battery Management System (BMS), Motor, Inverter, DC-DC Converter- Risk analysis and precautionary measures for High Voltage systems of EVs- Electrical and Mechanical Hazards- Overview of safety standards: ISO 6469, AIS-038, IEC standards

UNIT II TESTING OF ELECTRIC MOTORS AND CONTROLLERS FOR ELECTRIC AND HYBRID ELECTRIC VEHICLES **6**

Test Procedure Using M-G Set, electric motor, controller, application of Test Procedure, Analysis of Test Items for the Type Test - Motor Test and Controller Test (Controller Only). - Test Procedure Using Eddy Current Type Engine Dynamometer, Test Strategy, Test Procedure, Discussion on Test Procedure. Test Procedure Using AC Dynamometer.

UNIT III FUNDAMENTALS OF FUNCTIONAL SAFETY AND EMC 6

Functional safety life cycle - Fault tree analysis - Hazard and risk assessment – software development - Process models - Development assessments - Configuration management - Reliability - Reliability block diagrams and redundancy - Functional safety and EMC - Functional safety and quality - Standards - Functional safety of autonomous vehicles.

UNIT IV EMC IN ELECTRIC VEHICLES 6

Introduction - EMC Problems of EVs, EMC Problems of Motor Drive, EMC Problems of DC-DC Converter System, EMC Problems of Wireless Charging System, EMC Problem of Vehicle Controller, EMC Problems of Battery Management System, Vehicle EMC Requirements-

UNIT V EMI IN MOTOR DRIVE AND DC-DC CONVERTER SYSTEM 6

Overview -EMI Mechanism of Motor Drive System, Conducted Emission Test of Motor Drive System, IGBT EMI Source, EMI Coupling Path, EMI Modelling of Motor Drive System. EMI in DC-DC Converter, EMI Source, The Conducted Emission High-Frequency, Equivalent Circuit of DC-DC Converter System, EMI Coupling Path

30 PERIODS

LAB COMPONENT: 30 PERIODS

1. Design and simulate motor controller for hybrid electric vehicle applications
2. Simulation of EMC analysis for Wireless power transfer EV charging.
3. Design and simulation of EMI filter

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

Upon completion of the course, students will be able to:

CO1: To describe the status and other details of standardization of EVs
CO2: To illustrate the testing protocols for EVs and HEV components
CO3: To analyze the safety cycle and need for functions safety for EVs
CO4: To analyze the problems related with EMC for EV components.
CO5: To evaluate the EMI in motor drive and DC-DC converter system.

REFERENCES:

1. Handbook of Automotive Power Electronics and Motor Drives, Ali Emadi, Taylor & Francis, 2005, 1st Edition.
2. Electromagnetic Compatibility of Electric Vehicle, Li Zhai, Springer 2021, 1st Edition.
3. EMC and Functional Safety of Automotive Electronics, Kai Borgeest, IET 2018, 1st Edition.
4. EMI/EMC Computational Modeling Handbook, Druce Archam beault, colin branch, Omar M.Ramachi ,Springer 2012, 2nd Edition.
5. Automotive EMC, Mark Steffika, Springer 2013, 1st Edition.
6. Electric Vehicle Systems Architecture and Standardization Needs, Reports of the PPP European Green Vehicles Initiative, Beate Müller, Gereon Meyer, Springer 2015, 1st Edition.

MAPPING OF COs WITH POs AND PSOs

COs	POs												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	-	-	-	2	-	-	-	-	-	3	-	2
CO2	3	1	1	-	-	-	1	-	-	-	-	-	3	-	2
CO3	3	1	1	-	-	-	2	-	-	-	-	-	3	-	2
CO4	3	1	1	-	-	-	1	-	-	-	-	-	3	-	2
CO5	3	1	1	-	-	-	2	-	-	-	-	-	3	-	3
Avg	3	1	1	-	-	-	1.8	2		3		2	3	3	2.3

EP3003 **CONNECTED VEHICLES** **LT P C**
3 0 0 3

COURSE OBJECTIVE:

- To understand the fundamentals of connected and intelligent vehicle systems.
- To study vehicle communication technologies and networking protocols.
- To analyze IoT, sensors, and embedded systems used in connected vehicles.
- To understand autonomous driving concepts, cybersecurity, and smart transportation systems.
- To explore applications of AI, cloud computing, and electric mobility in connected vehicles.

UNIT I INTRODUCTION TO CONNECTED VEHICLES:

Evolution of intelligent and connected vehicles - Architecture of connected vehicle systems - Components of connected vehicles - Vehicle electronics and embedded systems - Types of vehicle connectivity - Intelligent Transportation Systems (ITS) - Overview of electric and autonomous vehicles

UNIT II VEHICLE COMMUNICATION TECHNOLOGIES

Vehicle-to-Vehicle (V2V) communication - Vehicle-to-Infrastructure (V2I) communication -Vehicle-to-Everything (V2X) communication -- Dedicated Short Range Communication (DSRC) - Cellular V2X (C-V2X) and 5G technologies - CAN, LIN, FlexRay and Automotive Ethernet - Wireless communication protocols in vehicles

UNIT III SENSORS, IOT AND EMBEDDED SYSTEMS

Sensors used in connected vehicles - Radar - LiDAR - Ultrasonic sensors - Cameras - GPS and IMU - IoT architecture for vehicles - Telematics systems - Embedded controllers and ECUs - Data acquisition and processing - Cloud connectivity and edge computing

UNIT IV AUTONOMOUS DRIVING AND CYBERSECURITY

Levels of vehicle automation - Advanced Driver Assistance Systems (ADAS) - Lane keeping and adaptive cruise control - Path planning and obstacle detection - Vehicle cybersecurity threats - Secure communication and encryption - Functional safety and standards (ISO 26262) - Privacy and ethical issues

UNIT V SMART MOBILITY AND APPLICATIONS

Smart traffic management systems - Connected electric vehicles and charging infrastructure - Fleet management and remote diagnostics - AI and Machine Learning applications in vehicles - Digital twin and predictive maintenance - Smart cities and sustainable transportation - Case studies of connected vehicle platforms

REFERENCES:

1. Sengupta, R. (2015). Connected vehicles: Intelligent transportation systems. Morgan & Claypool Publishers.
2. Gillespie, T. D. (1992). Fundamentals of vehicle dynamics. SAE International.
3. Smith, C. (2017). The car hacker's handbook: A guide for the penetration tester. No Starch Press.
4. Hu, F. (2014). Vehicle-to-vehicle and vehicle-to-infrastructure communications. CRC Press.
5. Navet, N., & Simonot-Lion, F. (Eds.). (2009). Automotive embedded systems handbook. CRC Press.
6. Ghosh, S., & Lee, T. (2000). Intelligent transportation systems: New principles and architectures. CRC Press.

Course Outcomes

CO1 Explain the architecture and operation of connected vehicle systems and communication technologies.

CO2 Analyze sensors, embedded systems, IoT and networking protocols used in connected vehicle

CO3 evaluate autonomous driving technologies, cybersecurity aspects and smart mobility applications.

CRA332	DRONE TECHNOLOGIES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To understand the basics of drone concepts
2. To learn and understand the fundaments of design, fabrication and programming of drone
3. To impart the knowledge of an flying and operation of drone
4. To know about the various applications of drone
5. To understand the safety risks and guidelines of fly safely

UNIT I INTRODUCTION TO DRONE TECHNOLOGY 9

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING 9

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION 9

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity - Removable storage devices- Linked mobile devices and applications

UNIT IV DRONE COMMERCIAL APPLICATIONS 9

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing

UNIT V FUTURE DRONES AND SAFETY 9

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Createthe programs for various drones

TEXT BOOKS

1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc, 2016

REFERENCES

1. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016
2. Zavrsnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance”, Springer, 2018.

CO’s- PO’s & PSO’s MAPPING

COs/Pos&PSOs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3	1	3	2						1	2	1	3
CO2	1	2	3	1	3	2						1	2	1	3
CO3	1	2	3	1	3	2						1	2	1	3
CO4	1	2	3	1	3	2						1	2	1	3
CO5	1	2	3	1	3	2						1	2	1	3
CO/PO & PSO Average	1	2	3	1	3	2						1	2	1	3
1 – Slight, 2 – Moderate, 3 – Substantial															

EP3004 SMART IoT ARCHITECTURE AND APPLICATIONS L T P C
3 0 0 3

UNIT I IoT FOUNDATIONS AND SMART SENSING 9

Introduction to Internet of Things ,IoT evolution, Industry 4.0/5.0, ISO/IEC 30141 and IEEE P2413 architectures — IoT ecosystem and layered architecture — Smart sensors and sensor fusion — Actuation systems Embedded platforms: ESP32, Raspberry Pi — Low-power IoT design.

UNIT II CONNECTIVITY AND IoT NETWORKING 9

IoT communication models: D2D, D2G, D2C, and M2M — Wireless protocols: BLE, Zigbee, Thread, NFC, Wi-Fi HaLow, and UWB — LPWAN technologies: LoRaWAN, NB-IoT, Sigfox, and LTE-M — 5G URLLC and industrial IoT networking — Application protocols: MQTT, CoAP, HTTP/2, AMQP, DDS, WebSockets, and LwM2M — IPv6, 6LoWPAN, MAC/EUI-64, and UUID-based addressing — Star, mesh, and hybrid topologies — Gateway architecture, SDN, TSN, and edge routing.

UNIT III EDGE-CLOUD IoT AND MIDDLEWARE 9

Edge, fog, and cloud computing architectures — Cloud IoT platforms and services — IoT data pipelines, stream analytics, and time-series databases — Middleware frameworks.

UNIT IV SMART IoT APPLICATIONS AND ARCHITECTURES 9

Smart Grid IoT: AMI, smart substations, demand response, and predictive maintenance — Industrial IoT (IIoT), and SCADA/PLC integration — Smart cities: intelligent lighting, traffic management, and environmental monitoring — Healthcare IoT: wearable systems and remote patient monitoring — Precision agriculture: soil telemetry, UAV sensing, and greenhouse automation.

UNIT V IoT SECURITY, STANDARDS, AND EMERGING TRENDS 9

IoT security architecture — Lightweight cryptography — standards: oneM2M, OCF, Matter, and IEEE 1451 — Sustainable IoT and green computing — Emerging trends: AIoT, federated learning, digital twins, metaverse-integrated IoT, 6G-enabled IoT, and post-quantum cryptography

COURSE OUTCOMES

CO1: Explain IoT architectures, sensing systems, embedded platforms, and real-time IoT design principles.

CO2: Analyze IoT communication protocols, LPWAN technologies, and networking architectures for smart connected systems.

CO3: Apply edge-cloud computing, middleware frameworks, and data pipeline concepts for scalable IoT applications.

CO4: Evaluate IoT architectures for smart grid, industrial automation, healthcare, smart city, and precision agriculture applications.

CO5: Assess IoT security, interoperability, sustainability, and emerging AIoT technologies using modern standards and compliance frameworks.

REFERENCES

1. Rajkumar Buyya, Satish Narayana Srirama, Internet of Things: Principles and Paradigms, Elsevier, 2022.
2 David Hanes, Gonzalo Salgueiro, Patrick Grossetete, et al., IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things, Cisco Press, 2017.
3.Shancang Li, Li Da Xu, Wuhui Zhao, Securing the Internet of Things, Wiley-IEEE Press, 2021.
4.Perry Lea, Internet of Things for Architects, Packt Publishing, 2018.
5.Vijay Madisetti, Arshdeep Bahga, Internet of Things: A Hands-On Approach, Universities Press, 2021.
6.IEEE P2413™ Standard for an Architectural Framework for the Internet of Things, IEEE Standards Association, 2020.

EP3005 DIGITAL TWIN L T P C

3 0 0 3

COURSE OBJECTIVES:

- To understand the principles, concepts, and framework of Digital Twin technology.
- To study modelling and virtual representation techniques for engineering systems.
- To learn sensor integration, data acquisition, IoT, and communication frameworks used in Digital Twin systems.
- To explore the fundamentals of Artificial Intelligence, Machine Learning, and data analytics for Digital Twin applications.
- To understand the applications of Digital Twin in industrial, energy, healthcare, and smart infrastructure systems.

UNIT I FUNDAMENTALS OF DIGITAL TWIN 9

Digital Twin - principles and concepts – Types and characteristics, Evolution and significance of Digital Twin, Stages of Digital Twin development – Digital Twin framework – Physical system, virtual system, and cyber-physical integration, Data-driven and physics-based Digital Twins.

UNIT II MODELLING AND VIRTUAL REPRESENTATION 9

Introduction to system modelling – Physical and virtual system representation – Mathematical and simulation models – Static and dynamic models – Digital representation of engineering systems – Model updating and validation – Introduction to simulation tools for Digital Twin applications.

UNIT III SENSOR INTEGRATION, DATA ACQUISITION, AND IoT FRAMEWORK 9

Smart sensors and transducers – Signal conditioning and pre-processing – Real-time monitoring and data acquisition systems – Sensor fusion techniques and

synchronization – Embedded platforms for Digital Twin applications – Internet of Things (IoT) concepts – Communication and networking frameworks – Edge and cloud-based Digital Twin architecture – Data synchronization, latency, and real-time constraints – Cybersecurity and data privacy in connected systems.

UNIT IV AI/ML AND DATA ANALYTICS FOR DIGITAL TWIN 9

Introduction to Artificial Intelligence and Machine Learning – Supervised and unsupervised learning – Neural networks and deep learning – Data collection and pre-processing – Feature extraction and data representation – Data analytics and visualization techniques – Time-series data analysis – Anomaly detection and condition monitoring – Overview of intelligent decision-making systems.

UNIT V APPLICATIONS OF DIGITAL TWIN 9

Applications of Digital Twin in smart manufacturing and industrial automation – Robotics and cyber-physical systems – Energy systems and smart infrastructure – Transportation and mobility systems – Healthcare and biomedical applications – Smart cities and sustainable systems – AR/VR integration in Digital Twin environments – Digital Twin for predictive monitoring and decision support – Challenges, opportunities, and future trends in Digital Twin technology.

TOTAL: 45 PERIODS

COURSE OUTCOMES

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

CO1: Explain the principles, concepts, and framework of Digital Twin technology.
CO2: Apply modelling and virtual representation techniques for engineering systems.
CO3: Analyse sensor integration, IoT, and communication frameworks used in Digital Twin systems.
CO4: Demonstrate the fundamentals of AI/ML and data analytics for Digital Twin applications.
CO5: Identify and evaluate Digital Twin applications in industrial and smart infrastructure systems.

TEXTBOOKS

1. Shyam Varan Nath, Pieter Van Schalkwyk, Building Industrial Digital Twins: Design, Develop, and Deploy Digital Twin Solutions for Real-World Industries Using Azure Digital Twins, 1st Edition, Packt Publishing, 2022.
2. Stuart Russell and Peter Norvig Artificial Intelligence - A Modern Approach, Prentice Hall, 3rd edition, 2011.
3. Rajeev Alur, “Principles of Cyber-Physical Systems”, MIT Press, 2015.

Mapping of COs with POs and PSOs

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1	1	2	-	-	-	-	-	1	2	2	2	-

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

1 – Low, 2 – Medium, 3 – High, '-' – No correlation

CCS361 ROBOTIC PROCESS AUTOMATION L T P C
2 0 2 3

COURSE OBJECTIVES:

- To understand the basic concepts of Robotic Process Automation.
- To expose to the key RPA design and development strategies and methodologies.
- To learn the fundamental RPA logic and structure.
- To explore the Exception Handling, Debugging and Logging operations in RPA.
- To learn to deploy and Maintain the software bot.

UNIT I INTRODUCTION TO ROBOTIC PROCESS AUTOMATION 6

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Differentiating RPA from Automation - Benefits of RPA - Application areas of RPA, Components of RPA, RPA Platforms. Robotic Process Automation Tools - Templates, User Interface, Domains in Activities, Workflow Files.

UNIT II AUTOMATION PROCESS ACTIVITIES 6

Sequence, Flowchart & Control Flow: Sequencing the Workflow, Activities, Flowchart, Control Flow for Decision making. Data Manipulation: Variables, Collection, Arguments, Data Table, Clipboard management, File operations Controls: Finding the control, waiting for a control, Act on a control, UiExplorer, Handling Events

UNIT III APP INTEGRATION, RECORDING AND SCRAPING 6

App Integration, Recording, Scraping, Selector, Workflow Activities. Recording mouse and keyboard actions to perform operation, Scraping data from website and writing to CSV. Process Mining.

UNIT IV EXCEPTION HANDLING AND CODE MANAGEMENT 6

Exception handling, Common exceptions, Logging- Debugging techniques, Collecting crash dumps, Error reporting. Code management and maintenance: Project organization, Nesting workflows, Reusability, Templates, Commenting techniques, State Machine.

UNIT V DEPLOYMENT AND MAINTENANCE 6

Publishing using publish utility, Orchestration Server, Control bots, Orchestration Server to deploy bots, License management, Publishing and managing updates. RPA Vendors - Open Source RPA, Future of RPA

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

Setup and Configure a RPA tool and understand the user interface of the tool:

1. Create a Sequence to obtain user inputs display them using a message box;
2. Create a Flowchart to navigate to a desired page based on a condition;
3. Create a State Machine workflow to compare user input with a random number.
4. Build a process in the RPA platform using UI Automation Activities.
5. Create an automation process using key System Activities, Variables and Arguments
6. Also implement Automation using System Trigger
7. Automate login to (web)Email account
8. Recording mouse and keyboard actions.
9. Scraping data from website and writing to CSV
10. Implement Error Handling in RPA platform
11. Web Scraping
12. Email Query Processing

TOTAL:60 PERIODS

COURSE OUTCOMES:

By the end of this course, the students will be able to:

- Enunciate the key distinctions between RPA and existing automation techniques and platforms.
- Use UiPath to design control flows and work flows for the target process
- Implement recording, web scraping andprocess mining by automation
- Use UIPath Studio to detect, and handle exceptions in automation processes
- Implement and use Orchestrator for creation, monitoring, scheduling, and controlling of automated bots and processes.

TEXT BOOKS:

1. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, 2018.
2. Tom Taulli , “The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems”, Apress publications, 2020.

REFERENCES:

1. Frank Casale (Author), Rebecca Dilla (Author), Heidi Jaynes (Author), Lauren Livingston (Author), Introduction to Robotic Process Automation: a Primer, Institute of Robotic Process Automation, Amazon Asia-Pacific Holdings Private Limited, 2018
2. Richard Murdoch, Robotic Process Automation: Guide To Building Software Robots, Automate Repetitive Tasks & Become An RPA Consultant, Amazon Asia-Pacific Holdings Private Limited, 2018
3. A Gerardus Blokdyk, “Robotic Process Automation Rpa A Complete Guide “, 2020

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	1	3	-	-	-	1	3	3	2	2	2	1

2	1	1	2	3	3	-	-	-	1	2	3	1	3	2	1
3	2	3	2	3	3	-	-	-	2	3	1	1	3	3	3
4	1	2	1	2	2	-	-	-	1	2	1	3	3	3	2
5	3	3	3	3	3	-	-	-	3	1	1	1	3	2	1
AVg.	2	2.2	2	2.4	2.8	-	-	-	1.6	2.2	1.8	1.6	2.8	2.4	1.6

1 - low, 2 - medium, 3 - high, '-' - no correlation

CCS333 AUGMENTED REALITY/VIRTUAL REALITY L T P C

2 0 2 3

OBJECTIVES:

- To impart the fundamental aspects and principles of AR/VR technologies.
- To know the internals of the hardware and software components involved in the development of AR/VR enabled applications.
- To learn about the graphical processing units and their architectures.
- To gain knowledge about AR/VR application development.
- To know the technologies involved in the development of AR/VR based applications.

UNIT I INTRODUCTION 7

Introduction to Virtual Reality and Augmented Reality – Definition – Introduction to Trajectories and Hybrid Space-Three I's of Virtual Reality – Virtual Reality Vs 3D Computer Graphics – Benefits of Virtual Reality – Components of VR System – Introduction to AR-AR Technologies-Input Devices – 3D Position Trackers – Types of Trackers – Navigation and Manipulation Interfaces – Gesture Interfaces – Types of Gesture Input Devices – Output Devices – Graphics Display – Human Visual System – Personal Graphics Displays – Large Volume Displays – Sound Displays – Human Auditory System**.**

UNIT II VR MODELING 6

Modeling – Geometric Modeling – Virtual Object Shape – Object Visual Appearance – Kinematics Modeling – Transformation Matrices – Object Position – Transformation Invariants –Object Hierarchies – Viewing the 3D World – Physical Modeling – Collision Detection – Surface Deformation – Force Computation – Force Smoothing and Mapping – Behavior Modeling – Model Management.

UNIT III VR PROGRAMMING 6

VR Programming – Toolkits and Scene Graphs – World ToolKit – Java 3D – Comparison of World ToolKit and Java 3D

UNIT IV APPLICATIONS 6

Human Factors in VR – Methodology and Terminology – VR Health and Safety Issues – VR and Society-Medical Applications of VR – Education, Arts and Entertainment – Military VR Applications – Emerging Applications of VR – VR Applications in Manufacturing – Applications of VR in Robotics – Information Visualization – VR in Business – VR in Entertainment – VR in Education.

UNIT V AUGMENTED REALITY 5

Introduction to Augmented Reality-Computer vision for AR-Interaction-Modelling and Annotation-Navigation-Wearable devices

30 PERIODS

PRACTICAL EXERCISES: **30 PERIODS**

1. Study of tools like Unity, Maya, 3DS MAX, AR toolkit, Vuforia and Blender.
2. Use the primitive objects and apply various projection types by handling camera.
3. Download objects from asset store and apply various lighting and shading effects.
4. Model three dimensional objects using various modelling techniques and apply textures over them.
5. Create three dimensional realistic scenes and develop simple virtual reality enabled mobile applications which have limited interactivity.
6. Add audio and text special effects to the developed application.
7. Develop VR enabled applications using motion trackers and sensors incorporating full haptic interactivity.
8. Develop AR enabled applications with interactivity like E learning environment, Virtual walkthroughs and visualization of historic places.
9. Develop AR enabled simple applications like human anatomy visualization, DNA/RNA structure visualization and surgery simulation.
10. Develop simple MR enabled gaming applications.

TOTAL PERIODS:60

OUTCOMES:

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

CO1: Understand the basic concepts of AR and VR
CO2: Understand the tools and technologies related to AR/VR
CO3:Know the working principle of AR/VR related Sensor devices
CO4: Design of various models using modeling techniques
CO5: Develop AR/VR applications in different domains

TEXTBOOKS:

1. Charles Palmer, John Williamson, "Virtual Reality Blueprints: Create compelling VR experiences for mobile", Packt Publisher, 2018
2. Dieter Schmalstieg, Tobias Hollerer, "Augmented Reality: Principles & Practice", Addison Wesley, 2016
3. John Vince, "Introduction to Virtual Reality", Springer-Verlag, 2004.
4. William R. Sherman, Alan B. Craig: Understanding Virtual Reality – Interface, Application, Design", Morgan Kaufmann, 2003

CO's – PO's & PSO's MAPPING

COs	POs													PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
1	3	2	2	-	3	-	-	-	2	2	1	2	2	1	2	
2	3	2	2	1	3	-	-	-	3	2	2	3	3	1	2	
3	3	3	2	2	3	-	-	-	3	2	1	2	3	2	2	
4	3	3	3	2	3	-	-	-	3	2	2	3	3	2	2	
5	3	3	3	3	3	-	-	-	3	3	3	3	3	3	3	
AVg.	3.00	2.60	2.40	2.00	3.00	-	-	-	2.80	2.20	1.80	2.60	2.80	1.80	2.20	

CCS342 **DEVOPS** **L T P C**
2 0 2 3

COURSE OBJECTIVES:

- To introduce DevOps terminology, definition & concepts

- To understand the different Version control tools like Git, Mercurial
- To understand the concepts of Continuous Integration/ Continuous Testing/ Continuous Deployment)
- To understand Configuration management using Ansible
- Illustrate the benefits and drive the adoption of cloud-based Devops tools to solve real world problems

UNIT I INTRODUCTION TO DEVOPS 6

Devops Essentials - Introduction To AWS, GCP, Azure - Version control systems: Git and Github.

UNIT II COMPILE AND BUILD USING MAVEN & GRADLE 6

Introduction, Installation of Maven, POM files, Maven Build lifecycle, Build phases(compile build, test, package) Maven Profiles, Maven repositories(local, central, global),Maven plugins, Maven create and build Artificats, Dependency management, Installation of Gradle, Understand build using Gradle

UNIT III CONTINUOUS INTEGRATION USING JENKINS 6

Install & Configure Jenkins, Jenkins Architecture Overview, Creating a Jenkins Job, Configuring a Jenkins job, Introduction to Plugins, Adding Plugins to Jenkins, Commonly used plugins (Git Plugin, Parameter Plugin, HTML Publisher, Copy Artifact and Extended choice parameters). Configuring Jenkins to work with java, Git and Maven, Creating a Jenkins Build and Jenkins workspace.

UNIT IV CONFIGURATION MANAGEMENT USING ANSIBLE 6

Ansible Introduction, Installation, Ansible master/slave configuration, YAML basics, Ansible modules, Ansible Inventory files, Ansible playbooks, Ansible Roles, adhoc commands in ansible

UNIT V BUILDING DEVOPS PIPELINES USING AZURE 6

Create Github Account, Create Repository, Create Azure Organization, Create a new pipeline, Build a sample code, Modify azure-pipelines.yaml file

COURSE OUTCOMES:

CO1: Understand different actions performed through Version control tools like Git.

CO2: Perform Continuous Integration and Continuous Testing and Continuous Deployment using Jenkins by building and automating test cases using Maven & Gradle.

CO3: Ability to Perform Automated Continuous Deployment

CO4: Ability to do configuration management using Ansible

CO5: Understand to leverage Cloud-based DevOps tools using Azure DevOps

30 PERIODS

PRACTICAL EXERCISES: 30 PERIODS

1. Create Maven Build pipeline in Azure
2. Run regression tests using Maven Build pipeline in Azure
3. Install Jenkins in Cloud

4. Create CI pipeline using Jenkins
5. Create a CD pipeline in Jenkins and deploy in Cloud
6. Create an Ansible playbook for a simple web application infrastructure
7. Build a simple application using Gradle
8. Install Ansible and configure ansible roles and to write playbooks

TOTAL:60 PERIODS

TEXT BOOKS

1. Roberto Vormittag, “A Practical Guide to Git and GitHub for Windows Users: From Beginner to Expert in Easy Step-By-Step Exercises”, Second Edition, Kindle Edition, 2016.
2. Jason Cannon, “Linux for Beginners: An Introduction to the Linux Operating System and Command Line”, Kindle Edition, 2014

REFERENCES

1. Hands-On Azure Devops: Cicd Implementation For Mobile, Hybrid, And Web Applications Using Azure Devops And Microsoft Azure: CICD Implementation for ... DevOps and Microsoft Azure (English Edition) Paperback – 1 January 2020
2. by Mitesh Soni
3. Jeff Geerling, “Ansible for DevOps: Server and configuration management for humans”, First Edition, 2015.
4. David Johnson, “Ansible for DevOps: Everything You Need to Know to Use Ansible for DevOps”, Second Edition, 2016.
5. Mariot Tsitoara, “Ansible 6. Beginning Git and GitHub: A Comprehensive Guide to Version Control, Project Management, and Teamwork for the New Developer”, Second Edition, 2019.
6. https://www.jenkins.io/user-handbook.pdf
7. https://maven.apache.org/guides/getting-started/

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
2	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
3	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
4	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
5	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2
AVg.	3	3	3	2	3	-	-	-	-	-	-	-	2	2	2

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

CCS359 **QUANTUM COMPUTING** **L T P C**
2 0 2 3

COURSE OBJECTIVES:

- To know the background of classical computing and quantum computing.
- To learn the fundamental concepts behind quantum computation.
- To study the details of quantum mechanics and its relation to Computer Science.
- To gain knowledge about the basic hardware and mathematical models of quantum computation.
- To learn the basics of quantum information and the theory behind it.

UNIT I QUANTUM COMPUTING BASIC CONCEPTS **6**

Complex Numbers - Linear Algebra - Matrices and Operators - Global Perspectives Postulates of Quantum Mechanics – Quantum Bits - Representations of Qubits - Superpositions

UNIT II QUANTUM GATES AND CIRCUITS **5**

Universal logic gates - Basic single qubit gates - Multiple qubit gates - Circuit development - Quantum error correction

UNIT III QUANTUM ALGORITHMS **7**

Quantum parallelism - Deutsch's algorithm - The Deutsch–Jozsa algorithm - Quantum Fourier transform and its applications - Quantum Search Algorithms: Grover's Algorithm

UNIT IV QUANTUM INFORMATION THEORY **6**

Data compression - Shannon's noiseless channel coding theorem - Schumacher's quantum noiseless channel coding theorem - Classical information over noisy quantum channels

UNIT V QUANTUM CRYPTOGRAPHY **6**

Classical cryptography basic concepts - Private key cryptography - Shor's Factoring Algorithm - Quantum Key Distribution - BB84 - Ekart 91

30 PERIODS

PRACTICAL EXERCISES **30 PERIODS**

1. Single qubit gate simulation - Quantum Composer
2. Multiple qubit gate simulation - Quantum Composer
3. Composing simple quantum circuits with q-gates and measuring the output into classical bits.
4. IBM Qiskit Platform Introduction
5. Implementation of Shor's Algorithms
6. Implementation of Grover's Algorithm
7. Implementation of Deutsch's Algorithm
8. Implementation of Deutsch-Jozsa's Algorithm
9. Integer factorization using Shor's Algorithm
10. QKD Simulation
11. Mini Project such as implementing an API for efficient search using Grover's Algorithms or

COURSE OUTCOMES:

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

CO1: Understand the basics of quantum computing.
CO2: Understand the background of Quantum Mechanics.
CO3: Analyze the computation models.
CO4: Model the circuits using quantum computation.
environments and frameworks.
CO5: Understand the quantum operations such as noise and error–correction.

TOTAL:60 PERIODS

TEXTBOOKS:

1. Parag K Lala, Mc Graw Hill Education, “Quantum Computing, A Beginners Introduction”, First edition (1 November 2020).
2. Michael A. Nielsen, Issac L. Chuang, “Quantum Computation and Quantum Information”, Tenth Edition, Cambridge University Press, 2010.
3. Chris Bernhardt, The MIT Press; Reprint edition (8 September 2020), “Quantum Computing for Everyone”.

REFERENCES

1. Scott Aaronson, “Quantum Computing Since Democritus”, Cambridge University Press, 2013.
2. N. David Mermin, “Quantum Computer Science: An Introduction”, Cambridge University Press, 2007.

CO’s-PO’s & PSO’s MAPPING

CO’s	PO’s												PSO’s		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	2	2	-	-	-	-	2	-	-	-	2	3	2
2	3	2	2	2	-	-	-	-	2	-	-	-	2	3	1
3	3	3	3	3	2	-	-	-	3	-	-	-	3	2	2
4	3	3	3	3	3	-	-	-	3	-	-	-	1	3	2
5	3	3	2	3	-	-	-	-	2	-	-	-	1	3	3
AVg.	3	2.6	2.4	2.6	1	-	-	-	2.4	-	-	-	1.8	2.8	2

1 - low, 2 - medium, 3 - high, ‘-' - no correlation

EP3006 EDGE AND FOG COMPUTING

L	T	P	C
3	0	0	3

COURSE OBJECTIVE:

This course aims to provide students with a comprehensive understanding of designing computing systems that process data closer to where it's created, rather than sending everything to distant cloud servers. Students will learn to build smart applications that work across different computing layers - from powerful cloud servers to small edge devices like sensors and smartphones. By the end, students can create practical solutions for smart cities, healthcare, and industry that respond quickly and work efficiently.

UNIT I CLOUD TO EDGE COMPUTING PARADIGMS

Evolution from Cloud to Fog and Edge Computing - IoT Architecture Requirements and Latency Limitations - Fog vs Edge vs Cloud: Differences in Computation and Storage - Multi-access Edge Computing (MEC) Concepts - Multi-tier Architectural Models for Distributed Systems

UNIT II EDGE OFFLOADING AND SYSTEM OPTIMIZATION

Edge Offloading Strategies and Placement Issues - Challenges in Latency, Energy Efficiency, QoS, and Privacy - Queuing Theory and System Performance Metrics - Optimization Techniques using Machine Learning for Slice Orchestration

UNITR III RESOURCE FEDERATION AND NETWORK SLICING

Cloud-to-Fog-to-Things (C2F2T) Integration - Network Slicing for 5G/6G: Slice Types and Lifecycle - Resource Virtualization: SDN, NFV, and Container-Based Federation - Modeling and Simulation for Resource Management

UNIT IV MIDDLEWARE FOR EDGE SYSTEMS

Middleware Design Goals: Heterogeneity, Discovery, Scalability - Service Orchestration at the Edge - Lightweight Containers: Docker and Kubernetes on Constrained Devices - Edge Cluster Formation and Node Coordination - Communication Protocols: MQTT, CoAP, and Microservices - Distributed Storage, Synchronization, and Fault Recovery

UNIT V INTELLIGENCE, SECURITY AND EMERGING TRENDS AT THE EDGE

Data Management at the Fog Layer: Caching, Placement, Lifecycle - Federated Learning and Distributed ML for Edge Analytics - Stream Processing and Real-Time Analytics Frameworks - Use Cases: Smart Cities, Healthcare, Smart Homes - Security Challenges: ML-Based Threat Detection, Behavioral Analysis - Privacy Techniques: Differential Privacy, Federated Anonymization - Blockchain for Fog Resource Security and Transparency - Software-defined Edge Networks and Intent-Based Networking - Green and Sustainable Edge Computing - Edge AI and TinyML: Neural Compression, Quantization, Model Deployment - 6G Vision: Ultra-Low Latency, Terahertz Communications - Advanced Paradigms: Digital Twins, Serverless Edge, Cognitive Networks

References:

1. Rajiv Pandey, Sunil Kumar Khatri, Neeraj Kumar Singh, Parul Verma, Artificial Intelligence and Machine Learning for EDGE Computing, 1st Edition,2022, Academic Press
2. S. Goundar, Ed., ‘Edge Computing - Technology, Management and Integration’. IntechOpen,2023.
3. Ahmed Banafa, Secure And Smart Internet of Things (loT) using Blockchain and Artificial Intelligence (AI).2018, River publications
4. Javid Taheri, Schahram Dustdar, Albert Zomaya, Shuiguang Deng, Edge Intelligence From Theory to Practice, 2023, Springer
5. Fog, Edge, and Pervasive Computing in Intelligent IoT Driven Applications Deepak Gupta, Aditya Khamparia ,2021, Wiley-IEEE Press

COURSE OUTCOMES

CO1 Explain the evolution of cloud-to-edge paradigms and describe the role of edge and fog computing in real-time IoT applications.
CO2 Design and optimize network slicing strategies for integrated cloud–fog–edge systems using mathematical modeling and optimization techniques.
CO3 Develop middleware architectures and container-based solutions for distributed edge computing environments.
CO4 Implement intelligent data management systems and machine learning solutions at the fog layer for real-time analytics.
CO5 Evaluate emerging technologies and research directions in edge and fog computing for future system design.

VERTICAL VI: APPLICATIONS OF COMPUTER SCIENCE IN ELECTRICAL SYSTEMS

EE3022 **VLSI DESIGN** **LT P C**
2 0 2 3

COURSE OBJECTIVES

- To explain the basic concepts of CMOS and
- To introduce the IC fabrication methods
- To introduce the Reconfigurable Processor technologies
- To introduce the basics of analog VLSI design and its importance.
- To learn about the programming of Programmable device using Hardware description Language.

UNIT I CMOS BASICS **6**
MOSFET Scaling - CMOS logic design- Dynamic CMOS –Transmission Gates- BiCMOS

UNIT II IC FABRICATION **6**
CMOS IC Fabrications: n well, p well, twin tub, SoI - Design Rules and Layout.

UNIT III PROGRAMABLE LOGIC DEVICES **6**
PAL, PLA, CPLD architecture and application.

UNIT IV RECONFIGURABLE PROCESSOR **6**
FPGA- Architecture, FPGA based application development- Introduction to FPAA.

UNIT V HDL PROGRAMMING **6**
Verilog HDL- Overview - structural and behavioural modeling concepts-Design examples- Carry Look ahead adders, ALU, Shift Registers.

30 PERIODS

LAB COMPONENTS: **30 PERIODS**

1. Laboratory exercise : Use any FPGA Board /IDE/open source package/ platform to give hands on training on CMOS design/ reconfigurable processor based applications.

a) CMOS logic circuit simulation using any open source software package

b) Experiments : structural and behavioural modeling based Verilog HDL programs
c) Experiment: Combinational and sequential Digital logic implementation with FPGA.
d) Implementation of carry look ahead adder with FPGA
e) Implementation of ALU with FPGA

2. Assignment : Low Power VLSI.

3. FPGA based Mini project .

TOTAL: 30+30 = 60 PERIODS

COURSE OUTCOMES:

At the end of this course, the students will have the ability to

CO1: Develop CMOS design techniques
CO2: Learn and build IC fabrication
CO3: Explain the need of reconfigurable computing with PLDs.
CO4: Design and development of reprogrammable FPGA.
CO5: Illustrate and develop HDL computational processes with improved design strategies.

TEXTBOOKS:

1. M.J.S Smith, “Application Specific integrated circuits”,Addition Wesley Longman Inc. 1st Edition 2010.
2. Kamran Eshraghian,Douglas A.pucknell and Sholeh Eshraghian,”Essentials of VLSI circuits and system”, Prentice Hall India,2005, 1st Edition.

REFERENCES:

1. Donald G. Givone, “Digital principles and Design”, Tata McGraw Hill 2002, 1st Edition.
2. Charles H. Roth Jr., “Fundamentals of Logic design”, Thomson Learning, 7th Edition 2013.
3. Nurmi, Jari (Ed.) "Processor Design System-On-Chip Computing for ASICs and FPGAs" Springer, 2007, 1st Edition.
4. Joao Cardoso, Michael Hübner, "Reconfigurable Computing: From FPGAs to Hardware/Software Codesign" Springer, 2011, 1st Edition.
5. Pierre-Emmanuel Gaillardon, Reconfigurable Logic: Architecture, Tools, and Applications, 1st Edition, CRC Press , 2018.

List of Open Source Software/ Learning website:

1) https://archive.nptel.ac.in/courses/108/107/108107129/
2) http://gn.dronacharya.info/ECEDept/Downloads/QuestionPapers/7th_Sem/VLSI-DESIGN/UNIT-1/Lecture-3.pdf
3) https://web.itu.edu.tr/~ateserd/vlsi2/2007/FPGAs&CPLD.pdf
4) https://kanchiuniv.ac.in/coursematerials/GSK_Notes_on_PLD_in_VLSI_design.pdf
5) https://www.xilinx.com/products/silicon-devices/resources/programming-an-fpga-an-introduction-to-how-it-works.html
6) https://www.allaboutcircuits.com/technical-articles/what-is-an-fpga-introduction-to-programmable-logic-fpga-vs-microcontroller/
7) https://www.tutorialspoint.com/vlsi_design/vlsi_design_vhdl_introduction.htm#:~:text=VHDL%20stands%20for%20very%20high,DoD)%20under%20the%20VHSIC%20program.

MAPPING OF COs WITH POs AND PSOs

COs	POs	PSOs

	PO1	PO2	PO3	PO4	PO5	P06	P07	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	1	2	1	-	-	-	-	-	-	-	2	2	3
CO2	3	1	2	3	1	-	-	-	-	-	-	-	1	1	3
CO3	3	2	2	2	3	-	-	-	-	-	-	-	2	1	3
CO4	3	2	2	2	3	-	-	-	-	-	-	-	2	2	3
CO5	3	2	1	3	3	-	-	-	1	-	-	-	2	2	3
Avg	3	1.6	1.6	2.4	2.2	-	-	-	1	-	-	-	1.8	1.6	3

EP3007 COMPUTER CONTROL IN POWER SYSTEMS L T P C

3 0 0 3

UNIT I INTRODUCTION TO POWER SYSTEM CONTROL 9

Need for computer control in power systems -Modern power system operation - Energy Control Centre (ECC) / Load Dispatch= Centre - Functions of control centers - Hierarchical control structure –

UNIT II SCADA SYSTEMS 9

Supervisory Control and Data Acquisition (SCADA) - Remote Terminal Units (RTUs) - Communication systems -Data acquisition and telemetry - Real-time monitoring and control - Human Machine Interface (HMI)

UNIT III ENERGY MANAGEMENT SYSTEM (EMS) 9

Functions of EMS -Load forecasting - Economic load dispatch - Unit commitment - Automatic Generation Control (AGC) - Voltage and reactive power control

UNIT IV STATE ESTIMATION AND SECURITY ANALYSIS 9

Network topology processing - State estimation techniques - Weighted Least Square Estimation (WLSE) - Bad data detection - Contingency analysis - Security monitoring and corrective control

UNIT V COMPUTER APPLICATIONS IN POWER SYSTEMS 9

Computer-based load flow studies - Power system simulation - Real-time digital control - Distributed control systems - Smart grid concepts - AI and expert systems in power system control

TOTAL: 45 PERIODS

TEXT BOOKS

1. Allen J. Wood, Bruce F. Wollenberg, Gerald B. Sheble, *Power Generation, Operation, and Control*, 3rd Edition, Wiley, 2013.
2. P. Kundur, *Power System Stability and Control*, 1st Edition, McGraw-Hill, 1994.

3. R. Bergen, Vijay Vittal, *Power Systems Analysis*, 2nd Edition, Pearson Education, 2000.
4. D. P. Kothari, I. J. Nagrath, *Modern Power System Analysis*, 4th Edition, McGraw-Hill Education, 2011.
5. Olle I. Elgerd, *Electric Energy Systems Theory: An Introduction*, 2nd Edition, McGraw-Hill, 1982.

EP3008 DEEP LEARNING FOR ELECTRICAL SYSTEM APPLICATIONS L T P C

3 0 0 3

Course Objectives

- To understand the role of computers in modern power system operation and control.
- To study power system modeling and digital simulation techniques.
- To analyze load frequency control and automatic generation control.
- To understand optimal power flow and economic operation of power systems.
- To explore SCADA systems and real-time power system control applications.

UNIT I DIGITAL COMPUTER APPLICATIONS IN POWER SYSTEMS 9

Role of computers in power system operation and control -Mathematical modeling of power systems - Power system analysis using digital computers - Load flow studies using numerical methods - Introduction to power system simulation tools - State estimation in power systems

UNIT II LOAD FREQUENCY CONTROL AND AGC 9

Basics of load frequency control (LFC) - Single-area and multi-area power systems - Tie-line power flow control - Automatic Generation Control (AGC) - Modeling of governor, turbine, and generator - Control strategies for frequency regulation - Digital implementation of LFC

UNIT III ECONOMIC OPERATION OF POWER SYSTEMS 9

Economic dispatch problem formulation - Lambda iteration method - Gradient and Newton-Raphson methods - Optimal generation scheduling - Fuel cost curves and incremental cost - Unit commitment problem Computer-based economic load dispatch-

UNIT IV OPTIMAL POWER FLOW AND SYSTEM CONTROL 9

Concept of Optimal Power Flow (OPF) AC and DC OPF formulations- Security constrained OPF- Voltage and reactive power control Voltage stability analysis- Contingency analysis- Computer algorithms for OPF

UNIT V SCADA AND REAL-TIME CONTROL SYSTEMS 9

Introduction to SCADA systems - SCADA architecture and components - Remote terminal units (RTU) and communication systems - Supervisory control and data acquisition - Energy management systems (EMS) - Real-time monitoring and control of power systems - Applications in smart grids and power utilities

REFERENCES:

1. Kundur, P. (1994). *Power system stability and control*. McGraw-Hill.
2. Elgerd, O. I. (1971). *Electric energy systems theory: An introduction*. McGraw-Hill.

3. Wood, A. J., Wollenberg, B. F., & Sheblé, G. B. (2013). *Power generation, operation, and control* (3rd ed.). Wiley.
4. Kothari, D. P., & Nagrath, I. J. (2011). *Modern power system analysis* (4th ed.). McGraw-Hill Education.
5. Saadat, H. (1999). *Power system analysis*. McGraw-Hill.
6. Stevenson, W. D., & Grainger, J. J. (1994). *Elements of power system analysis* (4th ed.). McGraw-Hill.

Course Outcome

CO1 Understand computer applications in power system modeling and analysis
CO2 Analyze load frequency control and automatic generation control systems
CO3 Apply economic dispatch and optimal power flow techniques
CO4 Evaluate SCADA and real-time power system control strategies

EP3009 INTELLIGENT CONTROL FOR ELECTRICAL SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES

- To understand the fundamentals of intelligent control techniques used in electrical systems.
- To study fuzzy logic, neural networks, and evolutionary computation methods.
- To analyze intelligent controllers for electrical machines and power systems.
- To design AI-based control systems for real-time applications.
- To explore applications of intelligent control in smart grids and automation systems.

UNIT I INTRODUCTION TO INTELLIGENT CONTROL SYSTEMS:
Conventional vs intelligent control systems - Need for intelligent control in electrical systems - Basic concepts of Artificial Intelligence (AI) in control - Knowledge-based systems - Expert systems in control applications - Hybrid control systems

UNIT II FUZZY LOGIC CONTROL SYSTEMS
Fuzzy set theory and fuzzy logic basics - Membership functions and fuzzy rules - Fuzzy inference systems (Mamdani and Sugeno models) - Fuzzification and defuzzification methods - Design of fuzzy logic controller - Applications in electrical systems (motor control, power systems)

UNIT III ARTIFICIAL NEURAL NETWORKS (ANN) IN CONTROL
Basics of neural networks -Neuron model and activation functions -Feedforward and feedback networks -Training algorithms (Backpropagation) - Adaptive learning systems -ANN-based system identification and control - Applications in electrical drives and power systems

UNIT IV EVOLUTIONARY AND OPTIMIZATION TECHNIQUES
Genetic Algorithms (GA) fundamentals - Selection, crossover, and mutation -Particle Swarm Optimization (PSO) -Ant Colony Optimization (ACO) basics -Optimization in control system design -Hybrid intelligent systems -Applications in parameter tuning and controller design
UNIT V INTELLIGENT CONTROL APPLICATIONS IN ELECTRICAL SYSTEMS
Intelligent control of DC and AC motor drives -Smart grid control and energy management - Power system stabilization using AI techniques -FACTS devices control using intelligent

methods -Renewable energy system control (solar, wind) -Robotics and industrial automation -Real-time implementation issues

REFERENCES:

1. Jang, J.-S. R., Sun, C.-T., & Mizutani, E. (1997). *Neuro-fuzzy and soft computing: A computational approach to learning and machine intelligence*. Prentice Hall.
2. Passino, K. M., & Yurkovich, S. (1998). *Fuzzy control*. Addison-Wesley.
3. Haykin, S. (2009). *Neural networks and learning machines* (3rd ed.). Pearson.
4. Goldberg, D. E. (1989). *Genetic algorithms in search, optimization, and machine learning*. Addison-Wesley.
5. Ross, T. J. (2010). *Fuzzy logic with engineering applications* (3rd ed.). Wiley.
6. Nagrath, I. J., & Gopal, M. (2008). *Control systems engineering* (5th ed.). New Age International.

Course Outcome

CO1 Understand intelligent control concepts and AI-based control systems
CO2 Apply fuzzy logic techniques in electrical system control
CO3 Analyze neural networks and evolutionary algorithms for control applications
CO4 Design intelligent controllers for electrical drives and power systems

EP3010 INDUSTRY 5.0 L T P C

3 0 0 3

COURSE OBJECTIVES

- To understand the evolution from Industry 4.0 to Industry 5.0.
- To study human-centric, sustainable, and resilient industrial systems.
- To analyze enabling technologies such as AI, IoT, robotics, and digital twins.
- To explore human–machine collaboration in smart industries.
- To apply Industry 5.0 concepts in electrical, energy, and industrial systems.

UNIT I – INTRODUCTION TO INDUSTRY 5.0

volution of industrial revolutions (Industry 1.0 to 5.0) -Concept of Industry 5.0 -Difference between Industry 4.0 and Industry 5.0 - Human-centric manufacturing systems - Sustainability and resilience in industries - Smart factories and cyber-physical systems - Role of IoT in Industry 5.0

UNIT II – ENABLING TECHNOLOGIES OF INDUSTRY 5.0:

Artificial Intelligence (AI) and Machine Learning -Industrial Internet of Things (IIoT) - Big Data analytics in industries - Cloud and edge computing - Digital Twin technology - 5G/6G communication in smart industries - Robotics and collaborative robots (cobots) - Additive manufacturing (3D printing)

UNIT III – HUMAN–MACHINE COLLABORATION SYSTEMS:

Human–machine interaction (HMI) - Augmented Reality (AR) and Virtual Reality (VR) in industry - Smart sensors and actuators - Wearable industrial devices - Intelligent decision support systems - Human-centered AI systems - Safety and ergonomics in smart workplaces

UNIT IV – INDUSTRY 5.0 IN ELECTRICAL AND INDUSTRIAL SYSTEM:
Smart power systems and smart grids - Renewable energy integration - Industrial automation and intelligent control - Predictive maintenance using AI/IoT - SCADA systems and real-time monitoring - Energy management systems - Smart manufacturing in electrical industries

UNIT V – SUSTAINABILITY, SECURITY AND APPLICATIONS:
Sustainable manufacturing and circular economy - Green energy and carbon-neutral systems - Cybersecurity in Industry 5.0 systems - Data privacy and ethical issues - Industrial resilience and risk management - Applications in: - Smart cities - Healthcare systems - Transportation systems - Industrial automation -Case studies of Industry 5.0 implementation

REFERENCES:

1. eschke, S., Brecher, C., Song, H., & Rawat, D. B. (Eds.). (2017). *Industry 4.0 and industry 5.0: Concepts and technologies for the future of manufacturing*. Springer.
2. European Commission. (2021). *Industry 5.0: Towards a sustainable, human-centric and resilient European industry*. Publications Office of the European Union. https://commission.europa.eu
3. Nahavandi, S. (2019). Industry 5.0—A human-centric solution. *Sustainability, 11*(16), 4371. https://doi.org/10.3390/su11164371
4. Monostori, L. (2014). Cyber-physical production systems: Roots, expectations and R&D challenges. *Procedia CIRP, 17*, 9–13. https://doi.org/10.1016/j.procir.2014.03.115
5. Kagermann, H. (2013). *Recommendations for implementing the strategic initiative INDUSTRIE 4.0.* acatech – National Academy of Science and Engineering.
6. Rajkumar, R. (2010). Cyber-physical systems: The next computing revolution. *Design Automation Conference*

Course Outcome

CO1 Understand evolution and principles of Industry 5.0
CO2 Analyze enabling technologies like AI, IoT, and digital twins
CO3 Apply human–machine collaboration concepts in engineering systems
CO4 Evaluate sustainability, security, and industrial applications

EP3011 ADVANCEMENTS IN ELECTRONIC WARFARE SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES

- To understand the fundamentals of electronic warfare (EW) systems and their evolution.
- To study radar, communication, and signal intelligence techniques used in EW.
- To analyze electronic support, attack, and protection systems.
- To explore modern EW technologies such as AI, RF systems, and cyber warfare integration.
- To understand applications of EW in defense and aerospace systems.

UNIT I – INTRODUCTION TO ELECTRONIC WARFARE:
Basics of electronic warfare (EW) -Types of EW: Electronic Support (ES), Electronic Attack (EA), Electronic Protection (EP) -Evolution of EW systems -Electromagnetic spectrum fundamentals -Role of EW in modern defense systems -Platforms: air, land, sea, and space-based systems

UNIT II – ELECTRONIC SUPPORT SYSTEMS (ES):
Signal intelligence (SIGINT) -Electronic intelligence (ELINT) and communications intelligence (COMINT) -Direction finding and signal detection -Threat warning receivers -Spectrum monitoring systems -Radar signal analysis and identification -Data fusion techniques

UNIT III – ELECTRONIC ATTACK SYSTEMS (EA):
Jamming techniques (noise, deception, barrage jamming) -Radar jamming and anti-radiation systems -Directed energy weapons (basic concepts) -Chaff and flare systems -Anti-jamming communication techniques -Electronic countermeasures (ECM) -RF interference and suppression methods

UNIT IV – ELECTRONIC PROTECTION SYSTEMS (EP):
Electronic counter-countermeasures (ECCM) -Frequency hopping and spread spectrum techniques -Low probability of intercept (LPI) radars -Signal encryption and secure communication -Stealth technology principles -Adaptive filtering and signal processing for protection -Resilient communication systems

UNIT V – MODERN TRENDS IN ELECTRONIC WARFARE:
AI and machine learning in EW systems -Cognitive electronic warfare -Cyber-electromagnetic activities (CEMA) -Software-defined radio (SDR) in EW -Satellite-based EW systems -Autonomous and drone-based EW platforms -Integration of EW with cyber warfare -Case studies of modern defense systems

REFENCES:

1. Schleher, D. C. (1999). *Electronic warfare in the information age: Artech House radar library*. Artech House.
2. Gupta, S. C. (2004). *Electronic warfare systems*. McGraw-Hill.
3. Poisel, R. A. (2011). *Electronic warfare signal processing*. Artech House.
4. Adamy, D. (2001). *EW 101: A first course in electronic warfare*. Artech House.
5. Richards, M. A. (2014). *Fundamentals of radar signal processing* (2nd ed.). McGraw-Hill Education.
6. Stimson, G. W. (1998). *Introduction to airborne radar* (2nd ed.). SciTech Publishing.

Course Outcome

CO1 Understand fundamentals and classification of electronic warfare systems
CO2 Analyze electronic support and attack techniques in EW systems
CO3 Apply protection and countermeasure techniques in EW
CO4 Evaluate modern EW technologies including AI and cyber integration

EP3012 CYBER PHYSICAL SYSTEMS L T P C

3 0

0 3

COURSE OBJECTIVES

- To understand the fundamentals and architecture of Cyber Physical Systems (CPS).
- To study integration of computation, communication, and physical processes.
- To analyze embedded systems, IoT, and real-time control in CPS.
- To explore modeling, verification, and security of CPS.
- To apply CPS concepts in smart grids, industries, and transportation systems.

UNIT I – INTRODUCTION TO CYBER PHYSICAL SYSTEMS:
Definition and evolution of CPS -Difference between embedded systems and CPS - CPS architecture and components - Cyber and physical integration - Real-world CPS applications - Characteristics: real-time, distributed, networked systems

UNIT II – MODELING OF CYBER PHYSICAL SYSTEMS:
Physical system modeling - Hybrid systems (continuous + discrete systems) - Finite state machines and automata theory- Mathematical modeling of dynamic systems -Simulation tools for CPS System abstraction and hierarchy

UNIT III – EMBEDDED AND NETWORKED SYSTEMS IN CPS:
Embedded system architecture -Real-time operating systems (RTOS) Sensor and actuator integration - Wireless sensor networks - IoT-enabled CPS systems - Communication protocols (CAN, ZigBee, MQTT, etc.) - Edge and fog computing

UNIT IV – CONTROL AND COMPUTATION IN CPS:
Feedback control systems in CPS - Distributed control systems - Supervisory control - Real-time scheduling - State estimation and filtering (Kalman filter basics) - Event-driven systems - AI integration in CPS

UNIT V – SECURITY, VERIFICATION AND APPLICATIONS:
Cybersecurity in CPS - Threats and vulnerabilities - Secure communication protocols - System verification and validation - Formal methods in CPS - Applications: - Smart grids - Smart transportation systems - Industrial automation - Healthcare systems - Autonomous systems - Future trends in CPS

REFERENCES:

1. Baheti, R., & Gill, H. (2011). Cyber-physical systems. In T. Samad & A. M. Annaswamy (Eds.), *The impact of control technology* (pp. 161–166). IEEE Control Systems Society.
2. Rajkumar, R., Lee, I., Sha, L., & Stankovic, J. (2010). Cyber-physical systems: The next computing revolution. In *Proceedings of the Design Automation Conference (DAC)* (pp. 731–736). https://doi.org/10.1145/1837274.1837461
3. Lee, E. A. (2008). Cyber physical systems: Design challenges. *11th IEEE International Symposium on Object and Component-Oriented Real-Time Distributed Computing (ISORC)*, 363–369. https://doi.org/10.1109/ISORC.2008.25
4. Alur, R. (2015). *Principles of cyber-physical systems*. MIT Press.

5. Tabuada, P. (2009). *Verification and control of hybrid systems: A symbolic approach*. Springer.
6. Liu, J. W. S. (2000). *Real-time systems*. Prentice Hall.

Course Outcome

CO1 Understand fundamentals and architecture of CPS
CO2 Analyze modeling and simulation of CPS
CO3 Apply embedded and IoT technologies in CPS
CO4 Evaluate control, security, and real-world CPS applications

MANDATORY COURSES I

MX3081 INTRODUCTION TO WOMEN AND GENDER STUDIES L T P C

3 0 0 0

COURSE OUTLINE

UNIT I CONCEPTS
Sex vs. Gender, masculinity, femininity, socialization, patriarchy, public/ private, essentialism, binaryism, power, hegemony, hierarchy, stereotype, gender roles, gender relation, deconstruction, resistance, sexual division of labour.

UNIT II FEMINIST THEORY
Liberal, Marxist, Socialist, Radical, Psychoanalytic, postmodernist, ecofeminist.

UNIT III WOMEN'S MOVEMENTS: GLOBAL, NATIONAL AND LOCAL
Rise of Feminism in Europe and America. Women's Movement in India.

UNIT IV GENDER AND LANGUAGE
Linguistic Forms and Gender. Gender and narratives.

UNIT V GENDER AND REPRESENTATION
Advertising and popular visual media.

Gender and Representation in Alternative Media. Gender and social media.

TOTAL : 45 PERIODS

MX3082 ELEMENTS OF LITERATURE L T P C

3 0 0 0

OBJECTIVE:

- To make the students aware about the finer sensibilities of human existence through an art form. The students will learn to appreciate different forms of literature as suitable modes of expressing human experience.

1. COURSE CONTENTS

Introduction to Elements of Literature

1. **Relevance of literature**
   a) Enhances Reading, thinking, discussing and writing skills.
   b) Develops finer sensibility for better human relationship.
   c) Increases understanding of the problem of humanity without bias.

d) Providing space to reconcile and get a cathartic effect.

2. Elements of fiction

a) Fiction, fact and literary truth.
b) Fictional modes and patterns.
c) Plot character and perspective.

3. Elements of poetry

a) Emotions and imaginations.
b) Figurative language.
c) (Simile, metaphor, conceit, symbol, pun and irony).
d) Personification and animation.
e) Rhetoric and trend.

4. Elements of drama

a) Drama as representational art.
b) Content mode and elements.
c) Theatrical performance.
d) Drama as narration, mediation and persuasion.
e) Features of tragedy, comedy and satire.

3. READINGS:

1. An Introduction to the Study of English Literature, W.H. Hudson, Atlantic, 2007.
2. An Introduction to Literary Studies, Mario Klarer, Routledge, 2013.
3. The Experience of Poetry, Graham Mode, Open college of Arts with Open Unv Press, 1991.
4. The Elements of Fiction: A Survey, Ulf Wolf (ed), Wolfstuff, 2114.
5. The Elements of Drama, J.L.Styan, Literary Licensing, 2011.

3.1 Textbook:

3.2 *Reference Books:: To be decided by the teacher and student, on the basis of individual student so as to enable him or her to write the term paper.

4. OTHER SESSION:

4.1*Tutorials:

4.2*Laboratory:

4.3*Project: The students will write a term paper to show their understanding of a particular piece of literature

5.*ASSESSMENT:

5.1HA:

5.2Quizzes-HA:

5.3Periodical Examination: one

5.4Project/Lab: one (under the guidance of the teachers the students will take a volume of poetry, fiction or drama and write a term paper to show their understanding of it in a given context; sociological, psychological, historical, autobiographical etc.

5.5Final Exam:

TOTAL : 45 PERIODS

OUTCOME OF THE COURSE:

- Students will be able to understand the relevance of literature in human life and appreciate its aspects in developing finer sensibilities.

MX3083 FILM APPRECIATION L T P C

3

0 0 0

In this course on film appreciation, the students will be introduced broadly to the development of film as an art and entertainment form. It will also discuss the language of cinema as it evolved over a century. The students will be taught as to how to read a film and appreciate the various nuances of a film as a text. The students will be guided to study film joyfully.

Theme - A: The Component of Films

A-1: The material and equipment
A-2: The story, screenplay and script
A-3: The actors, crew members, and the director
A-4: The process of film making… structure of a film

Theme - B: Evolution of Film Language

B-1: Film language, form, movement etc.
B-2: Early cinema… **silent film** (Particularly French)
B-3: The emergence of feature films: **Birth of a Nation**
B-4: Talkies

Theme - C: Film Theories and Criticism/Appreciation

C-1: Realist theory; Auteurists
C-2: Psychoanalytic, Ideological, Feminists
C-3: How to read films?
C-4: Film Criticism / Appreciation

Theme – D: Development of Films

D-1: Representative Soviet films
D-2: Representative Japanese films
D-3: Representative Italian films
D-4: Representative Hollywood film and the studio system

Theme - E: Indian Films

E-1: The early era
E-2: The important films made by the directors
E-3: The regional films
E-4: The documentaries in India

READING:

A Reader containing important articles on films will be prepared and given to the students. The students must read them and present in the class and have discussion on these.

MX3084 DISASTER RISK REDUCTION AND MANAGEMENT L

T P C

3

0 0 0

COURSE OBJECTIVE

- To impart knowledge on concepts related to disaster, disaster risk reduction, disaster management
- To acquaint with the skills for planning and organizing disaster response

UNIT I HAZRADS, VULNERABILITY AND DISASTER RISKS

9

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Types of Disasters: Natural, Human induced, Climate change induced –Earthquake, Landslide, Flood, Drought, Fire etc – Technological disasters- Structural collapse, Industrial accidents, oil spills -Causes, Impacts including social, Economic, political, environmental, health, psychosocial, etc.- Disaster vulnerability profile of India and Tamil Nadu - Global trends in disasters: urban disasters, pandemics, Complex emergencies, - -, Inter relations between Disasters and Sustainable development Goals.

UNIT II DISASTER RISK REDUCTION (DRR)

9

Sendai Framework for Disaster Risk Reduction**,** Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparedness community Based DRR, Structural- nonstructural measures, Roles and responsibilities of- community, Panchayati Raj Institutions / Urban Local Bodies (PRIs/ULBs), States, Centre, and other stakeholders- Early Warning System – Advisories from Appropriate Agencies.- Relevance of indigenous Knowledge, appropriate technology and Local resources.

UNIT III DISASTER MANAGEMENT

9

Components of Disaster Management – Preparedness of rescue and relief, mitigation, rehabilitation and reconstruction- Disaster Risk Management and post disaster management – Compensation and Insurance- Disaster Management Act (2005) and Policy - Other related policies, plans, programmers and legislation - Institutional Processes and Framework at State and Central Level- (NDMA –SDMA-DDMA-NRDF- Civic Volunteers)

UNIT IV TOOLS AND TECHNOLOGY FOR DISASTER MANAGEMENT

9

Early warning systems -Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response and Preparedness, – Role of GIS and Information Technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment. - Elements of Climate Resilient Development –Standard operation Procedure for disaster response – Financial planning for disaster Management

UNIT V DISASTER MANAGEMENT: CASE STUDIES

9

Discussion on selected case studies to analyse the potential impacts and actions in the contest of disasters-Landslide Hazard Zonation: Earthquake Vulnerability Assessment of Buildings and Infrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm Surge Assessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, Man Made disasters: Case Studies, Space Based Inputs for Disaster Mitigation and Management and field works related to disaster management.- Field work-Mock drill -

TOTAL : 45 PERIODS

TEXT BOOKS:

1 Taimpo (2016), Disaster Management and Preparedness, CRC Publications
2 Singh R (2017), Disaster Management Guidelines for earthquakes, Landslides, Avalanches and tsunami, Horizon Press Publications
3 Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13: 978-9380386423
4 Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt. Ltd., 2012. **ISBN-10:** 1259007367, **ISBN-13:** 978-1259007361]

REFERENCES

1. Govt. of India: Disaster Management Act, Government of India, New Delhi, 2005.
2. Government of India, National Disaster Management Policy, 2009.
3. Shaw R (2016), Community based Disaster risk reduction, Oxford University Press

COURSE OUTCOME:

CO1: To impart knowledge on the concepts of Disaster, Vulnerability and Disaster Risk reduction (DRR)
CO2: To enhance understanding on Hazards, Vulnerability and Disaster Risk Assessment prevention and risk reduction
CO3: To develop disaster response skills by adopting relevant tools and technology
CO4: Enhance awareness of institutional processes for Disaster response in the country and
CO5: Develop rudimentary ability to respond to their surroundings with potential Disaster response in areas where they live, with due sensitivity

COs – POs & PSOs MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	3	2	3	-	-	2	2	-	-	2	-	2	-	1
2	3	3	3	3	-	-	2	1	-	-	2	-	2	-	1
3	3	3	3	3	-	-	2	2	-	-	-	-	2	-	1
4	3	3	2	3	-	-	2	1	-	-	2	-	2	-	1
5	3	3	2	3	-	-	2	2	-	-	2	-	3	-	1
AVG	3	3	3	3	-	-	2	2	-	-	2	-	2	-	1

MANDATORY COURSES II

MX3085 WELL-BEING WITH TRADITIONAL PRACTICES-YOGA, AYURVEDA AND SIDDHA **L T P C**

3 0 0 0

COURSE OBJECTIVES:

- To enjoy life happily with fun filled new style activities that help to maintain health also
- To adapt a few lifestyle changes that will prevent many health disorders
- To be cool and handbill every emotion very smoothly in every walk of life
- To learn to eat cost effective but healthy foods that are rich in essential nutrients
- To develop immunity naturally that will improve resistance against many health disorders

UNIT I HEALTH AND ITS IMPORTANCE **2+4**

Health: Definition - Importance of maintaining health - More importance on prevention than treatment

Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational/Professional heath.

Present health status - The life expectancy-present status - mortality rate - dreadful diseases - Non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer – diabetes - chronic pulmonary diseases - risk factors – tobacco – alcohol - unhealthy diet - lack of physical activities.

Types of diseases and disorders - Lifestyle disorders – Obesity – Diabetes - Cardiovascular diseases – Cancer – Strokes – COPD - Arthritis - Mental health issues.

Causes of the above diseases / disorders - Importance of prevention of illness - Takes care of health - Improves quality of life - Reduces absenteeism - Increase satisfaction - Saves time

Simple lifestyle modifications to maintain health - Healthy Eating habits (Balanced diet according to age) Physical Activities (Stretching exercise, aerobics, resisting exercise) - Maintaining BMI-Importance and actions to be taken

UNIT II DIET 4+6

Role of diet in maintaining health - energy one needs to keep active throughout the day - nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes – arthritis – hypertension – PCOD – infertility – ADHD – sleeplessness -helps to reduce the risk of heart diseases - keeps the teeth and bones strong.

Balanced Diet and its 7 Components - Carbohydrates – Proteins – Fats – Vitamins – Minerals - Fibre and Water.

Food additives and their merits & demerits - Effects of food additives - Types of food additives - Food additives and processed foods - Food additives and their reactions

Definition of BMI and maintaining it with diet

Importance - Consequences of not maintaining BMI - different steps to maintain optimal BM

Common cooking mistakes

Different cooking methods, merits and demerits of each method

UNIT III ROLE OF AYURVEDA & SIDDHA SYSTEMS IN MAINTAINING HEALTH

4+4

AYUSH systems and their role in maintaining health - preventive aspect of AYUSH - AYUSH as a soft therapy.

Secrets of traditional healthy living - Traditional Diet and Nutrition - Regimen of Personal and Social Hygiene - Daily routine (Dinacharya) - Seasonal regimens (Ritucharya) - basic sanitation and healthy living environment - Sadvritta (good conduct) - for conducive social life.

Principles of Siddha & Ayurveda systems - Macrocosm and Microcosm theory - Pancheekarana Theory / **(**Five Element Theory) 96 fundamental Principles - Uyir Thathukkal

(Tri-Dosha Theory) - Udal Thathukkal

Prevention of illness with our traditional system of medicine
Primary Prevention - To decrease the number of new cases of a disorder or illness - Health promotion/education, and - Specific protective measures - Secondary Prevention - To lower the rate of established cases of a disorder or illness in the population (prevalence) - Tertiary Prevention - To decrease the amount of disability associated with an existing disorder.

UNIT IV MENTAL WELLNESS

3+4

Emotional health - Definition and types - Three key elements: the subjective experience - the physiological response - the behavioral response - Importance of maintaining emotional health - Role of emotions in daily life -Short term and long term effects of emotional disturbances - Leading a healthy life with emotions - Practices for emotional health - Recognize how thoughts influence emotions - Cultivate positive thoughts - Practice self-compassion - Expressing a full range of emotions.

Stress management - Stress definition - Stress in daily life - How stress affects one's life - Identifying the cause of stress - Symptoms of stress - Managing stress (habits, tools, training, professional help) - Complications of stress mismanagement.

Sleep - Sleep and its importance for mental wellness - Sleep and digestion.
Immunity - Types and importance - Ways to develop immunity

UNIT V YOGA
2+12
Definition and importance of yoga - Types of yoga - How to Choose the Right Kind for individuals according to their age - The Eight Limbs of Yoga - Simple yogasanas for cure and prevention of health disorders - What yoga can bring to our life.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Nutrition and Dietetics - Ashley Martin, Published by White Word Publications, New York, NY 10001, USA
2. Yoga for Beginners_ 35 Simple Yoga Poses to Calm Your Mind and Strengthen Your Body,
   by Cory Martin, Copyright © 2015 by Althea Press, Berkeley, California

REFERENCES:

1. WHAT WE KNOW ABOUT EMOTIONAL INTELLIGENCE How It Affects Learning, Work, Relationships, and Our Mental Health, by Moshe Zeidner, Gerald Matthews, and Richard D. Roberts
   A Bradford Book, The MIT Press, Cambridge, Massachusetts, London, England
2. The Mindful Self-Compassion Workbook, Kristin Neff, Ph.D Christopher Germer, Ph.D, Published by The Guilford Press A Division of Guilford Publications, Inc.370 Seventh Avenue,
   Suite 1200, New York, NY 10001
   1. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4799645/
   2. **Simple lifestyle modifications to maintain health**
      https://www.niddk.nih.gov/health-information/diet-nutrition/changing-habits-better-

health#:~:text=Make%20your%20new%20healthy%20habit,t%20have%20time%20to%20cook.

3. **Read more**: https://www.legit.ng/1163909-classes-food-examples-functions.html
4. https://www.yaclass.in/p/science-state-board/class-9/nutrition-and-health-5926
5. **Benefits of healthy eating** https://www.cdc.gov/nutrition/resources-publications/benefits-of-healthy-eating.html
6. **Food additives** https://www.betterhealth.vic.gov.au/health/conditionsandtreatments/food-additives
7. **BMI** https://www.hsph.harvard.edu/nutritionsource/healthy-weight/ https://www.who.int/europe/news-room/fact-sheets/item/a-healthy-lifestyle---who-recommendations
8. **Yoga**https://www.healthifyme.com/blog/types-of-yoga/ https://yogamedicine.com/guide-types-yoga-styles/ **Ayurveda**:https://vikaspedia.in/health/ayush/ayurveda-1/concept-of-healthy-living-in-ayurveda
9. **Siddha** : http://www.tkdl.res.in/tkdl/langdefault/Siddha/Sid_Siddha_Concepts.asp
10. **CAM :** https://www.hindawi.com/journals/ecam/2013/376327/
11. **Preventive** herbs : https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/

COURSE OUTCOMES:

After completing the course, the students will be able to:

- Learn the importance of different components of health
- Gain confidence to lead a healthy life
- Learn new techniques to prevent lifestyle health disorders
- Understand the importance of diet and workouts in maintaining health

MX3086 HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA L T P C

3 0 0 0

UNIT I CONCEPTS AND PERSPECTIVES

Meaning of History

Objectivity, Determinism, Relativism, Causation, Generalization in History; Moral judgment in history

Extent of subjectivity, contrast with physical sciences, interpretation and speculation, causation verses evidence, concept of historical inevitability, Historical Positivism.

Science and Technology-Meaning, Scope and Importance, Interaction of science, technology & society, Sources of history on science and technology in India.

UNIT II HISTORIOGRAPHY OF SCIENCE AND TECHNOLOGY IN INDIA

Introduction to the works of D.D. Kosambi, Dharmpal, Debiprasad Chattopadhyay, Rehman, S. Irfan Habib, Deepak Kumar, Dhruv Raina, and others.

UNIT III SCIENCE AND TECHNOLOGY IN ANCIENT INDIA

Technology in pre-historic period

Beginning of agriculture and its impact on technology

Science and Technology during Vedic and Later Vedic

times Science and technology from 1st century AD to C-1200.

UNIT IV SCIENCE AND TECHNOLOGY IN MEDIEVAL INDIA
Legacy of technology in Medieval India, Interactions with Arabs
Development in medical knowledge, interaction between Unani and Ayurveda and alchemy Astronomy and Mathematics: interaction with Arabic Sciences
Science and Technology on the eve of British conquest

UNIT V SCIENCE AND TECHNOLOGY IN COLONIAL INDIA
Science and the Empire
Indian response to Western Science
Growth of techno-scientific institutions

UNIT VI SCIENCE AND TECHNOLOGY IN A POST-INDEPENDENT INDIA
Science, Technology and Development
discourse Shaping of the Science and
Technology Policy
Developments in the field of Science and
Technology Science and technology in globalizing
India
Social implications of new technologies like the Information Technology and Biotechnology

TOTAL : 45 PERIODS

MX3087 POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY L T P C

3 0 0 0

Pre-Requisite**:** None. (Desirable: Universal Human Values 1, Universal Human Values 2)

OBJECTIVES:

- This course will begin with a short overview of human needs and desires and how different political-economic systems try to fullfill them. In the process, we will end with a critique of different systems and their implementations in the past, with possible future directions.

COURSE TOPICS:
Considerations for humane society, holistic thought, human being's desires, harmony in self, harmony in relationships, society, and nature, societal systems. **(9 lectures, 1 hour each)**

(Refs: A Nagaraj, M K Gandhi, JC Kumarappa)

Capitalism – Free markets, demand-supply, perfect competition, laissez-faire, monopolies, imperialism. Liberal democracy. **(5 lectures)**

(Refs: Adam smith, J S Mill)

Fascism and totalitarianism. World war I and II. Cold war. **(2 lectures)**

Communism – Mode of production, theory of labour, surplus value, class struggle, dialectical

materialism, historical materialism, Russian and Chinese models.

(Refs: Marx, Lenin, Mao, M N Roy) **(5 lectures)**

Welfare state. Relation with human desires. Empowered human beings, satisfaction. **(3 lectures)**

Gandhian thought. Swaraj, Decentralized economy & polity, Community. Control over one's lives. Relationship with nature. **(6 lectures)**

(Refs: M K Gandhi, Schumacher, Kumarappa)

Essential elements of Indian civilization. **(3 lectures)**

(Refs: Pt Sundarlal, R C Mazumdar, Dharampal)

Technology as driver of society, Role of education in shaping of society. Future directions. **(4 lectures)** (Refs: Nandkishore Acharya, David Dixon, Levis Mumford)

Conclusion (2 lectures)

Total lectures: 39

Preferred Textbooks: See Reference Books

Reference Books: Authors mentioned along with topics above. Detailed reading list will be provided.

GRADING:

Mid sems	30
End sem	20
Home Assign	10
Term paper	40

TOTAL : 45 PERIODS

OUTCOME:

- The students will get an understanding of how societies are shaped by philosophy, political and economic system, how they relate to fulfilling human goals & desires with some case studies of how different attempts have been made in the past and how they have fared.

MX3088 STATE, NATION BUILDING AND POLITICS IN INDIA L T P C

3 0 0 0

OBJECTIVE:

The objective of the course is to provide an understanding of the state, how it works through its main organs, primacy of politics and political process, the concept of sovereignty and its changing contours in a globalized world. In the light of this, an attempt will be made to acquaint the students with the main development and legacies of national movement and constitutional development in India, reasons for adopting a Parliamentary-federal system, the broad philosophy of the Constitution of India and the changing nature of Indian Political System. Challenges/ problems and issues concerning national integration and nation-building will also be discussed in the contemporary context with the aim of developing a future vision for a better India.

TOPICS:

Understanding the need and role of State and politics.

Development of Nation-State, sovereignty, sovereignty in a globalized world.

Organs of State – Executive, Legislature, Judiciary. Separation of powers, forms of government-unitary-federal, Presidential-Parliamentary,
The idea of India.

1857 and the national awakening.

1885 Indian National Congress and development of national movement – its legacies. Constitution making and the Constitution of India.
Goals, objective and
philosophy. Why a federal
system?
National integration and nation-building.

Challenges of nation-building – State against democracy (Kothari) New social movements.
The changing nature of Indian Political System, the future scenario. What can we do?

TOTAL : 45 PERIODS

OUTCOME OF THE COURSE:

It is expected that this course will make students aware of the theoretical aspect of the state, its organs, its operationalization aspect, the background and philosophy behind the founding of the present political system, broad streams and challenges of national integration and nation-building in India. It will equip the students with the real understanding of our political system/ process in correct perspective and make them sit up and think for devising ways for better participation in the system with a view to making the governance and delivery system better for the common man who is often left unheard and unattended in our democratic setup besides generating a lot of dissatisfaction and difficulties for the system.

SUGGESTED READING:

i. Sunil Khilnani, The Idea of India. Penguin India Ltd., New Delhi.
ii. Madhav Khosla, The Indian Constitution, Oxford University Press. New Delhi, 2012.
iii. Brij Kishore Sharma, Introduction to the Indian Constitution, PHI, New Delhi, latest edition.
iv. Sumantra Bose, Transforming India: Challenges to the World's Largest Democracy, Picador India, 2013.
v. Atul Kohli, Democracy and Discontent: India's Growing Crisis of Governability, Cambridge University Press, Cambridge, U. K., 1991.

vi. M. P. Singh and Rekha Saxena, Indian Politics: Contemporary Issues and Concerns, PHI, New Delhi, 2008, latest edition.
vii. Rajni Kothari, Rethinking Democracy, Orient Longman, New Delhi, 2005.

MX3089 INDUSTRIAL SAFETY L T P C

3 0 0 0

OBJECTIVES

- To Understand the Introduction and basic Terminologies safety.
- To enable the students to learn about the Important Statutory Regulations and standards.
- To enable students to Conduct and participate the various Safety activities in the Industry.
- To have knowledge about Workplace Exposures and Hazards.
- To assess the various Hazards and consequences through various Risk Assessment Techniques.

UNIT I SAFETY TERMINOLOGIES

Hazard-Types of Hazard- Risk-Hierarchy of Hazards Control Measures-Lead indicators- lag Indicators-Flammability- Toxicity Time-weighted Average (TWA) - Threshold LimitValue (TLV) - Short Term Exposure Limit (STEL)- Immediately dangerous to life or health (IDLH)- acute and chronic Effects- Routes of Chemical Entry-Personnel Protective Equipment- Health and Safety Policy-Material Safety Data Sheet MSDS

UNIT II STANDARDS AND REGULATIONS

Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006

UNIT III SAFETY ACTIVITIES

Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment

UNIT IV WORKPLACE HEALTH AND SAFETY

Noise hazard- Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition- Electrical Hazards- Crane Safety- Toxic gas Release

UNIT V HAZARD IDENTIFICATION TECHNIQUES

Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment

TOTAL : 45 PERIODS

Course outcomes

on completion of this course the student will be able:

- Understand the basic concept of safety.
- Obtain knowledge of Statutory Regulations and standards.
- Know about the safety Activities of the Working Place.
- Analyze on the impact of Occupational Exposures and their Remedies
- Obtain knowledge of Risk Assessment Techniques.

TEXTBOOKS

1. R.K. Jain and Prof. Sunil S. Rao Industrial Safety, Health and Environment Management Systems KHANNA PUBLISHER
2. L. M. Deshmukh Industrial Safety Management: Hazard Identification and Risk Control McGraw-Hill Education

REFERENCES

1. Frank Lees (2012) 'Lees' Loss Prevention in Process Industries.Butterworth-Heinemann publications, UK, 4th Edition.
2. John Ridley & John Channing (2008)Safety at Work: Routledge, 7th Edition.
3. Dan Petersen (2003) Techniques of Safety Management: A System Approach.
4. Alan Waring.(1996).Safety management system: Chapman &Hall,England
5. Society of Safety Engineers, USA

ONLINE RESOURCES

ISO 45001:2018 occupational health and safety (OH&S) International Organization for Standardization https://www.iso.org/standard/63787.html
Indian Standard code of practice on occupational safety and health audit https://law.resource.org/pub/in/bis/S02/is.14489.1998.pdf
Indian Standard code of practice on Hazard Identification and Risk Analysis IS 15656:2006 https://law.resource.org/pub/in/bis/S02/is.15656.2006.pdf

CO's – PO's & PSO's MAPPING

Course Outcomes	Statement	Program Outcome														
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	Understand the basic concept of safety.	3	3	3	1	1	3	2	2	3	3	1	3	3	3	3
CO2	Obtain knowledge of Statutory Regulations and standards.	2	3	2	2	1	3	2	3	3	2	1	3	3	3	3
CO3	Know about the safety Activities of the Working Place.	2	2	2	2	1	2	2	2	3	2	1	2	3	3	3
CO4	Analyze on the impact of Occupational Exposures and their Remedies	3	3	3	2	2	3	2	2	3	2	1	3	3	3	3
CO5	Obtain knowledge of Risk Assessment Techniques.	3	2	3	2	2	3	2	2	3	2	2	3	3	3	3

Industrial safety	3	3	3	2	1	3	2	2	3	2	1	3	3	3	3

ELECTIVE MANAGEMENT COURES

GE3751 PRINCIPLES OF MANAGEMENT L T P C

3 0 0 3

COURSE OBJECTIVES:

- Sketch the Evolution of Management.
- Extract the functions and principles of management.
- Learn the application of the principles in an organization.
- Study the various HR related activities.
- Analyze the position of self and company goals towards business.

UNIT I INTRODUCTION TO MANAGEMENT AND ORGANIZATIONS 9

Definition of Management – Science or Art – Manager Vs Entrepreneur- types of managers-managerial roles and skills – Evolution of Management –Scientific, human relations, system and contingency approaches– Types of Business organization- Sole proprietorship, partnership, company-public and private sector enterprises- Organization culture and Environment – Current trends and issues in Management.

UNIT II PLANNING 9

Nature and purpose of planning – Planning process – Types of planning – Objectives – Setting objectives – Policies – Planning premises – Strategic Management – Planning Tools and Techniques – Decision making steps and process.

UNIT III ORGANISING 9

Nature and purpose – Formal and informal organization – Organization chart – Organization structure – Types – Line and staff authority – Departmentalization – delegation of authority – Centralization and decentralization – Job Design - Human Resource Management – HR Planning, Recruitment, selection, Training and Development, Performance Management, Career planning and management.

UNIT IV DIRECTING 9

Foundations of individual and group behaviour– Motivation – Motivation theories – Motivational techniques – Job satisfaction – Job enrichment – Leadership – types and theories of leadership – Communication – Process of communication – Barrier in communication – Effective communication – Communication and IT.

UNIT V CONTROLLING 9

System and process of controlling – Budgetary and non - Budgetary control techniques – Use of computers and IT in Management control – Productivity problems and management – Control and performance – Direct and preventive control – Reporting.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Upon completion of the course, students will be able to have clear understanding of

managerial functions like planning, organizing, staffing, leading & controlling.
CO2: Have same basic knowledge on international aspect of management.
CO3: Ability to understand management concept of organizing.
CO4: Ability to understand management concept of directing.
CO5: Ability to understand management concept of controlling.

TEXT BOOKS:

1. Harold Koontz and Heinz Weihrich "Essentials of management" Tata McGraw Hill,1998.
2. Stephen P. Robbins and Mary Coulter, " Management", Prentice Hall (India)Pvt. Ltd., 10th Edition, 2009.

REFERENCES:

1. Robert Kreitner and MamataMohapatra, " Management", Biztantra, 2008.
2. Stephen A. Robbins and David A. Decenzo and Mary Coulter, "Fundamentals of Management" Pearson Education, 7th Edition, 2011.
3. Tripathy PC and Reddy PN, "Principles of Management", Tata Mcgraw Hill, 1999.

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3		-	-	-	1	-	-	-	-	-	-	2	1	1
2	-	1	1	-	-	-	-	-	-	-	-	-	2	1	-
3	1		-	2	-	-	1	-	2	-	1	1	-	-	2
4	-	1	1	1	2	-	-	1	2	-	-	-	1	1	1
5	1		-	-	1	1	-	-	-	3	-	1	1	-	1
AVg.	1.66	1	1	1.5	1.5	1	1	1	2	3	1	1	1.5	1	1.25

GE3752 TOTAL QUALITY MANAGEMENT

L	T	P	C
3	0		0 3

COURSE OBJECTIVES:

- Teach the need for quality, its evolution, basic concepts, contribution of quality gurus, TQMframework, Barriers and Benefits of TQM.
- Explain the TQM Principles for application.
- Define the basics of Six Sigma and apply Traditional tools, New tools, Benchmarking andFMEA.
- Describe Taguchi's Quality Loss Function, Performance Measures and apply Techniqueslike QFD, TPM, COQ and BPR.
- Illustrate and apply QMS and EMS in any organization.

UNIT I INTRODUCTION **9**

Introduction - Need for quality - Evolution of quality - Definition of quality - Dimensions of product and service quality –Definition of TQM-- Basic concepts

of TQM - Gurus of TQM (Brief introduction) -- TQM Framework- Barriers to TQM –Benefits of TQM.

UNIT II TQM PRINCIPLES **9**

Leadership - Deming Philosophy, Quality Council, Quality statements and Strategic planning- Customer Satisfaction –Customer Perception of Quality, Feedback, Customer complaints, Service Quality, Kano Model and Customer retention – Employee involvement – Motivation, Empowerment, Team and Teamwork, Recognition & Reward and Performance Appraisal-- Continuous process improvement –Juran Trilogy, PDSA cycle, 5S and Kaizen - Supplier partnership – Partnering, Supplier selection, Supplier Rating and Relationship development.

UNIT III TQM TOOLS & TECHNIQUES I **9**

The seven traditional tools of quality - New management tools - Six-sigma Process Capability- Bench marking - Reasons to benchmark, Benchmarking process, What to Bench Mark, Understanding Current Performance, Planning, Studying Others, Learning from the data, Using the findings, Pitfalls and Criticisms of Benchmarking - FMEA - Intent , Documentation, Stages: Design FMEA and Process FMEA.

UNIT IV TQM TOOLS & TECHNIQUES II **9**

Quality circles – Quality Function Deployment (QFD) - Taguchi quality loss function – TPM – Concepts, improvement needs – Performance measures- Cost of Quality - BPR.

UNIT V QUALITY MANAGEMENT SYSTEM **9**

Introduction-Benefits of ISO Registration-ISO 9000 Series of Standards-Sector-Specific Standards - AS 9100, TS16949 and TL 9000-- ISO 9001 Requirements-Implementation-Documentation- Internal Audits-Registration-ENVIRONMENTAL MANAGEMENT SYSTEM: Introduction—ISO 14000 Series Standards—Concepts of ISO 14001—Requirements of ISO 14001-Benefits of EMS.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Ability to apply TQM concepts in a selected enterprise.
CO2: Ability to apply TQM principles in a selected enterprise.
CO3: Ability to understand Six Sigma and apply Traditional tools, New tools, Benchmarking andFMEA.
CO4: Ability to understand Taguchi's Quality Loss Function, Performance Measures and applyQFD, TPM, COQ and BPR.
CO5: Ability to apply QMS and EMS in any organization.

COs- POs & PSOs MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3										3	2		3
2						3						3		2	
3					3				3					2	3
4		2			3	2	3	2				3	3	2	
5			3			3	3	2							
AVg.		2.5	3		3	2.6	3	2	3			3	2.5	2	3

TEXT BOOK:

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Bester field,MaryB.Sacre, HemantUrdhwareshe and RashmiUrdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression,2013.

REFERENCES:

1 Joel.E. Ross, “Total Quality Management – Text and Cases”,Routledge.,2017.
2. Kiran.D.R, “Total Quality Management: Key concepts and case studies, Butterworth –Heinemann Ltd, 2016.
3. Oakland, J.S. “TQM – Text with Cases”, Butterworth – Heinemann Ltd., Oxford, Third Edition,2003.
4. Suganthi,L and Anand Samuel, “Total Quality Management”, Prentice Hall (India) Pvt. Ltd.,2006 .

GE3753 ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING L T P C

3

0 0 3

COURSE OBJECTIVES:

- Understanding the concept of Engineering Economics.
- Implement various micro economics concept in real life.
- Gaining knowledge in the field of macro economics to enable the students to have better
- understanding of various components of macro economics.
- Understanding the different procedures of pricing.
- Learn the various cost related concepts in micro economics.

UNIT I DEMAND & SUPPLY ANALYSIS
9

Managerial Economics - Relationship with other disciplines - Firms: Types, objectives and goals - Managerial decisions - Decision analysis.Demand - Types of demand - Determinants of demand - Demand function – Demand elasticity - Demand forecasting - Supply - Determinants of supply - Supply function -Supply elasticity.

UNIT II PRODUCTION AND COST ANALYSIS
9

Production function - Returns to scale - Production optimization - Least cost input - Isoquants - Managerial uses of production function. Cost Concepts - Cost function - Determinants of cost - Short run and Long run cost curves - Cost Output Decision - Estimation of Cost.

UNIT III PRICING
9

Determinants of Price - Pricing under different objectives and different market structures - Price discrimination - Pricing methods in practice.

UNIT IV FINANCIAL ACCOUNTING (ELEMENTARY TREATMENT)
9

Balance sheet and related concepts - Profit & Loss Statement and related concepts - - Financial Ratio Analysis - Cash flow analysis - Funds flow analysis - Comparative financial statements - Analysis & Interpretation of financial statements.

UNIT V CAPITAL BUDGETING (ELEMENTARY TREATMENT) 9

Investments - Risks and return evaluation of investment decision - Average rate of return - Payback Period - Net Present Value - Internal rate of return.

TOTAL: 45 PERIODS

COURSE OUTCOMES: Students able to

CO1: Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions

CO2: Evaluate the economic theories, cost concepts and pricing policies

CO3: Understand the market structures and integration concepts

CO4: Understand the measures of national income, the functions of banks and concepts of globalization

CO5: Apply the concepts of financial management for project appraisal

TEXT BOOKS:

1. Panneer Selvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi,2001.
2. Managerial Economics: Analysis, Problems and Cases - P. L. Mehta, Edition, 13. Publisher, Sultan Chand, 2007.

REFERENCES:

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011.
4. Zahid A khan: Engineering Economy, "Engineering Economy", Dorling Kindersley, 2012
5. Dr. S. N. Maheswari and Dr. S.K. Maheshwari: Financial Accounting, Vikas, 2009

MAPPING OF COS AND POS:

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		3								2			1	3	
2		3												2	2
3		2													
4	2	3	3		2								2	3	
5	3	3	3		2								2		2
AVg.	2.5	2.4	3		2					2			1.8	2.6	2

GE3754 HUMAN RESOURCE MANAGEMENT L T P C

3 0 0 3

OBJECTIVE:

- To provide knowledge about management issues related to staffing,
- To provide knowledge about management issues related to training,
- To provide knowledge about management issues related to performance

- To provide knowledge about management issues related to compensation
- To provide knowledge about management issues related to human factors consideration and compliance with human resource requirements.

UNIT I INTRODUCTION TO HUMAN RESOURCE MANAGEMENT 9

The importance of human resources – Objective of Human Resource Management - Human resource policies - Role of human resource manager.

UNIT II HUMAN RESOURCE PLANNING 9

Importance of Human Resource Planning – Internal and External sources of Human Resources -Recruitment - Selection – Socialization.

UNIT III TRAINING AND EXECUTIVE DEVELOPMENT 9

Types of training and Executive development methods – purpose – benefits.

UNIT IV EMPLOYEE COMPENSATION 9

Compensation plan – Reward – Motivation – Career Development - Mentor – Protege relationships.

UNIT V PERFORMANCE EVALUATION AND CONTROL 9

Performance evaluation – Feedback - The control process – Importance – Methods – grievances –Causes – Redressal methods.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

CO1: Students would have gained knowledge on the various aspects of HRM

CO2: Students will gain knowledge needed for success as a human resources professional.

CO3: Students will develop the skills needed for a successful HR manager.

CO4: Students would be prepared to implement the concepts learned in the workplace.

CO5: Students would be aware of the emerging concepts in the field of HRM

TEXT BOOKS:

1. Decenzo and Robbins, "Human Resource Management", 8th Edition, Wiley, 2007.
2. John Bernardin. H., "Human Resource Management – An Experimental Approach", 5th Edition,
Tata McGraw Hill, 2013, New Delhi.

REFERENCES:

1. Luis R,. Gomez-Mejia, DavidB. Balkin and Robert L. Cardy, “Managing Human Resources", 7th
Edition, PHI, 2012.
2. Dessler, "Human Resource Management", Pearson Education Limited, 2007.

COs- POs & PSOs MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	2	1	2	2	2	1	1	2	1	1	1	1	1	1
2	3	3	2	3	2	2	2	2	3	1	2	1	1	2	1
3	3	3	3	3	3	3	2	2	3	1	2	1	1	2	1

4	3	3	2	3	3	2	2	2	2	1	1	1	1	1	1
5	3	3	1	2	2	2	2	2	2	1	1	1	1	1	1
AVg.	2.8	2.8	1.8	2.6	2.6	2.2	1.8	1.8	2.4	1	1.4	1	1	1.4	1

GE3755 KNOWLEDGE MANAGEMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

The student should be made to:

- Learn the Evolution of Knowledge management.
- Be familiar with tools.
- Be exposed to Applications.
- Be familiar with some case studies.

UNIT I INTRODUCTION 9

Introduction: An Introduction to Knowledge Management - The foundations of knowled ge management- including cultural issues- technology applications organizational concepts and processes- management aspects- and decision support systems. The Evolution of Knowledge management: From Information Management to Knowledge Management - Key Challenges Facing the Evolution of Knowledge Management - Ethics for Knowledge Management.

UNIT II CREATING THE CULTURE OF LEARNING AND KNOWLEDGE SHARING 9

Organization and Knowledge Management - Building the Learning Organization. Knowledge Markets: Cooperation among Distributed Technical Specialists – Tacit Knowledge and Quality Assurance.

UNIT III KNOWLEDGE MANAGEMENT-THE TOOLS 9

Telecommunications and Networks in Knowledge Management - Internet Search Engines and Knowledge Management - Information Technology in Support of Knowledge Management - Knowledge Management and Vocabulary Control - Information Mapping in Information Retrieval - Information Coding in the Internet Environment - Repackaging Information.

UNIT IV KNOWLEDGE MANAGEMENT APPLICATION 9

Components of a Knowledge Strategy - Case Studies (From Library to Knowledge Center, Knowledge
Management in the Health Sciences, Knowledge Management in Developing Countries).

UNIT V FUTURE TRENDS AND CASE STUDIES 9

Advanced topics and case studies in knowledge management - Development of a knowledge management map/plan that is integrated with an organization's strategic and business plan - A case study on Corporate Memories for supporting various aspects in the process life -cycles of an organization.

TOTAL: 45
PERIODS

COURSE OUTCOMES:

Upon completion of the course, the student should be able to:

CO1: Understand the process of acquiry knowledge from experts
CO2: Understand the learning organization.
CO3: Use the knowledge management tools.
CO4: Develop knowledge management Applications.

CO5: Design and develop enterprise applications.

COs- POs & PSOs MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1					1										
2					2								1		
3					2									2	
4				1	1				1					1	
5				1	1				1					1	
AVg.				1	1.4				1				1	1.33	

TEXT BOOK:

1. Srikantaiah, T.K., Koenig, M., "Knowledge Management for the Information Professional" Information Today, Inc., 2000.

REFERENCE:

1. Nonaka, I., Takeuchi, H., "The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation", Oxford University Press, 1995.

GE3792	INDUSTRIAL MANAGEMENT	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1 To study the basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.

2 To study the planning; organizing and staffing functions of management in professional organization.

3 To study the leading; controlling and decision making functions of management in professional organization.

4 To learn the organizational theory in professional organization.

5 To learn the principles of productivity and modern concepts in management in professional organization.

UNIT I INTRODUCTION TO MANAGEMENT 9

Management: Introduction; Definition and Functions – Approaches to the study of Management – Mintzberg's Ten Managerial Roles – Principles of Taylor; Fayol; Weber; Parker – Forms of Organization: Sole Proprietorship; Partnership; Company (Private and Public); Cooperative – Public Sector Vs Private Sector Organization – Business Environment: Economic; Social; Political; Legal – Trade Union: Definition; Functions; Merits & Demerits.

UNIT II FUNCTIONS OF MANAGEMENT - I 9

Planning: Characteristics; Nature; Importance; Steps; Limitation; Planning Premises; Strategic Planning; Vision & Mission statement in Planning– Organizing: Organizing Theory; Principles; Types; Departmentalization; Centralization and Decentralization; Authority & Responsibility – Staffing: Systems Approach; Recruiting and Selection Process; Human Resource Development (HRD) Concept and Design.

UNIT III FUNCTIONS OF MANAGEMENT - II 9

Directing (Leading): Leadership Traits; Style; Morale; Managerial Grids (Blake-Mounton, Reddin) – Communication: Purpose; Model; Barriers – Controlling: Process; Types; Levels; Guidelines; Audit (External, Internal, Merits); Preventive Control – Decision Making: Elements; Characteristics; Nature; Process; Classifications.

UNIT IV ORGANIZATION THEORY **9**

Organizational Conflict: Positive Aspects; Individual; Role; Interpersonal; Intra Group; Inter Group; Conflict Management – Maslow's hierarchy of needs theory; Herzberg's motivation-hygiene theory; McClelland's three needs motivation theory; Vroom's valence-expectancy theory – Change Management: Concept of Change; Lewin's Process of Change Model; Sources of Resistance; Overcoming Resistance; Guidelines to managing Conflict.

UNIT V PRODUCTIVITY AND MODERN TOPICS **9**

Productivity: Concept; Measurements; Affecting Factors; Methods to Improve – Modern Topics (concept, feature/characteristics, procedure, merits and demerits): Business Process Reengineering (BPR); Benchmarking; SWOT/SWOC Analysis; Total Productive Maintenance; Enterprise Resource Planning (ERP); Management of Information Systems (MIS).

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1 Explain basic concepts of management; approaches to management; contributors to management studies; various forms of business organization and trade unions function in professional organizations.

CO2 Discuss the planning; organizing and staffing functions of management in professional organization.

CO3 Apply the leading; controlling and decision making functions of management in professional organization.

CO4 Discuss the organizational theory in professional organization.

CO5 Apply principles of productivity and modern concepts in management in professional organization.

TEXTBOOKS:

1. M. Govindarajan and S. Natarajan, "Principles of Management", Prentice Hall of India, New Delhi, 2009.
2. Koontz. H. and Weihrich. H., "Essentials of Management: An International Perspective", 8th Edition, Tata McGrawhill, New Delhi, 2010.

REFERENCES:

1. Joseph J, Massie, "Essentials of Management", 4th Edition, Pearson Education, 1987.
2. Saxena, P. K., "Principles of Management: A Modern Approach", Global India Publications, 2009.
3. S.Chandran, "Organizational Behaviours", Vikas Publishing House Pvt. Ltd., 1994.
4. Richard L. Daft, "Organization Theory and Design", South Western College Publishing, 11th Edition, 2012.
5. S. TrevisCerto, "Modern Management Concepts and Skills", Pearson Education, 2018.

MAPPING OF COS AND POS:

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3

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

OPEN ELCTIVE I

OHS351 ENGLISH FOR COMPETITIVE EXAMINATIONS L T P C
3 0 0 3

Course Description:
Students aspiring to take up competitive exams of which the English language is a vital component will find this course useful. Designed for students in the higher semesters, the course will help students to familiarise themselves with those aspects of English that are tested in these examinations.

Objectives:

- To train the students in the language components essential to face competitive examinations both at the national (UPSC, Banking, Railway, Defence) and the international level (GRE, TOEFL, IELTS).
- To enhance an awareness of the specific patterns in language testing and the respective skills to tackle verbal reasoning and verbal ability tests.
- To inculcate effective practices in language-learning in order to improve accuracy in usage of grammar and coherence in writing.
- To improve students' confidence to express their ideas and opinions in formal contexts
- To create awareness of accuracy and precision in communication

UNIT I **9**
Orientation on different formats of competitive exams - Vocabulary – Verbal ability – Verbal reasoning - Exploring the world of words – Essential words – Meaning and their usage – Synonyms-antonyms – Word substitution – Word analogy – Idioms and phrases – Commonly confused words – Spellings – Word expansion – New words in use.

UNIT II **9**
Grammar – Sentence improvement –Sentence completion – Rearranging phrases into sentences – Error identification –Tenses – Prepositions – Adjectives – Adverbs – Subject-verb agreement – Voice – Reported speech – Articles – Clauses – Speech patterns.

UNIT III **9**

Reading - Specific information and detail – Identifying main and supporting ideas – Speed reading techniques – Improving global reading skills – Linking ideas – Summarising – Understanding argument – Identifying opinion/attitude and making inferences - Critical reading.

UNIT IV **9**

Writing – Pre-writing techniques – Mindmap - Describing pictures and facts - Paragraph structure – organising points – Rhetoric writing – Improving an answer – Drafting, writing and developing an argument – Focus on cohesion – Using cohesive devices –Analytic writing – Structure and types of essay – Mind maps – Structure of drafts, letters, memos, emails – Statements of Purpose – Structure, Content and Style.

UNIT V **9**

Listening and Speaking – Contextual listening – Listening to instructions – Listening for specific information – Identifying detail, main ideas – Following signpost words – Stress, rhythm and intonation - Speaking to respond and elicit ideas – Guided speaking – Opening phrases – Interactive communication – Dysfluency -Sentence stress – Speaking on a topic – Giving opinions – Giving an oral presentation – Telling a story or a personal anecdote – Talking about oneself - Utterance – Speech acts- Brainstorming ideas – Group discussion.

TOTAL: 45 PERIODS

Learning Outcomes:

At the end of the course, learners will be able

- expand their vocabulary and gain practical techniques to read and comprehend a wide range of texts with the emphasis required
- identify errors with precision and write with clarity and coherence
- understand the importance of task fulfilment and the usage of task-appropriate vocabulary
- communicate effectively in group discussions, presentations and interviews
- write topic based essays with precision and accuracy

Teaching Methods:

Instructional methods will involve discussions, taking mock tests on various question papers – Objective, multiple-choice and descriptive. Peer evaluation, self-check on improvement and peer feedback - Practice sessions on speaking assessments, interview and discussion – Using multimedia.

Evaluative Pattern:

Internal Tests – 50%
End Semester Exam - 50%

TEXTBOOKS:

1.R.P.Bhatnagar - *General English for Competitive Examinations.* Macmillan India Limited, 2009.

REFERENCEBOOKS:

1. Educational Testing Service - The Official Guide to the GRE Revised General Test, Tata McGraw Hill, 2010.
2. The Official Guide to the TOEFL Test, Tata McGraw Hill, 2010.
3. R Rajagopalan- General English for Competitive Examinations, McGraw Hill Education (India) Private Limited, 2008.

Websites

http://www.examenglish.com/, http://www.ets.org/ , http://www.bankxams.com/
http://civilservicesmentor.com/, http://www.educationobserver.com
http://www.cambridgeenglish.org/in/

CO-PO & PSO MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	3	3	1	3	3	3	3	1	3	1	3	-	-	-
2	2	3	3	2	3	3	3	3	1	3	3	3	-	-	-
3	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
4	2	2	2	2	2	2	2	2	3	3	3	3	-	-	-
5	2	2	2	2	2	2	2	2	2	3	2	3	-	-	-
AVg.	2	2.6	2.6	2	2.6	2.6	2.6	2.6	2	3	2.4	3	-	-	-

- 1-low, 2-medium, 3-high, '-"- no correlation

Note: The average value of this course to be used for program articulation matrix.

OMG352 NGOS AND SUSTAINABLE DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES

- to understand the importance of sustainable development
- to acquire a reasonable knowledge on the legal frameworks pertaining to pollution control and environmental management
- to comprehend the role of NGOs in attaining sustainable development

UNIT I ENVIRONMENTAL CONCERNS 9

Introduction to sustainable development goals, Global responsibility of environmental concern, Importance of environmental preservation, Environmental threats, Pollution and its types, Effects of Pollution, Pollution control, Treatment of wastes

UNIT II ROLE OF NGOS 9

Role of NGO's in national development, NGO's and participatory management, Challenges and limitations of NGO's, Community Development programmes, Role of NGO's in Community Development programmes, Participation of NGO's in environment management, Corporate Social responsibility, NGO's and corporate social responsibility

UNIT III SUSTAINABLE DEVELOPMENT 9

Issues and Challenges of Sustainable Development, Bioenergy, Sustainable Livelihoods and Rural Poor in Sustainable Development, Protecting ecosystem services for sustainable development, Non-renewable sources of energy and its effect, Renewable sources of energy for sustainability, Nuclear resources and Legal Regulation of Hazardous Substances, Sustainable Development: Programme and Policies, Sustainability assessment and Indicators

UNIT IV NGO'S FOR SUSTAINABILITY 9

Civil Society Initiatives in Environment Management, Civil Society Initiatives for Sustainable Development, Global Initiatives in Protecting Global Environment, World Summit on Sustainable Development (Johannesburg Summit 2002), Ecological economics, Environmental sustainability, Social inclusion, Health for all, education for all, Food security and Water security, NGOs and Sustainable Development strategies

UNIT V LEGAL FRAMEWORKS 9

Need for a Legal framework and its enforcement, Legal measures to control pollution, Environmental Legislations in India, Mechanism to implement Environmental Laws in India, Legal Protection of Forests Act 1927, Legal Protection of Wild Life, Role of NGO's in implementing environmental laws, Challenges in the implementation of environmental legislation

TOTAL 45 : PERIODS

OUTCOMES

Upon completion of this course, the student will :

CO1 Have a thorough grounding on the issues and challenges being faced in attaining sustainable development

CO2 have a knowledge on the role of NGOs towards sustainable developemnt

CO 3 present strategies for NGOs in attaining sustainable development

CO 4 recognize the importance of providing energy, food security and health equity to all members of the society without damaging the environment

CO 5 understand the environmental legislations

REFERENCE BOOKS

1. Kulsange, S and Kamble, R. (2019). Environmental NGO's: Sustainability Stewardship, Lap Lambert Academic Publishing, India, ISBN-13: 978-6200442444.
2. Dodds, F. (2007). NGO diplomacy: The influence of nongovernmental organizations in international environmental negotiations. Mit Press, Cambridge, ISBN-13: 978-0262524766.
3. Ghosh, S. (Ed.). (2019). Indian environmental law: Key concepts and principles. Orient BlackSwan, India, ISBN-13: 978-9352875795.
4. Alan Fowler and Chiku Malunga (2010) NGO Management: The Earthscan Companion, Routledge, ISBN-13 : 978-1849711197.

MF3003 REVERSE ENGINEERING LT P C
3 0 0 3

COURSE OBJECTIVES:

- The main learning objective of this course is to prepare students for:
- Applying the fundamental concepts and principles of reverse engineering in product design and development.
- Applying the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
- Applying the concept and principles of material identification and process verification in reverse engineering of product design and development.
- Analysing the various legal aspect and applications of reverse engineering in product design and development.
- Understand about 3D scanning hardware & software operations and procedure to generate 3D model

UNIT I INTRODUCTION & GEOMETRIC FORM 9

Definition – Uses – The Generic Process – Phases – Computer Aided Reverse Engineering - Surface and Solid Model Reconstruction – Dimensional Measurement – Prototyping.

UNIT II MATERIAL CHARACTERISTICS AND PROCESS IDENTIFICATION 9

Alloy Structure Equivalency – Phase Formation and Identification – Mechanical Strength – Hardness –Part Failure Analysis – Fatigue – Creep and Stress Rupture – Environmentally Induced Failure Material Specification - Composition Determination - Microstructure Analysis - Manufacturing Process Verification.

UNIT III DATA PROCESSING 9

Statistical Analysis – Data Analysis – Reliability and the Theory of Interference – Weibull Analysis – Data Conformity and Acceptance – Data Report – Performance Criteria – Methodology of Performance Evaluation – System Compatibility.

UNIT IV 3D SCANNING AND MODELLING 9

Introduction, working principle and operations of 3D scanners: Laser, White Light, Blue Light - Applications- Software for scanning and modelling: Types- Applications- Preparation techniques for Scanning objects- Scanning and Measuring strategies - Calibration of 3D Scanner- Step by step procedure: 3D scanning - Geometric modelling – 3D inspection- Case studies.

UNIT V INDUSTRIAL APPLICATIONS 9

Reverse Engineering in the Automotive Industry; Aerospace Industry; Medical Device Industry. Case studies and Solving Industrial projects in Reverse Engineering.Legality: Patent – Copyrights –Trade Secret – Third-Party Materials.

TOTAL : 45 PERIODS

COURSE OUTCOMES:

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

- Apply the fundamental concepts and principles of reverse engineering in product design and development.
- Apply the concept and principles material characteristics, part durability and life limitation in reverse engineering of product design and development.
- Apply the concept and principles of material identification and process verification in reverse engineering of product design and development.
- Apply the concept and principles of data processing, part performance and system compatibility in reverse engineering of product design and development.
- Analyze the various legal aspect
- Applications of reverse engineering in product design and development.

TEXT BOOKS:

1. Robert W. Messler, Reverse Engineering: Mechanisms, Structures, Systems & Materials, 1st Edition, McGraw-Hill Education, 2014
2. Wego Wang, Reverse Engineering Technology of Reinvention, CRC Press, 2011

REFERENCES:

1. Scott J. Lawrence , Principles of Reverse Engineering, Kindle Edition, 2022
2. Kevin Otto and Kristin Wood, Product Design: Techniques in Reverse Engineering and New Product Development, Prentice Hall, 2001
3. Kathryn, A. Ingle, “Reverse Engineering”, McGraw-Hill, 1994.
4. Linda Wills, “Reverse Engineering”, Kluver Academic Publishers, 1996
5. Vinesh Raj and Kiran Fernandes, “Reverse Engineering: An Industrial Perspective”, Springer-Verlag London Limited 2008.

OCH351 NANO TECHNOLOGY L T P C
3 0 0 3

UNIT I INTRODUCTION 8

General definition and size effects–important nano structured materials and nano particles-importance of nano materials- Size effect on thermal, electrical, electronic, mechanical, optical and magnetic properties of nanomaterials- surface area - band gap energy and applications. Photochemistry and Electrochemistry of nanomaterials –Ionic properties of nanomaterials-Nano catalysis.

UNIT II SYNTHESIS OF NANOMATERIALS 8

Bottom up and Top-down approach for obtaining nano materials - Precipitation methods – sol gel technique – high energy ball milling, CVD and PVD methods, gas phase condensation, magnetron sputtering and laser deposition methods – laser ablation, sputtering.

UNIT III NANO COMPOSITES 10

Definition- importance of nanocomposites- nano composite materials-classification of composites- metal/metal oxides, metal-polymer- thermoplastic based, thermoset based and elastomer based- influence of size, shape and role of interface in composites applications.

UNIT IV NANO STRUCTURES AND CHARACTERIZATION TECHNIQUES 10

Classifications of nanomaterials - Zero dimensional, one-dimensional and two-dimensional nanostructures- Kinetics in nanostructured materials- multilayer thin films and superlattice-clusters of metals, semiconductors and nanocomposites. Spectroscopic techniques, Diffraction methods, thermal analysis method, BET analysis method.

UNIT V APPLICATIONS OF NANO MATERIALS 9

Overview of nanomaterials properties and their applications, nano painting, nano coating, nanomaterials for renewable energy, Molecular Electronics and Nanoelectronics – Nanobots-Biological Applications. Emerging technologies for environmental applications- Practice of nanoparticles for environmental remediation and water treatment.

TOTAL : 45 PERIODS

OUTCOMES:

CO1 understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications.
CO2 able to acquire knowledge about the different types of nano material synthesis
CO3 describes about the shape, size,structure of composite nano materials and their interference
CO4 understand the different characterization techniques for nanomaterials
CO5 develop a deeper knowledge in the application of nanomaterials in different fields.

TEXT BOOKS

1. Mick Wilson, Kamali Kannangara,Geoff Smith, Michelle Simmom, Burkhard Raguse, “Nano Technology: Basic Science & Engineering Technology”, 2005, Overseas Press
2. G. Cao, “Nanostructures & Nanomaterials: Synthesis, Properties &Applications” Imperial College Press, 2004
3.William A Goddard “Handbook of Nanoscience, Engineering and Technology”, 3rd Edition, CRC Taylor and Francis group 2012.

REFERENCES

1. R.H.J.Hannink & A.J.Hill, Nanostructure Control, Wood Head Publishing Ltd.,Cambridge, 2006.

2. C.N.R.Rao, A.Muller, A.K.Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications Vol. I & II, 2nd edition, 2005, Wiley VCH Verlag Gibtl & Co
3. Ivor Brodie and Julius J.Muray,'The physics of Micro/Nano – Fabrication',Springer International Edition,2010

CO's- PO's & PSO's MAPPING

Course Outcomes	Statement	Program Outcome														
		PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	understand the basic properties such as structural, physical, chemical properties of nanomaterials and their applications	2	3	2	3	3	-	-	-	1	1	-	3	1	1	3
CO2	acquire knowledge about the different types of nano material synthesis	2	3	1	3	3	-	-	-	1	1	-	3	2	1	3
CO3	describes about the shape, size,structure of composite nano materials and their interference	2	2	2	3	3	1	1	-	1	1	-	3	2	1	3
CO4	understand the different characterization techniques for nanomaterials	2	2	1	3	3	1	1	1	1	-	1	3	1	1	3
CO5	develop a deeper knowledge in the application of nanomaterials in different fields	2	2	1	3	3	1	1	1	1	-	1	3	2	1	3
	Overall CO	3	2	2	1	3	3	1	1	1	1	1	1	3	2	1

OCH352 FUNCTIONAL MATERIALS L T P C
3 0 0 3

OBJECTIVE:

- The course emphasis on the molecular safe assembly and materials for polymer electronics

UNIT I INTRODUCTION 9

Historical Perspectives, Lessons from the Nature, Engineering the Functions, Tuning the functions, Multiscale Modeling and Computation, Classification of Functional Materials, Functional Diversity of Materials, Hybrid Materials, Technological Relevance, Societal Impact.

UNIT II MOLECULAR SELF ASSEMBLY 9

Molecular Organization, Self-Assembly in Biology, Energetics of Self-Organization, A Few Case Studies, Synthetic Protocols and Challenges, Solvent-assisted Self-Assembly, Directed Assembly-Langmuir-Blodgett and Langmuir-Schaefer techniques, Technological Applications of SAMs.

UNIT III BIO-INSPIRED MATERIALS 9

Bio-inspired materials, Classification, Biomimicry, Spider Silk, Lotus Leaf, Gecko feet, Synovial fluid, 'Bionics'-Bio-inspired Information Technologies, Artificial Sensory Organs, Biomineralization- En route to Nanotechnology.

UNIT IV SMART OR INTELLIGENT MATERIALS 9

Criteria for Smartness, Significance of Smart Materials, Representative Examples like Smart Gels and Polymers, Electro/Magneto Rheological Fluids, Smart Electroceramics, Technical Limitations and Challenges, Functional Nanocomposites, Polymer-carbon nanotube composities.

UNIT V MATERIALS FOR POLYMER ELECTRONICS 9

Polymers for Electronics, Organic Light Emitting Diodes, Working Principle of OLEDs, Illustrated Examples, Organic Field-Effect Transistors Operating Principle, Design Considerations, Polymer FETs vs Inorganic FETs, Liquid Crystal Displays, Engineering Aspects of Flat Panel Displays, Intelligent Polymers for Data Storage, Polymer-based Data Storage-Principle, Magnetic Vs. Polymer-based Data Storage.

TOTAL: 45 PERIODS

OUTCOME:

- Students will be able to differentiate among various functional properties and select appropriate material for certain functional applications, analyze the nature and potential of functional material.

TEXT BOOK:

1. Vijayamohanan K. Pillai and MeeraParthasarathy, "Functional Materials: A chemist's perpective", Universities Press Hyderabad (2012).

REFERENCE:

1. Stephen Manne "Biomimetic Materials Chemistry" Wiley-VCH Newyork, 1966.

OEC351 SIGNALS AND SYSTEMS L T P C
3 0 0 3

COURSE OBJECTIVES :

- To understand the basic properties of signal & systems
- To know the methods of characterization of LTI systems in time domain
- To analyze continuous time signals and system in the Fourier and Laplace domain
- To analyze discrete time signals and system in the Fourier and Z transform domain

UNIT I CLASSIFICATION OF SIGNALS AND SYSTEMS 9

Standard signals- Step, Ramp, Pulse, Impulse, Real and complex exponentials and Sinusoids_Classification of signals – Continuous time (CT) and Discrete Time (DT) signals, Periodic & Aperiodic signals, Deterministic & Random signals, Energy & Power signals - Classification of systems- CT systems and DT systems- – Linear & Nonlinear, Time-variant& Time-invariant,Causal & Non-causal, Stable & Unstable.

UNIT II ANALYSIS OF CONTINUOUS TIME SIGNALS 9

Fourier series for periodic signals - Fourier Transform – properties- Laplace Transforms and Properties

UNIT III LINEAR TIME INVARIANT CONTINUOUS TIME SYSTEMS 9

Impulse response - convolution integrals- Differential Equation- Fourier and Laplace transforms in Analysis of CT systems - Systems connected in series / parallel.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS 9

Baseband signal Sampling–Fourier Transform of discrete time signals (DTFT)– Properties of DTFT - Z Transform & Properties

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS 9

Impulse response–Difference equations-Convolution sum- Discrete Fourier Transform and Z Transform Analysis of Recursive & Non-Recursive systems-DT systems connected in series and parallel.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

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

CO1:determine if a given system is linear/causal/stable
CO2: determine the frequency components present in a deterministic signal
CO3:characterize continuous LTI systems in the time domain and frequency domain
CO4:characterize discrete LTI systems in the time domain and frequency domain
CO5:compute the output of an LTI system in the time and frequency domains

TEXT BOOKS:

1. Oppenheim, Willsky and Hamid, "Signals and Systems", 2nd Edition, Pearson Education, New Delhi, 2015.(Units I - V)
2. Simon Haykin, Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2002

REFERENCES :

1. B. P. Lathi, "Principles of Linear Systems and Signals", 2nd Edition, Oxford, 2009.
2. M. J. Roberts, "Signals and Systems Analysis using Transform methods and MATLAB", McGraw- Hill Education, 2018.
3. John Alan Stuller, "An Introduction to Signals and Systems", Thomson, 2007.

CO's- PO's & PSO's MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PS O1	PS O2	PS O3
1	3	-	3	-	3	2	-	-	-	-		3	-	-	1
2	3	-	3	-	-	2	-	-	-	-		3	-	3	-
3	3	3	-	-	3	2	-	-	-	-		3	2	-	-
4	3	3	-	-	3	2	-	-	-	-		3	-	3	1
5	3	3	-	3	3	2	-	-	-	-		3	-	3	1
CO	**3**	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**3**	**1**

CME365 RENEWABLE ENERGY TECHNOLOGIES LT P C

3 0 0 3

COURSE OBJECTIVES

1 To know the Indian and global energy scenario
2 To learn the various solar energy technologies and its applications.
3 To educate the various wind energy technologies.
4 To explore the various bio-energy technologies.
5 To study the ocean and geothermal technologies.

UNIT I ENERGY SCENARIO 9

Indian energy scenario in various sectors – domestic, industrial, commercial, agriculture, transportation and others – Present conventional energy status – Present renewable energy status-Potential of various renewable energy sources-Global energy status-Per capita energy consumption - Future energy plans

UNIT II SOLAR ENERGY 9

Solar radiation – Measurements of solar radiation and sunshine – Solar spectrum - Solar thermal collectors – Flat plate and concentrating collectors – Solar thermal applications – Solar thermal energy storage – Fundamentals of solar photo voltaic conversion – Solar cells – Solar PV Systems – Solar PV applications.

UNIT III WIND ENERGY 9

Wind data and energy estimation – Betz limit - Site selection for windfarms – characteristics - Wind resource assessment - Horizontal axis wind turbine – components - Vertical axis wind turbine – Wind turbine generators and its performance – Hybrid systems – Environmental issues - Applications.

UNIT IV BIO-ENERGY 9

Bio resources – Biomass direct combustion – thermochemical conversion - biochemical conversion-mechanical conversion - Biomass gasifier - Types of biomass gasifiers - Cogeneration –- Carbonisation – Pyrolysis - Biogas plants – Digesters –Biodiesel production – Ethanol production - Applications.

UNIT V OCEAN AND GEOTHERMAL ENERGY 9

Small hydro - Tidal energy – Wave energy – Open and closed OTEC Cycles – Limitations – Geothermal energy – Geothermal energy sources - Types of geothermal power plants – Applications - Environmental impact.

TOTAL: 45 PERIODS

OUTCOMES:

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

- Discuss the Indian and global energy scenario.
- Describe the various solar energy technologies and its applications.
- Explain the various wind energy technologies.
- Explore the various bio-energy technologies.
- Discuss the ocean and geothermal technologies.

TEXT BOOKS:

- Fundamentals and Applications of Renewable Energy | Indian Edition, by Mehmet Kanoglu, Yunus A. Cengel, John M. Cimbala, cGraw Hill; First edition (10 December 2020), ISBN-10 : 9390385636
- Renewable Energy Sources and Emerging Technologies, by Kothari, Prentice Hall India Learning Private Limited; 2nd edition (1 January 2011), ISBN-10 : 8120344707

REFERENCES:

1. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012.
2. Rai.G.D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2014.
3. Sukhatme.S.P., “Solar Energy: Principles of Thermal Collection and Storage”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2009.
4. Tiwari G.N., “Solar Energy – Fundamentals Design, Modelling and applications”, Alpha Science Intl Ltd, 2015.
5. Twidell, J.W. & Weir A., “Renewable Energy Resources”, EFNSpon Ltd., UK, 2015.

CO's – PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	1	1	1	1	1	2	3	2	2	1	1	3	2	1	2
2	3	2	2	1	1	1	3	1	1	1	2	3	2	1	2
3	3	2	3	1	2	1	3	1	1	1	1	3	1	1	2
4	2	2	2	1	2	1	3	1	1	1	2	3	2	2	2
5	2	1	2	1	2	1	3	1	1	1	1	3	2	1	2
Low (1) ; Medium (2) ; High (3)															

AU3008 SENSORS AND ACTUATORS L T P C
3 0 0 3

COURSE OBJECTIVES:

- The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

UNIT I INTRODUCTION TO MEASUREMENTS AND SENSORS 9

Sensors: Functions- Classifications- Main technical requirement and trends Units and standards-Calibration methods- Classification of errors- Error analysis- Limiting error-Probable error-Propagation of error- Odds and uncertainty- principle of transduction-Classification. Static characteristics- mathematical model of transducers- Zero, First and Second order transducers-Dynamic characteristics of first and second order transducers for standard test inputs.

UNIT II VARIABLE RESISTANCE AND INDUTANCE SENSORS 9

Principle of operation- Construction details- Characteristics and applications of resistive potentiometer- Strain gauges- Resistive thermometers- Thermistors- Piezoresistive sensors Inductive potentiometer- Variable reluctance transducers:- EI pick up and LVDT

UNIT III VARIABLE AND OTHER SPECIAL SENSORS 9

Variable air gap type, variable area type and variable permittivity type- capacitor microphone Piezoelectric, Magnetostrictive, Hall Effect, semiconductor sensor- digital transducers-Humidity Sensor. Rain sensor, climatic condition sensor, solar, light sensor, antiglare sensor.

UNIT IV AUTOMOTIVE ACTUATORS 9

Electromechanical actuators- Fluid-mechanical actuators- Electrical machines- Direct-current machines- Three-phase machines- Single-phase alternating-current Machines - Duty-type ratings for electrical machines. Working principles, construction and location of actuators viz. Solenoid, relay, stepper motor etc.

UNIT V AUTOMATIC TEMPERATURE CONTROL ACTUATORS 9

Different types of actuators used in automatic temperature control- Fixed and variable displacement temperature control- Semi Automatic- Controller design for Fixed and variable displacement type air conditioning system.

TOTAL :45 PERIODS

COURSE OUTCOMES:

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

1. List common types of sensor and actuators used in vehicles.
2. Design measuring equipment's for the measurement of pressure force, temperature and flow.

3. Generate new ideas in designing the sensors and actuators for automotive application
4. Understand the operation of thesensors, actuators and electronic control.
5. Design temperature control actuators for vehicles.

TEXT BOOKS:

1. Doebelin's Measurement Systems: 7th Edition (SIE),Ernest O. Doebelin DhaneshN.Manik McGraw Hill Publishers, 2019.
2. Robert Brandy, " Automotive Electronics and Computer System", Prentice Hall,2001
3. William Kimberley," Bosch Automotive Handbook", 6th Edition, Robert Bosch GmbH, 2004.
4. Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th Edition, 2007, ISBN No: 978-3-658-01783-5.

REFERENCES:

1. James D Halderman, " Automotive Electrical and Electronics" , Prentice Hall, USA, 2013
2. Tom Denton, "Automotive Electrical and Electronics Systems," Third Edition, 2004, SAE International.
3. Patranabis.D, " Sensors and Transducers", 2nd Edition, Prentice Hall India Ltd,2003
4. William Ribbens, "Understanding Automotive Electronics -An Engineering Perspective," 7th Edition, Elsevier Butterworth-Heinemann Publishers, 2012.

ORA351	FOUNDATION OF ROBOTICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To study the kinematics, drive systems and programming of robots.
2. To study the basics of robot laws and transmission systems.
3. To familiarize students with the concepts and techniques of robot manipulator, its kinematics.
4. To familiarize students with the various Programming and Machine Vision application in robots.
5. To build confidence among students to evaluate, choose and incorporate robots in engineering systems.

UNIT I FUNDAMENTALS OF ROBOT 9

Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications.

UNIT II ROBOT KINEMATICS 9

Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems. Homogeneous transformation matrices, translation and rotation matrices.

UNIT III ROBOT DRIVE SYSTEMS AND END EFFECTORS 9

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic grippers, vacuum grippers, internal grippers and external grippers, selection and design considerations of a gripper

UNIT IV SENSORS IN ROBOTICS 9

Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis – data reduction, segmentation, feature extraction, object recognition, other algorithms, applications – Inspection, identification, visual serving and navigation.

UNIT V PROGRAMMING AND APPLICATIONS OF ROBOT 9

Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1: Interpret the features of robots and technology involved in the control.

CO2: Apply the basic engineering knowledge and laws for the design of robotics.

CO3: Explain the basic concepts like various configurations, classification and parts of end effectors compare various end effectors and grippers and tools and sensors used in robots.

CO4: Explain the concept of kinematics, degeneracy, dexterity and trajectory planning.

CO5: Demonstrate the image processing and image analysis techniques by machine vision system.

TEXT BOOKS:

1. Ganesh.S.Hedge,"A textbook of Industrial Robotics", Lakshmi Publications, 2006.
2. Mikell.P.Groover , "Industrial Robotics – Technology, Programming and applications" McGraw Hill 2ND edition 2012.

REFERENCES:

1. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co. 2007.
2. YoramKoren, "Robotics for Engineers", McGraw Hill Book, Co., 2002.
3. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill 2005.
4. John. J.Craig, "Introduction to Robotics: Mechanics and Control" 2nd Edition, 2002.
5. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer India reprint, 2010.

CO's- PO's & PSO's MAPPING

COs/POs&PSOs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	1	1								1			3
CO2	3	2	1	1								1			3
CO3	3	2	1	1								1			3
CO4	3	2	1	1								1			3
CO5	3	2	1	1								1			3
CO/PO & PSO Average															
1 – Slight, 2 – Moderate, 3 – Substantial															

CBM356 MEDICAL INFORMATICS L T P C
3 0 0 3

Preamble:

1. To study the applications of information technology in health care management.
2. This course provides knowledge on resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine.

UNIT I INTRODUCTION TO MEDICAL INFORMATICS 9

Introduction - Structure of Medical Informatics –Internet and Medicine -Security issues , Computer based medical information retrieval, Hospital management and information system, Functional capabilities of a computerized HIS, Health Informatics – Medical Informatics, Bioinformatics

UNIT II COMPUTERS IN CLINICAL LABORATORY AND MEDICAL IMAGING 9

Automated clinical laboratories-Automated methods in hematology, cytology and histology, Intelligent Laboratory Information System - Computer assisted medical imaging- nuclear medicine, ultrasound imaging, computed X-ray tomography, Radiation therapy and planning, Nuclear Magnetic Resonance.

UNIT III COMPUTERISED PATIENT RECORD 9

Introduction - conventional patient record, Components and functionality of CPR, Development tools, Intranet, CPR in Radiology- Application server provider, Clinical information system, Computerized prescriptions for patients.

UNIT IV COMPUTER ASSISTED MEDICAL DECISION-MAKING 9

Neuro computers and Artificial Neural Networks application, Expert system-General model of CMD, Computer–assisted decision support system-production rule system cognitive model, semantic networks, decisions analysis inclinical medicine-computers in the care of critically ill patients, Computer aids for the handicapped.

UNIT V RECENT TRENDS IN MEDICAL INFORMATICS 9

Virtual reality applications in medicine, Virtual endoscopy, Computer assisted surgery, Surgical simulation, Telemedicine - Tele surgery, Computer assisted patient education and

health- Medical education and healthcare information, computer assisted instruction in medicine.

TOTAL : 45 PERIODS

Course Outcomes:

Upon completion of the course, students will be able to:

1. Explain the structure and functional capabilities of Hospital Information System.
2. Describe the need of computers in medical imaging and automated clinical laboratory.
3. Articulate the functioning of information storage and retrieval in computerized patient record system.
4. Apply the suitable decision support system for automated clinical diagnosis.
5. Discuss the application of virtual reality and telehealth technology in medical industry.

TEXT BOOKS:

1. Mohan Bansal, "Medical informatics", Tata McGraw Hill Publishing Ltd, 2003.
2. R.D.Lele, "Computers in medicine progress in medical informatics", Tata Mcgraw Hill,2005

REFERENCES:

1. Kathryn J. Hannah, Marion J Ball, "Health Informatics", 3rd Edition, Springer, 2006.

COs- POs & PSOs MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	3	2	1	1	2			1					1	1	1
2	3	2	1	1	2			1					1	1	1
3	3	2	1	1	2			1					1	1	1
4	3	2	1	1	2			1					1	1	1
5	3	2	1	1	2			1					1	1	1
AVg.															

OPEN ELECTIVE II

OEI353 INTRODUCTION TO PLC PROGRAMMING L T P C
3 0 0 3

COURSE OBJECTIVES:

1. Understand basic PLC terminologies digital principles, PLC architecture and operation.
2. Familiarize different programming language of PLC.
3. Develop PLC logic for simple applications using ladder logic.
4. Understand the hardware and software behind PLC and SCADA.
5. Exposures about communication architecture of PLC/SCADA.

UNIT I INTRODUCTION TO PLC 9

Introduction to PLC: Microprocessor, I/O Ports, Isolation, Filters, Drivers, Microcontrollers/DSP, PLC/DDC- PLC Construction: What is a PLC, PLC Memories, PLC I/O, , PLC Special I/O, PLC Types.

UNIT II PLC INSTRUCTIONS 9

PLC Basic Instructions: PLC Ladder Language- Function block Programming- Ladder/Function Block functions- PLC Basic Instructions, Basic Examples (Start Stop Rung, Entry/Reset Rung)- Configuration of Sensors, Switches, Solid State Relays-Interlock examples- Timers, Counters, Examples.

UNIT III PLC PROGRAMMING 9

Different types of PLC program, Basic Ladder logic, logic functions, PLC module addressing, registers basics, basic relay instructions, Latching Relays, arithmetic functions, comparison functions, data handling, data move functions, timer-counter instructions, input-output instructions, sequencer instructions

UNIT IV COMMUNICATION OF PLC AND SCADA 9

Communication Protocol – Modbus, HART, Profibus- Communication facilities SCADA: - Hardware and software, Remote terminal units, Master Station and Communication architectures

UNIT V CASE STUDIES 9

Stepper Motor Control- Elevator Control-CNC Machine Control- conveyor control-Interlocking Problems

TOTAL:45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc) 5

1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)
4. Market survey of Communication Network Used for PLC/SCADA.

COURSE OUTCOMES:

CO1 Know the basic requirement of a PLC input/output devices and architecture. (L1)
CO2 Ability to apply Basics Instruction Sets used for ladder Logic and Function Block Programming.(L2)
CO3 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function BIock.(L3)
CO4 Able to develop a PLC logic for a specific application on real world problem. (L5)
CO5 Ability to Understand the Concepts of Communication used for PLC/SCADA.(L1)

TEXT BOOKS:

1. Frank Petruzzula, Programmable Logic Controllers, Tata Mc-Graw Hill Edition
2. John W. Webb, Ronald A. Reis, Programmable Logic Controllers Principles and Applications, PHI publication

REFERENCES:

1. MadhuchanndMitra and SamerjitSengupta, Programmable Logic Controllers Industrial Automation an Introduction, Penram International Publishing Pvt. Ltd.
2. J. R. Hackworth and F. D. Hackworth, Programmable Logic Controllers Principles andApplications, Pearson publication

List of Open Source Software/ Learning website:

1. https://nptel.ac.in/courses/108105063
2. https://www.electrical4u.com/industrial-automation/
3. https://www.etf.ues.rs.ba/~slubura/Procesni%20racunari/Programmable%20Logic%20Controllers%20Programming%20Methods.pdf
4. https://www.electrical4u.com/industrial-automation/

CO's- PO's & PSO's MAPPING

PO, PSO / CO	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1					1		1					
CO2	3	3	2					1		1	2				2
CO3	3	3	3	3	1			1		1					
CO4	3	3		3	3			1		1			3	3	
CO5	3	3	3	2	1			1		1			3	3	3
Avg	3	2.9	2.25	2.6	1.6			1		1			3	3	2.9

CPE334 ENERGY CONSERVATION AND MANAGEMENT L T P C
3 0 0 3

OBJECTIVES:

At the end of the course, the student is expected to

- understand and analyse the energy data of industries
- carryout energy accounting and balancing
- conduct energy audit and suggest methodologies for energy savings and
- utilise the available resources in optimal ways

UNIT I INTRODUCTION 9

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types, Methodology and Barriers. Role of Energy Managers. Instruments for energy auditing.

UNIT II ELECTRICAL SYSTEMS 9

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept of Capacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor Efficiency Computation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting, Efficacy, LED Lighting and scope of Encon in Illumination.

UNIT III THERMAL SYSTEMS 9

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation and encon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, Flash Steam Utilization, Insulators & Refractories

UNIT IV ENERGY CONSERVATION IN MAJOR UTILITIES 9

Pumps, Fans, Blowers, Compressed Air Systems, Refrigeration and Air Conditioning Systems –Cooling Towers – D.G. sets

UNIT V ECONOMICS **9**

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net Present Value, Life Cycle Costing –ESCO concept

TOTAL: 45 PERIODS

OUTCOMES:

Upon completion of this course, the students can able to analyze the energy data of industries.

CO1: Remember the knowledge for Basic combustion and furnace design and selection of thermal and mechanical energy equipment.

CO2: Study the Importance of Stoichiometry relations, Theoretical air required for complete combustion.

CO3: Skills on combustion thermodynamics and kinetics.

CO4: Apply calculation and design tube still heaters.

CO5: Studied different heat treatment furnace.

CO6: Practical and theoretical knowledge burner design.

TEXT BOOKS:

1. Energy Manager Training Manual (4 Volumes) available at www.energymanagertraining.com. a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India, 2004.

REFERENCES:

1. Witte. L.C., P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation” Hemisphere Publ, Washington, 1988.
2. Callaghn, P.W. “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981.
3. Dryden. I.G.C., “The Efficient Use of Energy” Butterworths, London, 1982
4. Turner. W.C., “Energy Management Hand book”, Wiley, New York, 1982.
5. Murphy. W.R. and G. Mc KAY, “Energy Management”, Butterworths, London 1987

OMA352 OPERATIONS RESEARCH **L T P C**

3 0 0 3

OBJECTIVES:

This course will help the students to

- determine the optimum solution for Linear programming problems.
- study the Transportation and assignment models and various techniques to solve them.
- acquire the knowledge of optimality, formulation and computation of integer programming problems.
- acquire the knowledge of optimality, formulation and computation of dynamic programming problems.
- determine the optimum solution for non-linear programming problems.

UNIT I LINEAR PROGRAMMING **9**

Formulation of linear programming models – Graphical solution – Simplex method - Big M Method – Two phase simplex method - Duality - Dual simplex method.

UNIT II TRANSPORTATION AND ASSIGNMENT PROBLEMS **9**

Matrix form of Transportation problems – Loops in T.P – Initial basic feasible solution – Transportation algorithm – Assignment problem – Unbalanced assignment problems .

UNIT III INTEGER PROGRAMMING 9

Introduction – All and mixed I.P.P – Gomory's method – Cutting plane algorithm – Branch and bound algorithm – Zero – one programming.

UNIT IV DYNAMIC PROGRAMMING PROBLEMS 9

Recursive nature of computation – Forward and backward recursion – Resource Allocation model – Cargo – loading model – Work – force size model - Investment model – Solution of L.P.P by dynamic programming .

UNIT V NON - LINEAR PROGRAMMING PROBLEMS 9

Lagrange multipliers – Equality constraints – Inequality constraints – Kuhn – Tucker Conditions – Quadratic programming.

TOTAL:45 PERIODS

OUTCOMES :

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

- Could develop a fundamental understanding of linear programming models, able to develop a linear programming model from problem description, apply the simplex method for solving linear programming problems.
- analyze the concept of developing, formulating, modeling and solving transportation and assignment problems.
- solve the integer programming problems using various methods.
- conceptualize the principle of optimality and sub-optimization, formulation and computational procedure of dynamic programming.
- determine the optimum solution for non linear programming problems.

TEXT BOOKS:

1. Kanti Swarup, P.K.Gupta and Man Mohan, " Operations Research " , Sultan Chand & Sons, New Delhi, Fifth Edition , 1990.
2. Taha. H.A, " Operations Research – An Introduction , Pearson Education, Ninth Edition , New Delhi, 2012.

REFERENCES :

1. J.K.Sharma , " Operations Research - Theory and Applications " Mac Millan India Ltd , Second Edition , New Delhi , 2003.
2. Richard Bronson & Govindasami Naadimuthu , " Operations Research " (Schaum's Outlines – TMH Edition) Tata McGraw Hill, Second Edition, New Delhi, 2004.
3. Pradeep Prabhakar Pai , " Operations Research and Practice", Oxford University Press, New Delhi , 2012.
4. J.P.Singh and N.P.Singh , " Operations Research , Ane Books Pvt.L.td, New Delhi , 2014.
5. F.S.Hillier and G.J. Lieberman, " Introduction to Operations Research " , Tata McGraw Hill, Eighth Edition , New Delhi, 2005.

CO's- PO's & PSO's MAPPING

	PO 01	PO 02	PO 03	PO 04	PO 05	PO 06	PO 07	PO 08	PO 09	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	3	0	0	0	0	0	0	2	0	0	2	-	-	-
CO2	3	3	3	2	0	0	0	0	2	0	0	2	-	-	-
CO3	3	3	0	0	0	0	0	0	2	0	0	2	-	-	-
CO4	3	3	0	0	0	0	0	0	2	0	0	2	-	-	-
CO5	3	3	2	2	0	0	0	0	2	0	0	2	-	-	-
Avg	3	3	1	0.8	0	0	0	0	2	0	0	2	-	-	-

OHS352 **PROJECT REPORT WRITING** **L T P C**
3 0 0 3

COURSE OBJECTIVE

The Course will enable Learners to,

- Understand the essentials of project writing.
- Perceive the difference between general writing and technical writing
- Assimilate the fundamental features of report writing.
- Understand the essential differences that exist between general and technical writing.
- Learn the structure of a technical and project report.

UNITI **9**

Writing Skills – Essential Grammar and Vocabulary – Passive Voice, Reported Speech, Concord, Signpost words, Cohesive Devices – Paragraph writing - Technical Writing vs. General Writing.

UNIT II **9**

Project Report – Definition, Structure, Types of Reports, Purpose – Intended Audience – Plagiarism – Report Writing in STEM fields – Experiment – Statistical Analysis.

UNIT III **9**

Structure of the Project Report: (Part 1) Framing a Title – Content – Acknowledgement – Funding Details -Abstract – Introduction – Aim of the Study – Background - Writing the research question - Need of the Study/Project Significance, Relevance – Determining the feasibility – Theoretical Framework.

UNIT IV **9**

Structure of the Project Report: (Part 2) – Literature Review, Research Design, Methods of Data Collection - Tools and Procedures - Data Analysis - Interpretation - Findings –Limitations -Recommendations – Conclusion – Bibliography.

UNIT V **9**

Proof reading a report – Avoiding Typographical Errors – Bibliography in required Format – Font – Spacing – Checking Tables and Illustrations – Presenting a Report Orally – Techniques.

TOTAL:45 PERIODS

OUTCOMES

By the end of the course, learners will be able to

- Write effective project reports.
- Use statistical tools with confidence.
- Explain the purpose and intension of the proposed project coherently and with clarity.
- Create writing texts to suit achieve the intended purpose.
- Master the art of writing winning proposals and projects.

REFERENCES

1. Gerson and Gerson - Technical Communication: Process and Product, 7th Edition, Prentice Hall(2012)
2. Virendra K. Pamecha - Guide to Project Reports, Project Appraisals and Project Finance (2012)
3. Daniel Riordan - Technical Report Writing Today (1998)
   Darla-Jean Weatherford - Technical Writing for Engineering Professionals (2016) Penwell
   Publishers.

CO's- PO's & PSO's MAPPING

CO	PO												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2	1	1	1	1	3	2	2	3	3	3	3	-	-	-
2	2	2	2	1	1	1	2	1	2	3	2	3	-	-	-
3	2	2	3	3	2	3	2	2	2	3	2	3	-	-	-
4	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
5	3	3	3	3	3	3	3	3	3	3	3	3	-	-	-
AVg.	2.4	2.2	2.4	2.2	2	2.6	2.4	2.2	2.6	3	2.6	3	-	-	-

- 1-low, 2-medium, 3-high, '-"- no correlation
- **Note:** The average value of this course to be used for program articulation matrix.

OMG355 MULTIVARIATE DATA ANALYSIS L T P C
3 0 0 3

OBJECTIVE:

- To know various multivariate data analysis techniques for business research.

UNIT I INTRODUCTION 9

Uni-variate, Bi-variate and Multi-variate techniques – Classification of multivariate techniques – Guidelines for multivariate analysis and interpretation.

UNIT II PREPARING FOR MULTIVARIATE ANALYSIS 9

Conceptualization of research model with variables, collection of data –-Approaches for dealing with missing data – Testing the assumptions of multivariate analysis.

UNIT III MULTIPLE LINEAR REGRESSION ANALYSIS, FACTOR ANALYSIS 9

Multiple Linear Regression Analysis – Inferences from the estimated regression function – Validation of the model. -Approaches to factor analysis – interpretation of results.

UNIT IV LATENT VARIABLE TECHNIQUES 9

Confirmatory Factor Analysis, Structural equation modelling, Mediation models, Moderation models, Longitudinal studies.

UNIT V ADVANCED MULTIVARIATE TECHNIQUES 9

Multiple Discriminant Analysis, Logistic Regression, Cluster Analysis, Conjoint Analysis, multidimensional scaling.

TOTAL: 45 PERIODS

OUTCOMES :

- Demonstrate a sophisticated understanding of the concepts and methods; know the exact scopes and possible limitations of each method; and show capability of using multivariate techniques to provide constructive guidance in decision making.
- Use advanced techniques to conduct thorough and insightful analysis, and interpret the results correctly with detailed and useful information.
- Show substantial understanding of the real problems; conduct deep analysis using correct methods; and draw reasonable conclusions with sufficient explanation and elaboration.
- Write an insightful and well-organized report for a real-world case study, including thoughtful and convincing details.
- Make better business decisions by using advanced techniques in data analytics. ‘

REFERENCES :

1. Joseph F Hair, Rolph E Anderson, Ronald L. Tatham & William C. Black, Multivariate Data Analysis, Pearson Education, New Delhi, 2005.
2. Barbara G. Tabachnick, Linda S.Fidell, Using Multivariate Statistics, 6th Edition, Pearson, 2012.
3. Richard A Johnson and Dean W.Wichern, Applied Multivariate Statistical Analysis, Prentice Hall, New Delhi, 2005.
4. David R Anderson, Dennis J Seveency, and Thomas A Williams, Statistics for Business and Economics, Thompson, Singapore, 2002

OME355 INDUSTRIAL DESIGN & RAPID PROTOTYPING TECHNIQUES L T P C
3 0 0 3

OBJECTIVES:

The course aims to

- Outline Fundamental concepts in UI & UX
- Introduce the principles of Design and Building an mobile app
- Illustrate the use of CAD in product design
- Outline the choice and use of prototyping tools
- Understanding design of electronic circuits and fabrication of electronic devices

UNIT I UI/UX 9

Fundamental concepts in UI & UX - Tools - Fundamentals of design principles - Psychology and Human Factors for User Interface Design - Layout and composition for Web, Mobile and Devices - Typography - Information architecture - Color theory - Design process flow, wireframes, best practices in the industry -User engagement ethics - Design alternatives

UNIT II APP DEVELOPMENT 9

SDLC - Introduction to App Development - Types of Apps - web Development - understanding Stack - Frontend - backend - Working with Databases - Introduction to API - Introduction to Cloud services - Cloud environment Setup- Reading and writing data to cloud - Embedding ML models to Apps - Deploying application.

UNIT III INDUSTRIAL DESIGN 9

Introduction to Industrial Design - Points, lines, and planes - Sketching and concept generation - Sketch to CAD - Introduction to CAD tools - Types of 3D modeling - Basic 3D Modeling Tools - Part creation – Assembly - Product design and rendering basics - Dimensioning & Tolerancing

UNIT IV MECHANICAL RAPID PROTOTYPING 9

Need for prototyping - Domains in prototyping - Difference between actual manufacturing and prototyping - Rapid prototyping methods - Tools used in different domains - Mechanical Prototyping; 3D Printing and classification - Laser Cutting and engraving - RD Works - Additive manufacturing

UNIT V ELECTRONIC RAPID PROTOTYPING 9

Basics of electronic circuit design - lumped circuits - Electronic Prototyping - Working with simulation tool - simple PCB design with EDA

TOTAL: 45 PERIODS

Course Outcomes

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

- Create quick UI/UX prototypes for customer needs
- Develop web application to test product traction / product feature
- Develop 3D models for prototyping various product ideas
- Built prototypes using Tools and Techniques in a quick iterative methodology

Text Books

1. Peter Fiell, Charlotte Fiell, Industrial Design A-Z, TASCHEN America Llc(2003)
2. Samar Malik, Autodesk Fusion 360 - The Master Guide.
3. Steve Krug, Don't Make Me Think, Revisited: A Common Sense Approach to Web Usability,
Pearson,3rd edition(2014)

References

1. https://www.adobe.com/products/xd/learn/get-star ted.html
2. https://developer.android.com/guide
3. https://help.autodesk.com/view/fusion360/ENU/courses/
4. https://help.prusa3d.com/en/categor y/prusaslicer_204

OML352 ELECTRICAL, ELECTRONIC AND MAGNETIC MATERIALS L T P C
3 0 0 3

COURSE OBJECTIVES:

The main learning objective of this course is to prepare the students for:

1. Understanding the importance of various materials used in electrical, electronics and magnetic applications
2. Acquiring knowledge on the properties of electrical, electronics and magnetic materials.
3. Gaining knowledge on the selection of suitable materials for the given application
4. Knowing the fundamental concepts in Semiconducting materials
5. Getting equipped with the materials used in optical and optoelectronic applications.

UNIT I DIELECTRIC MATERIALS 9

Dielectric as Electric Field Medium, leakage currents, dielectric loss, dielectric strength, breakdown voltage, breakdown in solid dielectrics, flashover, liquid dielectrics, electric conductivity in solid, liquid and gaseous dielectrics, Ferromagnetic materials, properties of ferromagnetic materials in static fields, spontaneous, polarization, curie point, anti-ferromagnetic materials, piezoelectric materials, pyroelectric materials.

UNIT II MAGNETIC MATERIALS 9

Classification of magnetic materials, spontaneous magnetization in ferromagnetic materials, magnetic Anisotropy, Magnetostriction, diamagnetism, magnetically soft and hard materials, special purpose materials, feebly magnetic materials, Ferrites, cast and cermet permanent magnets, ageing of magnets. Factors effecting permeability and Hysteresis

UNIT III SEMICONDUCTOR MATERIALS 9

Properties of semiconductors, Silicon wafers, integration techniques, Large and very large scale Integration techniques. Concept of superconductivity; theories and examples for high temperature superconductivity; discussion on specific superconducting materials; comments on fabrication and engineering applications.

UNIT IV MATERIALS FOR ELECTRICAL APPLICATIONS 9

Materials used for Resistors, rheostats, heaters, transmission line structures, stranded conductors, bimetals fuses, soft and hard solders, electric contact materials, electric carbon materials, thermocouple materials. Solid, Liquid and Gaseous insulating materials, Effect of moisture on insulation.

UNIT V OPTICAL AND OPTOELECTRONIC MATERIALS 9

Principles of photoconductivity - effect of impurities - principles of luminescence-laser principles - He-Ne, injection lasers, LED materials - binary, ternary photoelectronic materials - LCD materials - photo detectors - applications of optoelectronic materials - optical fibres and materials - electro optic modulators - Kerr effect - Pockels effect.

TOTAL: 45 PERIODS

COURSE OUTCOMES:

After completion of this course, the students will be able to

1. Understand various types of dielectric materials, their properties in various conditions.
2. Evaluate magnetic materials and their behavior.
3. Evaluate semiconductor materials and technologies.
4. Select suitable materials for electrical engineering applications.
5. Identify right material for optical and optoelectronic applications

TEXT BOOKS:

1. Pradeep Fulay, “Electronic, Magnetic and Optical materials”, CRC Press, taylor and Francis, 2 nd illustrated edition, 2017.
2. “R K Rajput”, “A course in Electrical Engineering Materials”, Laxmi Publications, 2009.

REFERENCE BOOKS:

1. T K Basak, “A course in Electrical Engineering Materials”, New Age Science Publications, 2009
2. TTTI Madras, “Electrical Engineering Materials”, McGraw Hill Education, 2004.
3. Adrianus J. Dekker, “Electrical Engineering Materials”, PHI Publication, 2006.
4. S. P. Seth, P. V. Gupta “A course in Electrical Engineering Materials”, Dhanpat Rai & Sons, 2011.
5. C. Kittel, “Introduction to Solid State Physics”, 7th Edition, John Wiley & Sons,Singapore, (2006).

CO's- PO's & PSO's MAPPING

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
C01	3	2	2	3								2	2	2	1
C02	3	1	2	2								2	2	2	1
C03	3	2	1	2								2	2	2	1
CO4	3	2	1	2								2	2	2	2
CO5	3	2	2	2								2	2	2	1
Avg	3	1.8	1.6	2.2								2	2	2	1.2

CRA332 DRONE TECHNOLOGIES

L	T	P	C
3	0	0	3

COURSE OBJECTIVES:

6. To understand the basics of drone concepts
7. To learn and understand the fundaments of design, fabrication and programming of drone
8. To impart the knowledge of an flying and operation of drone
9. To know about the various applications of drone
10. To understand the safety risks and guidelines of fly safely

UNIT I INTRODUCTION TO DRONE TECHNOLOGY 9

Drone Concept - Vocabulary Terminology- History of drone - Types of current generation of drones based on their method of propulsion- Drone technology impact on the businesses- Drone business through entrepreneurship- Opportunities/applications for entrepreneurship and employability

UNIT II DRONE DESIGN, FABRICATION AND PROGRAMMING 9

Classifications of the UAV -Overview of the main drone parts- Technical characteristics of the parts -Function of the component parts -Assembling a drone- The energy sources- Level of autonomy- Drones configurations -The methods of programming drone- Download program - Install program on computer- Running Programs- Multi rotor stabilization- Flight modes -Wi-Fi connection.

UNIT III DRONE FLYING AND OPERATION 9

Concept of operation for drone -Flight modes- Operate a small drone in a controlled environment- Drone controls Flight operations –management tool –Sensors-Onboard storage capacity - Removable storage devices- Linked mobile devices and applications

UNIT IV DRONE COMMERCIAL APPLICATIONS 9

Choosing a drone based on the application -Drones in the insurance sector- Drones in delivering mail, parcels and other cargo- Drones in agriculture- Drones in inspection of transmission lines and power distribution -Drones in filming and panoramic picturing

UNIT V FUTURE DRONES AND SAFETY 9

The safety risks- Guidelines to fly safely -Specific aviation regulation and standardization- Drone license- Miniaturization of drones- Increasing autonomy of drones -The use of drones in swarms

TOTAL: 45 PERIODS

COURSE OUTCOMES

Upon successful completion of the course, students should be able to:

CO1: Know about a various type of drone technology, drone fabrication and programming.
CO2: Execute the suitable operating procedures for functioning a drone
CO3: Select appropriate sensors and actuators for Drones
CO4: Develop a drone mechanism for specific applications
CO5: Createthe programs for various drones

TEXT BOOKS

1. Daniel Tal and John Altschuld, “Drone Technology in Architecture, Engineering and Construction: A Strategic Guide to Unmanned Aerial Vehicle Operation and Implementation”, 2021 John Wiley & Sons, Inc.
2. Terry Kilby and Belinda Kilby, “Make:Getting Started with Drones “,Maker Media, Inc, 2016

REFERENCES

1. John Baichtal, “Building Your Own Drones: A Beginners' Guide to Drones, UAVs, and ROVs”, Que Publishing, 2016
2. Zavrsnik, “Drones and Unmanned Aerial Systems: Legal and Social Implications for Security and Surveillance”, Springer, 2018.

CO’s- PO’s & PSO’s MAPPING

COs/Pos&PSOs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	1	2	3	1	3	2						1	2	1	3
CO2	1	2	3	1	3	2						1	2	1	3
CO3	1	2	3	1	3	2						1	2	1	3
CO4	1	2	3	1	3	2						1	2	1	3
CO5	1	2	3	1	3	2						1	2	1	3
CO/PO & PSO Average	1	2	3	1	3	2						1	2	1	3
1 – Slight, 2 – Moderate, 3 – Substantial															

OEI354 INTRODUCTION TO INDUSTRIAL AUTOMATION SYSTEMS L T P C

3 0 0 3

COURSE OBJECTIVES:

1. To educate on design of signal conditioning circuits for various applications.
2. To Introduce signal transmission techniques and their design.
3. Study of components used in data acquisition systems interface techniques
4. To educate on the components used in distributed control systems
5. To introduce the communication buses used in automation industries.

UNIT I INTRODUCTION 9

Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Introduction of PLC and supervisory control and data acquisition (SCADA). Industrial bus systems : Modbus & Profibus

UNIT II AUTOMATION COMPONENTS 9

Sensors for temperature, pressure, force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control.

UNIT III COMPUTER AIDED MEASUREMENT AND CONTROL SYSTEMS 9

Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation.

UNIT IV PROGRAMMABLE LOGIC CONTROLLERS 9

Programmable controllers, Programmable logic controllers, Analog digital input and output modules, PLC programming, Ladder diagram, Sequential flow chart, PLC Communication and networking, PLC selection, PLC Installation, Advantage of using PLC for Industrial automation, Application of PLC to process control industries.

UNIT V DISTRIBUTED CONTROL SYSTEM 9

Overview of DCS, DCS software configuration, DCS communication, DCS Supervisory Computer Tasks, DCS integration with PLC and Computers, Features of DCS, Advantages of DCS.

TOTAL:45 PERIODS

SKILL DEVELOPMENT ACTIVITIES (Group Seminar/Mini Project/Assignment/Content Preparation / Quiz/ Surprise Test / Solving GATE questions/ etc) 5

1. Market survey of the recent PLCs and comparison of their features.
2. Summarize the PLC standards
3. Familiarization of any one programming language (Ladder diagram/ Sequential Function Chart/ Function Block Diagram/ Equivalent open source software)
4. Market survey of Industrial Data Networks.

COURSE OUTCOMES:

Students able to

CO1 Design a signal conditioning circuits for various application (L3).

CO2 Acquire a detail knowledge on data acquisition system interface and DCS system (L2).

CO3 Understand the basics and Importance of communication buses in applied automation Engineering (L2).

CO4 Ability to design PLC Programmes by Applying Timer/Counter and Arithmetic and Logic Instructions Studied for Ladder Logic and Function BIock.(L3)

CO5 Able to develop a PLC logic for a specific application on real world problem. (L5)

TEXT BOOKS:

1. S.K.Singh, “Industrial Instrumentation”, Tata Mcgraw Hill, 2nd edition companies,2003.
2. C D Johnson, “Process Control Instrumentation Technology”, Prentice Hall India,8th Edition, 2006.
3. E.A.Parr, Newnes ,NewDelhi,“Industrial Control Handbook”,3rd Edition, 2000.

REFERENCES:

1. John W. Webb and Ronald A. Reis, “Programmable Logic Controllers: Principles and Applications”, 5th Edition, Prentice Hall Inc., New Jersey, 2003.
2. Frank D. Petruzella, “Programmable Logic Controllers”, 5th Edition, McGraw- Hill, New York, 2016.
3. Krishna Kant, “Computer - Based Industrial Control”, 2nd Edition, Prentice Hall, New Delhi, 2011.
4. Gary Dunning, Thomson Delmar,“Programmable Logic Controller”, CeneageLearning, 3 rd Edition,2005.

List of Open Source Software/ Learning website:

1. https://archive.nptel.ac.in/courses/108/105/108105062/
2. https://nptel.ac.in/courses/108105063
3. https://www.electrical4u.com/industrial-automation/
4. https://realpars.com/what-is-industrial-automation/
5. https://automationforum.co/what-is-industrial-automation-2/

COs- POs & PSOs MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
CO1	3	2	2	2	1	1	-	1	-	1	-	1	1	-	1
CO2	3	`1	1	-	1	-	-	1	-	1	-	-	1	-	1
CO3	3	-	1	-	1	-	-	1	-	1	-	-	1	-	1
CO4	3	3	3	3	1			1		1			1		1
CO5	3	3	3	3	1	1		1		1			1		1
AVg.	3	2.25	2	2.6	1	1	-	1	-	1	-	-	1	-	1

OCH353 ENERGY TECHNOLOGY L T P C
3 0 0 3

UNIT I INTRODUCTION 8

Units of energy, conversion factors, general classification of energy, world energy resources and energy consumption, Indian energy resources and energy consumption, energy crisis, energy alternatives, Renewable and non-renewable energy sources and their availability. Prospects of Renewable energy sources

UNIT II CONVENTIONAL ENERGY 8

Conventional energy resources, Thermal, hydel and nuclear reactors, thermal, hydel and nuclear power plants, efficiency, merits and demerits of the above power plants, combustion processes, fluidized bed combustion.

UNIT III NON-CONVENTIONAL ENERGY 10

Solar energy, solar thermal systems, flat plate collectors, focusing collectors, solar water heating, solar cooling, solar distillation, solar refrigeration, solar dryers, solar pond, solar thermal power generation, solar energy application in India, energy plantations. Wind energy, types of windmills, types of wind rotors, Darrieus rotor and Gravian rotor, wind electric power generation, wind power in India, economics of wind farm, ocean wave energy conversion, ocean thermal energy conversion, tidal energy conversion, geothermal energy.

UNIT IV BIOMASS ENERGY 10

Biomass energy resources, thermo-chemical and biochemical methods of biomass conversion, combustion, gasification, pyrolysis, biogas production, ethanol, fuel cells, alkaline fuel cell, phosphoric acid fuel cell, molten carbonate fuel cell, solid oxide fuel cell, solid polymer electrolyte fuel cell, magneto hydrodynamic power generation, energy storage routes like thermal energy storage, chemical, mechanical storage and electrical storage.

UNIT V ENERGY CONSERVATION 9

Energy conservation in chemical process plants, energy audit, energy saving in heat exchangers, distillation columns, dryers, ovens and furnaces and boilers, steam economy in chemical plants, energy conservation.

TOTAL : 45 PERIODS

OUTCOMES:

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

CO1: Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.

CO2: Students will excel as professionals in the various fields of energy engineering

CO3: Compare different renewable energy technologies and choose the most appropriate based on local conditions.

CO4: Explain the technological basis for harnessing renewable energy sources.

CO5: Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level.

TEXT BOOKS

1. Rao, S. and Parulekar, B.B., Energy Technology, Khanna Publishers, 2005.
2. Rai, G.D., Non-conventional Energy Sources, Khanna Publishers, New Delhi, 1984.
3. Bansal, N.K., Kleeman, M. and Meliss, M., Renewable Energy Sources and Conversion Technology, Tata McGraw Hill, 1990.
4. Nagpal, G.R., Power Plant Engineering, Khanna Publishers, 2008.

REFERENCES

1. Nejat Vezirog, Alternate Energy Sources, IT, McGraw Hill, New York.
2. El. Wakil, Power Plant Technology, Tata McGraw Hill, New York, 2002.
3. Sukhatme. S.P., Solar Enery - Thermal Collection and Storage, Tata McGraw hill, New Delhi, 1981.

CO's- PO's & PSO's MAPPING

Course Outcomes	Program Outcomes															
	Statements	PO1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	Students will be able to describe the fundamentals and main characteristics of renewable energy sources and their differences compared to fossil fuels.	2	3	2	3	3	-	-	-	1	1	-	3	1	1	3
CO2	Students will excel as professionals in the various fields of	2	3	1	3	3	-	-	-	1	1	-	3	2	1	3

	energy engineering															
CO3	Compare different renewable energy technologies and choose the most appropriate based on local conditions.	**2**	**2**	**2**	**3**	**3**	**1**	**1**	**-**	**1**	**1**	**-**	**3**	**2**	**1**	**3**
CO4	Explain the technological basis for harnessing renewable energy sources.	**2**	**2**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**-**	**1**	**3**	**1**	**1**	**3**
CO5	Identify and critically evaluate current developments and emerging trends within the field of renewable energy technologies and to develop in-depth technical understanding of energy problems at an advanced level	**2**	**2**	**1**	**3**	**3**	**1**	**1**	**1**	**1**	**-**	**1**	**3**	**2**	**1**	**3**
OVERALL CO		**2**	**2**	**1**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**3**	**2**	**1**	**3**

1, 2 and 3 are correlation levels with weightings as Slight (Low), Moderate (Medium) and Substantial (High) respectively

VERTICAL 1: FINTECH AND BLOCK CHAIN

CMG331 FINANCIAL MANAGEMENT LT P C
3 0 0 3

LEARNING OBJECTIVES

1.To acquire the knowledge of the decision areas in finance.
2. To learn the various sources of Finance
3. To describe about capital budgeting and cost of capital.
4. To discuss on how to construct a robust capital structure and dividend policy
5. To develop an understanding of tools on Working Capital Management.

UNIT I INTRODUCTION TO FINANCIAL MANGEMENT 9

Definition and Scope of Finance Functions - Objectives of Financial Management - Profit Maximization and Wealth Maximization- Time Value of money- Risk and return concepts.

UNIT II .SOURCES OF FINANCE 9

Long term sources of Finance -Equity Shares – Debentures - Preferred Stock – Features – Merits and Demerits. Short term sources - Bank Sources, Trade Credit, Overdrafts, Commercial Papers, Certificate of Deposits, Money market mutual funds etc

UNIT III INVESTMENT DECISIONS: 9

Investment Decisions: capital budgeting – Need and Importance – Techniques of Capital Budgeting -– Payback -ARR – NPV – IRR –Profitability Index.

Cost of Capital - Cost of Specific Sources of Capital - Equity -Preferred Stock- Debt - Reserves - Concept and measurement of cost of capital - Weighted Average Cost of Capital.

UNIT IVFINANCING AND DIVIDEND DECISION 9

Operating Leverage and Financial Leverage- EBIT-EPS analysis. Capital Structure – determinants of Capital structure- Designing an Optimum capital structure .

Dividend policy - Aspects of dividend policy - practical consideration - forms of dividend policy - - Determinants of Dividend Policy.

UNIT V WORKING CAPITAL DECISION 9

Working Capital Management: Working Capital Management - concepts - importance - Determinants of Working capital. Cash Management: Motives for holding cash – Objectives and Strategies of Cash Management. Receivables Management: Objectives - Credit policies.

TOTAL : 45 PERIODS

TEXT BOOKS

1. M.Y. Khan and P.K.Jain Financial management, Text, Tata McGraw Hill
2. M. Pandey Financial Management, Vikas Publishing House Pvt. Ltd

REFERENCES .

1. James C. Vanhorne –Fundamentals of Financial Management– PHI Learning,.
2. Prasanna Chandra, Financial Management,
3. Srivatsava, Mishra, Financial Management, Oxford University Press, 2011

CMG332 **FUNDAMENTALS OF INVESTMENT** **LT P C**
3 0 0 3

OBJECTIVES:

1. Describe the investment environment in which investment decisions are taken.
2. Explain how to Value bonds and equities
3. Explain the various approaches to value securities
4. Describe how to create efficient portfolios through diversification
5. Discuss the mechanism of investor protection in India.

UNIT I THE INVESTMENT ENVIRONMENT **9**

The investment decision process, Types of Investments – Commodities, Real Estate and FinancialAssets, the Indian securities market, the market participants and trading of securities, securitymarket indices, sources of financial information, Concept of return and risk, Impact of Taxes andInflationonreturn.

UNIT II FIXED INCOME SECURITIES **9**

Bond features, types of bonds, estimating bond yields, Bond Valuation types of bond risks, defaultrisk andcreditrating.

UNIT III APPROACHES TOEQUITYANALYSIS **9**

Introduction to Fundamental Analysis, Technical Analysis and Efficient Market Hypothesis, dividend capitalisation models, and price-earnings multiple approach to equity valuation.

UNIT IV PORTFOLIO ANALYSIS AND FINANCIAL DERIVATIVES **9**

Portfolio and Diversification, Portfolio Risk and Return; Mutual Funds; Introduction to Financial Derivatives; Financial Derivatives Markets in India

UNIT V INVESTOR PROTECTION **9**

Role of SEBI and stock exchanges in investor protection; Investor grievances and their redressal system, insider trading, investors' awareness andactivism

TOTAL : 45 PERIODS

REFERENCES

1. Charles P. Jones, Gerald R. Jensen. Investments: analysis and management. Wiley, 14TH Edition, 2019.
2. Chandra, Prasanna. Investment analysis and portfolio management. McGraw-hill education, 5th, Edition, 2017.
3. Rustagi, R. P. Investment Management Theory and Practice. Sultan Chand & Sons, 2021.
4. ZviBodie, Alex Kane, Alan J Marcus, PitabusMohanty, Investments, McGraw Hill Education (India), 11 Edition(SIE), 2019

CMG333 BANKING, FINANCIAL SERVICES AND INSURANCE LT P C
3 0 0 3

OBJECTIVES

- Understand the Banking system in India
- Grasp how banks raise their sources and how they deploy it
- Understand the development in banking technology
- Understand the financial services in India
- Understand the insurance Industry in India

UNIT I INTRODUCTION TO INDIAN BANKING SYSTEM 9

Overview of Banking system – Structure – Functions –Banking system in India - Key Regulations in Indian Banking sector –RBI. Relationship between Banker and Customer - Retail & Wholesale Banking – types of Accounts - Opening and operation of Accounts.

UNIT II MANAGING BANK FUNDS/ PRODUCTS 9

Liquid Assets - Investment in securities - Advances - Loans.Negotiable Instruments – Cheques, Bills of Exchange & Promissory Notes.Designing deposit schemes– Asset and Liability Management – NPA's – Current issues on NPA's – M&A's of banks into securities market

UNIT III DEVELOPMENT IN BANKING TECHNOLOGY 9

Payment system in India – paper based – e payment –electronic banking –plastic money – e-money –forecasting of cash demand at ATM's –The Information Technology Act, 2000 in India – RBI's Financial Sector Technology vision document – security threats in e-banking & RBI's Initiative.

UNIT IV FINANCIAL SERVICES 9

Introduction – Need for Financial Services – Financial Services Market in India – NBFC –– Leasing and Hire Purchase –– mutual funds. Venture Capital Financing –Bill discounting – factoring – Merchant Banking

UNIT V INSURANCE 9

Insurance –Concept - Need - History of Insurance industry in India. Insurance Act, 1938 – IRDA – Regulations – Life Insurance - Annuities and Unit Linked Policies - Lapse of the Policy – revival – settlement of claim

TOTAL : 45 PERIODS

REFERENCES :

1. Padmalatha Suresh and Justin Paul, "Management of Banking and Financial Services, Pearson, Delhi, 2017.
2. Meera Sharma, "Management of Financial Institutions – with emphasis on Bank and Risk Management", PHI Learning Pvt. Ltd., New Delhi 2010
3. Peter S. Rose and Sylvia C. and Hudgins, "Bank Management and Financial Services", Tata McGraw Hill, New Delhi, 2017

CMG334 INTRODUCTION TO BLOCKCHAIN AND ITS APPLICATIONS LT P C
3 0 0 3

UNIT I INTRODUCTION TO BLOCKCHAIN 9

Blockchain: The growth of blockchain technology - Distributed systems - The history of blockchain and Bitcoin - Features of a blockchain - Types of blockchain, Consensus: Consensus mechanism - Types of consensus mechanisms - Consensus in blockchain. Decentralization: Decentralization using blockchain - Methods of decentralization - Routes to decentralization- Blockchain and full ecosystem decentralization - Smart contracts - Decentralized Organizations- Platforms for decentralization.

UNIT II INTRODUCTION TO CRYPTOCURRENCY 9

Bitcoin – Digital Keys and Addresses – Transactions – Mining – Bitcoin Networks and Payments – Wallets – Alternative Coins – Theoretical Limitations – Bitcoin limitations – Name coin – Prime coin – Zcash – Smart Contracts – Ricardian Contracts- Deploying smart contracts on a blockchain

UNIT III ETHEREUM 9

Introduction - The Ethereum network - Components of the Ethereum ecosystem - Transactions and messages - Ether cryptocurrency / tokens (ETC and ETH) - The Ethereum Virtual Machine (EVM), Ethereum Development Environment: Test networks - Setting up a private net - Starting up the private network

UNIT IV WEB3 AND HYPERLEDGE ` 9

Introduction to Web3 – Contract Deployment – POST Requests – Development Frameworks – Hyperledger as a Protocol – The Reference Architecture – Hyperledger Fabric – Distributed Ledger – Corda.

UNIT V EMERGING TRENDS 9

Kadena – Ripple – Rootstock – Quorum – Tendermint – Scalability – Privacy – Other Challenges – Blockchain Research – Notable Projects – Miscellaneous Tools.

TOTAL : 45 PERIODS

REFERENCE

1. Imran. Bashir. Mastering block chain: Distributed Ledger Technology, Decentralization, and Smart Contracts Explained. Packt Publishing, 2nd Edition, 2018
2. Peter Borovykh , Blockchain Application in Finance, Blockchain Driven, 2nd Edition, 2018
3. ArshdeepBahga, Vijay Madisetti, “Blockchain Applications: A Hands On Approach”, VPT, 2017.

CMG335 FINTECH PERSONAL FINANCE AND PAYMENTS LT P C
3 0 0 3

UNIT I CURRENCY EXCHANGE AND PAYMENT 9

Understand the concept of Crypto currency- Bitcoin and Applications -Cryptocurrencies and Digital Crypto Wallets -Types of Cryptocurrencies - Cryptocurrencies and Applications, block chain, Artificial Intelligence, machine learning. Fintech users, Individual Payments, RTGS Systems, Immediate Page 54 of 90 Payment Service (IMPS), Unified Payments Interface (UPI).Legal and Regulatory Implications of Crypto currencies, Payment systems and their regulations.Digital Payments Smart Cards, Stored-Value Cards, EC Micropayments, Payment

Gateways, Mobile Payments, Digital and Virtual Currencies, Security, Ethical, Legal, Privacy, and Technology Issues

UNIT II DIGITAL FINANCE AND ALTERNATIVE FINANCE 9

A Brief History of Financial Innovation, Digitization of Financial Services, Crowd funding, Charity and Equity,. Introduction to the concept of Initial Coin Offering

UNIT III INSURETECH 9

InsurTech Introduction , Business model disruption AI/ML in InsurTech ● IoT and InsurTech ,Risk Modeling ,Fraud Detection Processing claims and Underwriting Innovations in Insurance Services

UNIT IV PEER TO PEER LENDING 9

P2P and Marketplace Lending, New Models and New Products in market place lending P2P Infrastructure and technologies , Concept of Crowdfunding Crowdfunding Architecture and Technology ,P2P and Crowdfunding unicorns and business models , SME/MSME Lending: Unique opportunities and Challenges, Solutions and Innovations

UNIT V REGULATORY ISSUES 9

FinTech Regulations: Global Regulations and Domestic Regulations, Evolution of RegTech, RegTech Ecosystem: Financial Institutions, RegTech Ecosystem: StartupsRegTech, Startups: Challenges, RegTech Ecosystem: Regulators, Use of AI in regulation and Fraud detection

TOTAL : 45 PERIODS

REFERENCE

1. Swanson Seth, Fintech for Beginners: Understanding and Utilizing the power of technology, Createspace Independent Publishing Platform,2016.
2. Models AuTanda, Fintech Bigtech And Banks Digitalization and Its Impact On Banking Business, Springer, 2019
3. Henning Diedrich, Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations, Wildfire Publishing, 2016
4. Jacob William, FinTech:TheBeginner's Guide to Financial Technology, Createspace Independent Publishing Platform, 2016
5. IIBF, Digital Banking, Taxmann Publication, 2016
6. Jacob William, Financial Technology, Create space Independent Pub, 2016
7. Luke Sutton, Financial Technology: Bitcoin & Blockchain, Createspace Independent Pub, 2016

CMG336 INTRODUCTION TO FINTECH LT P C
3 0 0 3

OBJECTIVES:

1. To learn about history, importance and evolution of Fintech
2. To acquire the knowledge of Fintech in payment industry
3. To acquire the knowledge of Fintech in insurance industry
4. To learn the Fintech developments around the world
5. To know about the future of Fintech

UNIT I INTRODUCTION **9**

Fintech - Definition, History, concept, meaning, architecture, significance, Goals, key areas in Fintech, Importance of Fintech, role of Fintech in economic development, opportunities and challenges in Fintech, Evolution of Fintech in different sectors of the industry - Infrastructure, Banking Industry, Startups and Emerging Markets, recent developments in FinTech, future prospects and potential issues with Fintech.

UNIT II PAYMENT INDUSTRY **9**

FinTech in Payment Industry-Multichannel digital wallets, applications supporting wallets, onboarding and KYC application, FinTech in Lending Industry- Formal lending, Informal lending, P2P lending, POS lending, Online lending, Payday lending, Microfinance, Crowdfunding.

UNIT III INSURANCE INDUSTRY **9**

FinTech in Wealth Management Industry-Financial Advice, Automated investing, Socially responsible investing, Fractional Investing, Social Investing. FinTech in Insurance Industry-P2P insurance, On-Demand Insurance, On-Demand Consultation, Customer engagement through Quote to sell, policy servicing, Claims Management, Investment linked health insurance.

UNIT IV FINTECH AROUND THE GLOBE **9**

FinTech developments - US, Europe and UK, Germany, Sweden, France, China, India, Africa, Australia, New Zealand, Brazil and Middle East, Regulatory and Policy Assessment for Growth of FinTech. FinTech as disruptors, Financial institutions collaborating with FinTech companies, The new financial world.

UNIT V FUTURE OF FINTECH **9**

How emerging technologies will change financial services, the future of financial services, banking on innovation through data, why FinTech banks will rule the world, The FinTech Supermarket, Banks partnering with FinTech start-ups, The rise of BankTech, Fintech impact on Retail Banking, A future without money, Ethics in Fintech.

TOTAL : 45 PERIODS

REFERENCES

1. Arner D., Barbers J., Buckley R, The evolution of FinTech: a new post crisis paradigm, University of New South Wales Research Series, 2015
2. Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley Publications, 2016
3. Richard Hayen, FinTech: The Impact and Influence of Financial Technology on Banking and the Finance Industry, 2016
4. Parag Y Arjunwadkar, FinTech: The Technology Driving Disruption in the financial service industry CRC Press, 2018
5. Sanjay Phadke, Fintech Future : The Digital DNA of Finance Paperback .Sage Publications, 2020
6. Pranay Gupta, T. Mandy Tham, Fintech: The New DNA of Financial Services Paperback, 2018

VERTICAL 2: ENTREPRENEURSHIP

CMG337 FOUNDATIONS OF ENTREPRENERUSHIP

L	T	P	C
3	0	0	3

Course Objectives

- To develop and strengthen the entrepreneurial quality and motivation of learners.
- To impart the entrepreneurial skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of entrepreneurship and management in Technology oriented businessess.
- To empower the learners to run a Technology driven business efficiently and effectively

UNIT I INTRODUCTION TO ENTREPRENEURSHIP 9

Entrepreneurship- Definition, Need, Scope - Entrepreneurial Skill & Traits - Entrepreneur vs. Intrapreneur; Classification of entrepreneurs, Types of entrepreneurs -Factors affecting entrepreneurial development – Achievement Motivation – Contributions of Entreprenrship to Economic Development.

UNIT II BUSINESS OWNERSHIP & ENVRIONMENT 9

Types of Business Ownership – Buiness Envrionemental Factors – Political-Economic-Sociological-Technological-Environmental-Legal aspects – Human Reosurces Mobilisation-Basics of Managing Finance- Esentials of Marketing Management - Production and Operations Planning – Systems Management and Administration

UNIT III FUNDAMENTALS OF TECHNOPRENEURSHIP 9

Introduction to Technopreneurship - Definition, Need, Scope- Emerging Concepts- Principles - Characterisitcis of a technopreneur - Impacts of Technopreneurship on Society – Economy-Job Opportuinites in Technopreneurship - Recent trends

UNIT IV APPLICATIONS OF TECHNOPRENEURSHIP 9

Technology Entrepreneurship - Local, National and Global practices - Intrapreneurship and Technology interactions, Networking of entrepreneurial activities – Launching - Managing Technology based Product / Service entrepreneurship -– Success Stories of Technopreneurs - Case Studies

UNIT V EMERGING TRENDS IN ENTREPRENERUSHIP 9

Effective Business Management Strategies For Franchising - Sub-Contracting- Leasing-Technopreneurs – Agripreneurs - Netpreneurs- Portfolio entreprenerushiip - NGO Entrepreneurship – Recent Entrperneruial Develoments - Local – National – Global perspectives.

TOTAL45 : PERIODS

OUTCOMES:

Upon completion of this course, the student should be able to:

CO 1 Learn the basics of Entrepreneurship

CO 2 Understand the business ownership patterns and evnironment

CO 3 Understand the Job opportunites in Industries relating to Technopreneurship

CO 4 Learn about applications of tehnopreneurship and successful technopreneurs

CO 5 Acquaint with the recent and emerging trends in entreprenerushiip

TEXT BOOKS:

1) S.S.Khanka, “Entrepreneurial Development” S.Chand & Co. Ltd. Ram Nagar New Delhi, 2021.

2) Donal F Kuratko Entrepreneurship (11th Edition) Theory, Process, Practice by Published 2019 by Cengage Learning,

REFERENCES :

1) Daniel Mankani. 2003. Technopreneurship: The successful Entrepreneur in the new Economy. Prentice Hall
2) Edward Elgar. 2007. Entrepreneurship, Cooperation and the Firm: The Emergence and Survival of High-Technology Ventures in Europe. Edi: Jan Ulijn, Dominique Drillon, and Frank Lasch. Wiley Pub.
3) Lang, J. 2002, The High Tech Entrepreneur's Handbook, Ft.com.
4) David Sheff 2002, China Dawn: The Story of a Technology and Business Revolution,
5) HarperBusiness,https://fanny.staff.uns.ac.id/files/2013/12/Technopreneur-BASED-EDUCATION-REVOLUTION.pdf
6) JumpStart: A Technoprenuership Fable, Dennis Posadas, (Singapore: Pearson Prentice Hall, 2009
7) Basics of Technoprenuership: Module 1.1-1.2, Frederico Gonzales, President-PESO Inc; M. Barcelon, UP
8) Journal articles pertaining to Entrepreneurship

CMG338 TEAM BUILDING & LEADERSHIP MANAGEMENT FOR BUSINESS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To develop and strengthen the Leadership qualities and motivation of learners.
- To impart the Leadership skills and traits essential to become successful entrepreneurs.
- To apply the principles and theories of Team Building in managing Technology oriented businessess.
- To empower the learners to build robust teams for running and leading a business efficiently and effectively

UNIT I INTRODUCTION TO MANAGING TEAMS 9

Introduction to Team - Team Dynamics - Team Formation – Stages of Team Devlopment - Enhancing teamwork within a group - Team Coaching - Team Decision Making - Virtual Teams - Self Directed Work Teams (SDWTs) -Multicultural Teams.

UNIT II MANAGING AND DEVELOPING EFFECTIVE TEAMS 9

Team-based Organisations- Leadershp roles in team-based organisations - Offsite training and team development - Experiential Learning - Coaching and Mentoring in team building - Building High-Performance Teams - Building Credibility and Trust - Skills for Developing Others - Team Building at the Top - Leadership in Teamwork Effectiveness.

UNIT III INTRODUCTION TO LEADERSHIP 9

Introduction to Leadership - Leadership Myths – Characteristics of Leader, Follower and Situation - Leadership Attributes - Personality Traits and Leadership- Intelligence Types and Leadership - Power and Leadership - Delegation and Empowerment .

UNIT IV LEADERSHIP IN ORGANISATIONS 9

Leadership Styles – LMX Theory- Leadership Theory and Normative Decision Model - Situational Leadership Model - Contingency Model and Path Goal Theory – Transactional and Transformational Leadership - Charismatic Leadership - Role of Ethics and Values in Organisational Leadership.

UNIT V LEADERSHIP EFFECTIVENESS 9

Leadership Behaviour - Assessment of Leadership Behaviors - Destructive Leadership - Motivation and Leadership - Managerial Incompetence and Derailment Conflict Management - Negotiation and Leadership - Culture and Leadership - Global Leadership – Recent Trends in Leadership.

TOTAL 45 : PERIODS

Upon completion of this course, the student should be able to:

CO 1 Learn the basics of managing teams for business.
CO 2 Understand developing effective teams for business management.
CO 3 Understand the fundamentals of leadership for running a business.
CO 4 Learn about the importance of leadership for business development.
CO 5 Acquaint with emerging trends in leadership effectiveness for entreprenerus.''

REFERENCES :

1. Hughes, R.L., Ginnett, R.C., & Curphy, G.J., Leadership: Enhancing the lessons of experience ,9th Ed, McGraw Hill Education, Chennai, India. (2019).
2. Katzenback, J.R., Smith, D.K., The Wisdom of Teams: Creating the High Performance Organisations, Harvard Business Review Press, (2015).
3. Haldar, U.K., Leadership and Team Building, Oxford University Press, (2010). 4. Daft, R.L., The Leadership Experience, Cengage, (2015).
5. Daniel Levi, Group Dynamics for Teams ,4th Ed, (2014), Sage Publications.
6. Dyer, W. G., Dyer, W. G., Jr., & Dyer, J. H..Team building: Proven strategies for improving team performance, 5thed, Jossey-Bass, (2013).

CMG339 CREATIVITY & INNOVATION IN ENTREPRENEURSHIP L T P C
3 0 0 3

COURSE OBJECTIVES

- To develop the creativity skills among the learners
- To impart the knowledge of creative intelligence essential for entrepreneurs
- To know the applications of innovation in entprerenship.
- To develeop innovative business models for business.

UNIT I CREATIVITY 9

Creativity: Definition- Forms of Creativity-Essence, Elaborative and Expressive Creativities-Quality of Creativity-Existential, Entrepreneurial and Empowerment Creativities – Creative Environment- Creative Technology- - Creative Personality and Motivation.

UNIT II CREATIVE INTELLIGENCE 9

Creative Intelligence: Convergent thinking ability – Traits Congenial to creativity – Creativity Training--Criteria for evaluating Creativity-Credible Evaluation- Improving the quality of our creativity – Creative Tools and Techniques - Blocks to creativity- fears and Disabilities-Strategies for Unblocking- Designing Creativity Enabling Environment.

UNIT III INNOVATION 9

Innovation: Definition- Levels of Innovation- Incremental Vs Radical Innovation-Product Innovation and Process- Technological, Organizational Innovation – Indicators-Characteristics of Innovation in Different Sectors. Theories in Innovation and Creativity-Design Thinking and Innovation- Innovation as Collective Change-Innovation as a system

UNIT IV INNOVATION AND ENTREPRENEURSHIP 9

Innovation and Entrepreneurship: Entrepreneurial Mindset , Motivations and Behaviours- Opportunity Analysis and Decision Making- Industry Understanding - Entrepreneurial Opportunities- Entrepreneurial Strategies – Technology Pull/Market Push – Product -Market fit

UNIT V INNOVATIVE BUSINESS MODELS 9

Innovative Business Models: Customer Discovery-Customer Segments-Prospect Theory and Developing Value Propositions- Developing Business Models: Elements of Business Models – Innovative Business Models: Elements, Designing Innovative Business Models- Responsible Innovation and Creativity.

TOTAL 45 : PERIODS

Upon completion of this course, the student should be able to:
CO 1 Learn the basics of creativity for developing Entrepreneurship
CO 2 Understand the importance of creative inteligence for business growth
CO 3 Understand the advances through Innovation in Industries
CO 4 Learn about applications of innovation in building successful ventures
CO 5 Acquaint with developing innovative business models to run the business effecientlty and effectively

Suggested Readings:

Creativity and Inovation in Entrepreneurship, Kankha, Sultan Chand
Pradip N Khandwalla, Lifelong Creativity, An Unending Quest, Tata Mc Graw Hill, 2004.
Paul Trott, Innovation Management and New Product Development, 4e, Pearson, 2018.
Vinnie Jauhari, Sudanshu Bhushan, Innovation Management, Oxford Higher Education, 2014.
Innovation Management, C.S.G. Krishnamacharyulu, R. Lalitha, Himalaya Publishing House, 2010.
A. Dale Timpe, Creativity, Jaico Publishing House, 2003.
Brian Clegg, Paul Birch, Creativity, Kogan Page, 2009.
Strategic Innovation: Building and Sustaining Innovative Organizations- Course Era, Raj Echambadi.

CMG340 PRINCIPLES OF MARKETING MANAGEMENT FOR BUSINESS L T P C
3 0 0 3

COURSE OBJECTIVES:

- To provide basic knowledge of concepts, principles, tools and techniques of marketing for entrepreneurs
- To provide an exposure to the students pertaining to the nature and Scope of marketing, which they are expected to possess when they enter the industry as practitioners.
- To give them an understanding of fundamental premise underlying market driven strategies and the basic philosophies and tools of marketing management for business owners.

UNIT I INTRODUCTION TO MARKETING MANAGEMENT 9

Introduction - Market and Marketing – Concepts- Functions of Marketing - Importance of Marketing - Marketing Orientations - Marketing Mix-The Traditional 4Ps - The Modern Components of the Mix - The Additional 3Ps - Developing an Effective Marketing Mix.

UNIT II MARKETING ENVIRONMENT **9**

Introduction - Environmental Scanning - Analysing the Organisation's Micro Environment and Macro Environment - Differences between Micro and Macro Environment – Techniques of Environment Scanning - Marketing organization - Marketing Research and the Marketing Information System, Types and Components.

UNIT III PRODUCT AND PRICING MANAGEMENT **9**

Product- Meaning, Classification, Levels of Products – Product Life Cycle (PLC) - Product Strategies - Product Mix - Packaging and Labelling - New Product Development - Brand and Branding - Advantages and disadvantages of branding Pricing - Factors Affecting Price Decisions - Cost Based Pricing - Value Based and Competition Based Pricing - Pricing Strategies - National and Global Pricing.

UNIT IV PROMOTION AND DISTRIBTUION MANAGEMENT **9**

Introduction to Promotion – Marketing Channels- Integrated Marketing Communications (IMC) - Introduction to Advertising and Sales Promotion – Basics of Public Relations and Publicity - Personal Selling - Process - Direct Marketing - Segmentation, Targeting and Positioning (STP)-Logistics Management- Introduction to Retailing and Wholesaling.

UNIT V CONTEMPORARY ISSUES IN MARKETING MANAGEMENT **9**

Introduction - Relationship Marketing Vs. Relationship Management - Customer Relationship Management (CRM) - Forms of Relationship Management - CRM practices - Managing Customer Loyalty and Development – Buyer-Seller Relationships- Buying Situations in Industrial / Business Market - Buying Roles in Industrial Marketing - Factors that Influence Business - Services Marketing - E-Marketing or Online Marketing.

TOTAL 45 : PERIODS

COURSE OUTCOMES:

After completion of this course, the students will be able to :

CO1 Have the awareness of marketing management process

CO 2 Understand the marketing environment

CO 3 Acquaint about product and pricing strategies

CO 4 Knowledge of promotion and distribution in marketing management.

CO 5 Comprehend the contemporary marketing scenairos and offer solutions to marketing issues.

REFERENCES:

1. Marketing Management, Sherlekar S.A, Himalaya Publishing House, 2016.

2. Marketing Management , Philip Kortler and Kevin Lane Keller, PHI 15th Ed, 2015.

3 Marketing Management- An Indian perspective, Vijay Prakash Anand, Biztantra, Second edition,
2016.

4. Marketing Management Global Perspective, Indian Context, V.S.Ramaswamy & S.Namakumari, Macmillan Publishers India,5th edition, 2015.

5. Marketing Management, S.H.H. Kazmi, 2013, Excel Books India.

6. Marketing Management- text and Cases, Dr. C.B.Gupta & Dr. N.Rajan Nair, 17th edition, 2016.

CMG341 HUMAN RESOURCE MANAGEMENT FOR ENTREPRENEURS L T P C
3 0 0 3

OBJECTIVES:

1. To introduce the basic concepts, structure and functions of human resource management for entrepreneurs.
2. To create an awareness of the roles, functions and functioning of human resource department.
3. To understand the methods and techniques followed by Human Resource Management practitioners.

UNIT I INTRODUCTION TO HRM 9

Concept, Definition, Objectives- Nature and Scope of HRM - Evolution of HRM - HR Manager Roles- Skills - Personnel Management Vs. HRM - Human Resource Policies - HR Accounting - HR Audit - Challenges in HRM.

UNIT II HUMAN RESOURCE PLANNING 9

HR Planning - Definition - Factors- Tools - Methods and Techniques - Job analysis- Job rotation- Job Description - Career Planning - Succession Planning - HRIS - Computer Applications in HR - Recent Trends

UNIT III RECRUITMENT AND SELECTION 9

Sources of recruitment- Internal Vs. External - Domestic Vs. Global Sources -eRecruitment - Selection Process- Selection techniques -eSelection- Interview Types- Employee Engagement.

UNIT IV TRAINING AND EMPLOYEE DEVELOPMENT 9

Types of Training - On-The-Job, Off-The-Job - Training Needs Analysis – Induction and Socialisation Process - Employee Compensation - Wages and Salary Administration – Health and Social Security Measures- Green HRM Practices

UNIT V CONTROLLING HUMAN RESOURCES 9

Performance Appraisal – Types - Methods - Collective Bargaining - Grievances Redressal Methods – Employee Discipline – Promotion – Demotion - Transfer – Dismissal - Retrenchment - Union Management Relationship - Recent Trends

TOTAL 45 : PERIODS

Upon completion of this course the learners will be able:

CO 1 To understand the Evolution of HRM and Challenges faced by HR Managers
CO 2 To learn about the HR Planning Methods and practices.
CO 3 To acquaint about the Recruitment and Selection Techniques followed in Industries.
CO 4 To known about the methods of Training and Employee Development.
CO 5 To comprehend the techniques of controlling human resources in organisations.

REFERENCES

1) Gary Dessler and Biju Varkkey, Human Resource Management, 14e , Pearson, 2015.
2) Mathis and Jackson, Human Resource Management, Cengage Learning 15e, 2017.
3) David A. Decenzo, Stephen.P.Robbins, and Susan L. Verhulst, Human Resource Management, Wiley, International Student Edition, 11th Edition, 2014
4) R. Wayne Mondy, Human Resource Management, Pearson , 2015.
5) Luis R.Gomez-Mejia, David B.Balkin, Robert L Cardy. Managing Human Resource. PHI Learning. 2012

6) John M. Ivancevich, Human Resource Management,12e, McGraw Hill Irwin,2013.
7) K. Aswathappa, Sadhna Dash , Human Resource Management - Text and Cases , 9th Edition, McGraw Hill, 2021.
8) Uday Kumar Haldar, Juthika Sarkar. Human Resource management. Oxford. 2012

CMG342 FINANCING NEW BUSINESS VENTURES L T P C
3 0 0 3

Course Objectives

- To develop the basics of business venture financing.
- To impart the knowledge essential for entrepreneurs for financing new ventures.
- To acquaint the learners with the sources of debt and quity financing.
- To empower the learners towards fund rasiing for new ventures effectively.

UNIT I ESSENTIALS OF NEW BUSINES VENTURE 9

Setting up new Business Ventures – Need - Scope - Franchising - Location Strategy, Registration Process - State Directorate of Industries- Financing for New Ventures - Central and State Government Agencies - Types of loans – Financial Institutions - SFC, IDBI, NSIC and SIDCO.

UNIT II INTRODUCTION TO VENTURE FINANCING 9

Venture Finance – Definition – Historic Background - Funding New Ventures- Need – Scope – Types - Cost of Project - Means of Financing - Estimation of Working Capital - Requirement of funds – Mix of Dent and Equity - Challenges and Opportunities.

UNIT III SOURCES OF DEBT FINANCING 9

Fund for Capital Assets - Term Loans - Leasing and Hire-Purchase - Money Market instruments – Bonds, Corporate Papers – Preference Capital- Working Capital Management- Fund based Credit Facilities - Cash Credit - Over Draft.

UNIT IV SOURCES OF EQUITY FINANCING 9

Own Capital, Unsecured Loan - Government Subsidies , Margin Money- Equity Funding - Private Equity Fund- Schemes of Commercial banks - Angel Funding – Crowdfunding- Venture Capital.

UNIT V METHODS OF FUND RAISING FOR NEW VENTURES 9

Investor Decision Process - Identifying the appropriate investors- Targeting investors- Developing Relationships with investors - Investor Selection Criteria- Company Creation- Raising Funds - Seed Funding- VC Selection Criteria – Process- Methods- Recent Trends

TOTAL 45 : PERIODS

OUTCOMES:

Upon completion of this course, the students should be able to:

CO 1 Learn the basics of starting a new business venture.
CO 2 Understand the basics of venture financing.
CO 3 Understand the sources of debt financing.
CO 4 Understanf the sources of equity financing.
CO 5 Acquaint with the methods of fund raising for new business ventures.

REFERENCES :

1) Principles of Corporate Finance by Brealey and Myers et al.,12TH ed, McGraw Hill Education (India) Private Limited, 2018

2) Prasanna Chandra, Projects : Planning ,Analysis,Selection ,Financing,Implementation and Review, McGraw Hilld Education India Pvt Ltd ,New Delhi , 2019.
3) Introduction to Project Finance. Andrew Fight,Butterworth-Heinemann, 2006.
4) Metrick, Andrew; Yasuda, Ayako. Venture Capital And The Finance Of Innovation. Venture Capital And The Finance Of Innovation, 2nd Edition, Andrew Metrick And Ayako Yasuda, Eds., John Wiley And Sons, Inc, 2010.
5) Feld, Brad; Mendelson, Jason. Venture Deals. Wiley, 2011.
6) May, John; Simons, Cal. Every Business Needs An Angel: Getting The Money You Need To Make Your Business Grow. Crown Business, 2001.
7) Gompers, Paul Alan; Lerner, Joshua. The Money Of Invention: How Venture Capital Creates New Wealth. Harvard Business Press, 2001.
8) Camp, Justin J. Venture Capital Due Diligence: A Guide To Making Smart Investment Choices And Increasing Your Portfolio Returns. John Wiley & Sons, 2002.
9) Byers, Thomas. Technology Ventures: From Idea To Enterprise. Mcgraw-Hill Higher Education, 2014.
10) Lerner, Josh; Leamon, Ann; Hardymon, Felda. Venture Capital, Private Equity, And The Financing Of Entrepreneurship. 2012.

VERTICAL 3: PUBLIC ADMINISTRATION

CMG343	PRINCIPLES OF PUBLIC ADMINISTRATION	L T P C 3 0 0 3

UNIT I **(9)**

1. Meaning, Nature and Scope of Public Administration
2. Importance of Public Administration
3. Evolution of Public Administration

UNIT II **(9)**

1. New Public Administration
2. New Public Management
3. Public and Private Administration

UNIT III **(9)**

1. Relationships with Political Science, History and Sociology
2. Classical Approach
3. Scientific Management Approach

UNIT IV **(9)**

1. Bureaucratic Approach: Max Weber
2. Human Relations Approach : Elton Mayo
3. Ecological Approach : Riggs

UNIT V **(9)**

1. Leadership: Leadership - Styles - Approaches
2. Communication: Communication Types - Process - Barriers
3. Decision Making: Decision Making - Types, Techniques and Processes.

TOTAL: 45 PERIODS

REFERENCES:
1. Avasthi and Maheswari: Public Administration in India, Agra:Lakshmi Narain Agarwal,2013.
2. Ramesh K Arora: Indian Public Administration, New Delhi: Wishwa Prakashan, 2012.
3. R.B. Jain: Public Administration in India,21st Century Challenges for Good Governance, New Delhi: Deep and Deep, 2002.
4. Rumki Basu: Public Administration:Concept and Theories, New Delhi:Sterling, 2013.
5. R. Tyagi, Public Administration, Atma Ram & Sons, New Delhi, 1983.

CMG344 **CONSTITUTION OF INDIA** **L T P C**
3 0 0 3

UNIT I **(9)**
1. Constitutional Development Since 1909 to 1947
2. Making of the Constitution.
3. Constituent Assembly

UNIT II **(9)**
1. Fundamental Rights
2. Fundamental Duties
3. Directive Principles of State Policy

UNIT III **(9)**
1. President
2. Parliament
3. Supreme Court

UNIT IV **(9)**
1. Governor
2. State Legislature
3. High Court

UNIT V **(9)**
1. Secularism
2. Social Justice
3. Minority Safeguards

TOTAL: 45 PERIODS

REFERENCES:
1. Basu. D.D.: Introduction to Indian Constitution ; Prentice Hall; New Delhi.
2. Kapur. A.C: Indian Government and Political System; S.Chand and Company Ltd., New Delhi.
3. Johari J.C.: Indian Politics, Vishal Publications Ltd, New Delhi
4. Agarwal R.C: Indian Political System; S.Chand & Co., New Delhi

CMG345 PUBLIC PERSONNEL ADMINISTRATION L T P C
3 0 0 3

UNIT I (9)

1. Meaning, Scope and Importance of Personnel Administration
2. Types of Personnel Systems: Bureaucratic, Democratic and Representative systems

UNIT II (9)

1. Generalist Vs Specialist
2. Civil Servants' Relationship with Political Executive
3. Integrity in Administration.

UNIT III (9)

1. Recruitment: Direct Recruitment and Recruitment from Within
2. Training: Kinds of Training
3. Promotion

UNIT IV (9)

1. All India Services
2. Service Conditions
3. State Public Service Commission

UNIT V (9)

1. Employer Employee Relations
2. Wage and Salary Administration
3. Allowances and Benefits

TOTAL: 45 PERIODS

REFERENCES:

1. Stahl Glean O: Public Personnel Administration
2. Parnandikar Pai V.A: Personnel System for Development Administration.
3. Bhambhiru . P: Bureaucracy and Policy in India.
4. Dwivedi O.P and Jain R.B: India's Administrative state.
5. Muttalis M.A: Union Public Service Commission.
6. Bhakara Rao .V: Employer Employee Relations in India.
7. Davar R.S. Personnel Management & Industrial Relations

CMG346 ADMINISTRATIVE THEORIES LT P C
3 0 0 3

UNIT I (9)

Meaning, Scope and significance of Public Administration, Evolution of Public Administration as a discipline and Identity of Public Administration

UNIT II (9)

Theories of Organization: Scientific Management Theory, Classical Model, Human Relations Theory

UNIT III **(9)**

Organization goals and Behaviour, Groups in organization and group dynamics, Organizational Design.

UNIT IV **(9)**

Motivation Theories, content, process and contemporary; Theories of Leadership: Traditional and Modern: Process and techniques of decision-making

UNIT V **(9)**

Administrative thinkers: Kautilya, Woodrow Willson, C.I. Barnard . Peter Drucker

TOTAL: 45 PERIODS

REFERENCES:

1. Crozior M : The Bureaucratic phenomenon (Chand)
2. Blau. P.M and Scott. W : Formal Organizations (RKP)
3. Presthus. R : The Organizational Society (MAC)
4. Alvi, Shum Sun Nisa : Eminent Administrative Thinkers.
5. Keith Davis : Organization Theory (MAC)

CMG347 **INDIAN ADMINISTRATIVE SYSTEM** **L T P C**
3 0 0 3

UNIT I **(9)**

Evolution and Constitutional Context of Indian Administration, Constitutional Authorities: Finance Commission, Union Public Services Commission, Election Commission, Comptroller and Auditor General of India, Attorney General of India

UNIT II **(9)**

Role & Functions of the District Collector, Relationship between the District Collector and Superintendent of Police, Role of Block Development Officer in development programmes, Local Government

UNIT III **(9)**

Main Features of 73rd Constitutional Amendment Act 1992, Salient Features of 74th Constitutional Amendment Act 1992

UNIT IV **(9)**

Coalition politics in India, Integrity and Vigilance in Indian Administration

UNIT V **(9)**

Corruption – Ombudsman, Lok Pal & Lok Ayuktha

TOTAL: 45 PERIODS

REFERENCES:

1. S.R. Maheswari : Indian Administration
2. Khera. S.S : Administration in India
3. Ramesh K. Arora : Indian Public Administration
4. T.N. Chaturvedi : State administration in India
5. Basu, D.D : Introduction to the Constitution of India

CMG348 PUBLIC POLICY ADMINISTRATION L T P C
3 0 0 3

UNIT I (9)

Meaning and Definition of Public Policy - Nature, Scope and Importance of public policy – Public policy relationship with social sciences especially with political science and Public Administration.

UNIT II (9)

Approaches in Policy Analysis - Institutional Approach – Incremental Approach and System's Approach – Dror's Optimal Model

UNIT III (9)

Major stages involved in Policy making Process – Policy Formulation – Policy Implementation –Policy Evaluation.

UNIT IV (9)

Institutional Framework of Policy making – Role of Bureaucracy – Role of Interest Groups and Role of Political Parties.

UNIT V (9)

Introduction to the following Public Policies – New Economic Policy – Population Policy – Agriculture policy - Information Technology Policy.

TOTAL: 45 PERIODS

REFERENCES:

1. Rajesh Chakrabarti & Kaushik Sanyal : Public Policy in India, Oxford University Press, 2016.
2. Kuldeep Mathur : Public Policy and Politics in India, Oxford University Press, 2016.
3. Bidyutv Chakrabarty: Public Policy: Concept, Theory and Practice, 2015.
4. Pradeep Saxena : Public Policy Administration and Development
5. Sapru R.K. : Public Policy: Formulation, Implementation and Evaluation, Sterling Publishers,
2016.

VERTICAL 4: BUSINESS DATA ANALYTICS

CMG349 STATISTICS FOR MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To learn the applications of statistics in business decision making.

UNIT I INTRODUCTION 9

Basic definitions and rules for probability, Baye's theorem and random variables, Probability distributions: Binomial, Poisson, Uniform and Normal distributions.

UNIT II SAMPLING DISTRIBUTION AND ESTIMATION 9

Introduction to sampling distributions, Central limit theorem and applications, sampling techniques, Point and Interval estimates of population parameters.

UNIT III TESTING OF HYPOTHESIS - PARAMETIRC TESTS **9**

Hypothesis testing: one sample and two sample tests for means of large samples (z-test), one sample and two sample tests for means of small samples (t-test), ANOVA one way.

UNIT IV NON-PARAMETRIC TESTS **9**

Chi-square tests for independence of attributes and goodness of fit, Kolmogorov-Smirnov – test for goodness of fit, Mann – Whitney U test and Kruskal Wallis test.

UNIT V CORRELATION AND REGRESSION **9**

Correlation –Rank Correlation – Regression – Estimation of Regression line – Method of Least Squares – Standard Error of estimate.

TOTAL:45 PERIODS

OUTCOMES:

- To facilitate objective solutions in business decision making.
- To understand and solve business problems
- To apply statistical techniques to data sets, and correctly interpret the results.
- To develop skill-set that is in demand in both the research and business environments
- To enable the students to apply the statistical techniques in a work setting.

REFERENCES:

1. Richard I. Levin, David S. Rubin, Masood H.Siddiqui, Sanjay Rastogi, Statistics for Management, Pearson Education, 8th Edition, 2017.
2. Prem. S. Mann, Introductory Statistics, Wiley Publications, 9th Edition, 2015.
3. T N Srivastava and Shailaja Rego, Statistics for Management, Tata McGraw Hill, 3rd Edition 2017.
4. Ken Black, Applied Business Statistics, 7th Edition, Wiley India Edition, 2012.
5. David R. Anderson, Dennis J. Sweeney, Thomas A.Williams, Jeffrey D.Camm, James J.Cochran, Statistics for business and economics, 13th edition, Thomson (South – Western) Asia, Singapore, 2016.
6. N. D. Vohra, Business Statistics, Tata McGraw Hill, 2017.

CMG350 DATAMINING FOR BUSINESS INTELLIGENCE **L T P C**
3 0 0 3

OBJECTIVES :

- To know how to derive meaning form huge volume of data and information.
- To understand how knowledge discovering process is used in business decision making.

UNIT I INTRODUCTION **9**

Data mining, Text mining, Web mining, Data ware house.

UNIT II DATA MINING PROCESS **9**

Datamining process – KDD, CRISP-DM, SEMMA
Prediction performance measures

UNIT III PREDICTION TECHNIQUES **9**

Data visualization, Time series – ARIMA, Winter Holts,

UNIT IV CLASSIFICATION AND CLUSTERING TECHNIQUES **9**

Classification, Association, Clustering.

UNIT V MACHINE LEARNING AND AI **9**

Genetic algorithms, Neural network, Fuzzy logic, Ant Colony optimization, Particle Swarm optimization

TOTAL: 45 PERIODS

OUTCOMES:

1. Learn to apply various data mining techniques into various areas of different domains.
2. Be able to interact competently on the topic of data mining for business intelligence.
3. Apply various prediction techniques.
4. Learn about supervised and unsupervised learning technique.
5. Develop and implement machine learning algorithms

REFERENCES :

1. Jaiwei Ham and Micheline Kamber, Data Mining concepts and techniques, Kauffmann Publishers 2006
2. Efraim Turban, Ramesh Sharda, Jay E. Aronson and David King, Business Intelligence, Prentice Hall, 2008.
3. W.H.Inmon, Building the Data Warehouse, fourth edition Wiley India pvt. Ltd. 2005.
4. Ralph Kimball and Richard Merz, The data warehouse toolkit, John Wiley, 3rd edition,2013.
5. Michel Berry and Gordon Linoff, Mastering Data mining, John Wiley and Sons Inc, 2nd Edition, 2011
6. Michel Berry and Gordon Linoff, Data mining techniques for Marketing, Sales and Customer support, John Wiley, 2011
7. G. K. Gupta, Ïntroduction to Data mining with Case Studies, Prentice hall of India, 2011
8. Giudici, Applied Data mining – Statistical Methods for Business and Industry, John Wiley. 2009
9. Elizabeth Vitt, Michael Luckevich Stacia Misner, Business Intelligence, Microsoft, 2011
10. Michalewicz Z., Schmidt M. Michalewicz M and Chiriac C, Adaptive Business Intelligence, Springer – Verlag, 2007
11. GalitShmueli, Nitin R. Patel and Peter C. Bruce, Data Mining for Business Intelligence – Concepts, Techniques and Applications Wiley, India, 2010.

CMG351 HUMAN RESOURCE ANALYTICS **L T P C**

3 0 0 3

OBJECTIVE:

- To develop the ability of the learners to define and implement HR metrics that are aligned with the overall business strategy.
- To know the different types of HR metrics and understand their respective impact and application.
- To understand the impact and use of HR metrics and their connection with HR analytics.
- To understand common workforce issues and resolving them using people analytics.

UNIT I INTRODUCTION TO HR ANALYTICS 9

People Analytics - stages of maturity - Human Capital in the Value Chain : impact on business – HR metrics and KPIs.

UNIT II HR ANLYTICS I: RECRUITMENT 9

Recruitment Metrics : Fill-up ratio - Time to hire - Cost per hire - Early turnover - Employee referral hires - Agency hires - Lateral hires - Fulfillment ratio- Quality of hire.

UNIT III HR ANALYTICS - TRAINING AND DEVELOPMENT 9

Training & Development Metrics : Percentage of employees trained- Internally and externally trained -Training hours and cost per employee - ROI.

UNIT IV HR ANALYTICS EMPLOYEE ENGAGEMENT AND CAREER PROGRESSION 9

Employee Engagement Metrics :Talent Retention index - Voluntary and involuntary turnover- grades, performance, and service tenure - Internal hired index Career Progression Metrics: Promotion index - Rotation index - Career path index.

UNIT V HR ANALYTICS IV: WORKFORCE DIVERSITY AND DEVELOPMENT 9

Workforce Diversity and Development Metrics : Employees per manager – Workforce age profiling - Workforce service profiling - Churnover index - Workforce diversity index - Gender mix

TOTAL: 45 PERIODS

OUTCOME:

- The learners will be conversant about HR metrics and ready to apply at work settings.
- The learners will be able to resolve HR issues using people analytics.

REFERENCES:

1. JacFitzenz , The New HR Analytics, AMACOM , 2010.
2. Edwards M. R., & Edwards K, Predictive HR Analytics: Mastering the HR Metric.London: Kogan Page.2016.
3. Human Resources kit for Dummies – 3 rd edition – Max Messmer, 2003
4. Dipak Kumar Bhattacharyya, HR Analytics ,Understanding Theories and Applications, SAGE Publications India ,2017.
5. Sesil, J. C. , Applying advanced analytics to HR management decisions: Methods fo selection, developing incentives, and improving collaboration. Upper Saddle River,New Jersey: Pearson Education,2014.
6. Pease, G., & Beresford, B, Developing Human Capital: Using Analytics to Plan and Optimize Your Learning and Development Investments. Wiley ,2014.
7. Phillips, J., & Phillips, P.P, Making Human Capital Analytics Work: Measuring the ROI of Human Capital Processes and OUTCOME. McGraw-Hill,2014.
8. HR Scorecard and Metrices, HBR, 2001.

CMG352 MARKETING AND SOCIAL MEDIA WEB ANALYTICS L T P C
3 0 0 3

OBJECTIVE:

- To showcase the opportunities that exist today to leverage the power of the web and social media

UNIT I MARKETING ANALYTICS 9

Marketing Budget and Marketing Performance Measure, Marketing - Geographical Mapping, Data Exploration, Market Basket Analysis

UNIT II COMMUNITY BUILDING AND MANAGEMENT 9

History and Evolution of Social Media-Understanding Science of Social Media –Goals for using Social Media- Social Media Audience and Influencers - Digital PR- Promoting Social Media Pages- Linking Social Media Accounts-The Viral Impact of Social Media.

UNIT III SOCIAL MEDIA POLICIES AND MEASUREMENTS 9

Social Media Policies-Etiquette, Privacy- ethical problems posed by emerging social media technologies - The Basics of Tracking Social Media.

UNIT IV WEB ANALYTICS 9

Data Collection, Overview of Qualitative Analysis, Business Analysis, KPI and Planning, Critical Components of a Successful Web Analytics Strategy, Proposals & Reports, Web Data Analysis.

UNIT V SEARCH ANALYTICS 9

Search engine optimization (SEO), user engagement, user-generated content, web traffic analysis, online security, online ethics, data visualization.

TOTAL: 45 PERIODS

OUTCOME:

- The Learners will understand social media, web and social media analytics and their potential impact.

REFERENCES:

1. K. M. Shrivastava, Social Media in Business and Governance, Sterling Publishers Private Limited, 2013
2. Christian Fuchs, Social Media a critical introduction, SAGE Publications Ltd, 2014
3. Bittu Kumar, Social Networking, V & S Publishers, 2013
4. Avinash Kaushik, Web Analytics - An Hour a Day, Wiley Publishing, 2007
5. Ric T. Peterson, Web Analytics Demystified, Celilo Group Media and CafePress 2004
6. Takeshi Moriguchi, Web Analytics Consultant Official Textbook, 7th Edition, 2016

CMG353 OPERATION AND SUPPLY CHAIN ANALYTICS L T P C
3 0 0 3

OBJECTIVE:

- To treat the subject in depth by emphasizing on the advanced quantitative models and methods in operations and supply chain management and its practical aspects and the latest developments in the field.

UNIT I INTRODUCTION **9**

Descriptive, predictive and prescriptive analytics, Data Driven Supply Chains – Basics, transforming supply chains.

UNIT II WAREHOUSING DECISIONS **9**

P-Median Methods - Guided LP Approach, Greedy Drop Heuristics, Dynamic Location Models, Space Determination and Layout Methods.

UNIT III INVENTORY MANAGEMENT **9**

Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and LIMIT, Risk Analysis in Supply Chain, Risk pooling strategies.

UNIT IV TRANSPORTATION NETWORK MODELS **9**

Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Transportation Problems, Set covering and Set Partitioning Problems, Travelling Salesman Problem, Scheduling Algorithms.

UNIT V MCDM MODELS **9**

Analytic Hierarchy Process(AHP), Data Envelopment Analysis (DEA), Fuzzy Logic an Techniques, the analytical network process (ANP), TOPSIS.

TOTAL: 45 PERIODS

OUTCOME:

- To enable quantitative solutions in business decision making under conditions of certainty, risk and uncertainty.

REFERENCES:

1. Nada R. Sanders, Big data driven supply chain management: A framework for implementing analytics and turning information into intelligence, Pearson Education, 2014.
2. Michael Watson, Sara Lewis, Peter Cacioppi, Jay Jayaraman, Supply Chain Network Design:Applying Optimization and Analytics to the Global Supply Chain, Pearson Education, 2013.
3. Anna Nagurney, Min Yu, Amir H. Masoumi, Ladimer S. Nagurney, Networks Against Time: Supply Chain Analytics for Perishable Products, Springer, 2013.
4. Muthu Mathirajan, Chandrasekharan Rajendran, Sowmyanarayanan Sadagopan, Arunachalam Ravindran, Parasuram Balasubramanian, Analytics in Operations/Supply Chain Management , I.K. International Publishing House Pvt. Ltd., 2016.
5. Gerhard J. Plenert, Supply Chain Optimization through Segmentation and Analytics, CRC Press, Taylor & Francis Group, 2014.

CMG354 FINANCIAL ANALYTICS **L T P C**
3 0 0 3

OBJECTIVE:

- This course introduces a core set of modern analytical tools that specifically target finance applications.

UNIT I CORPORATE FINANCE ANALYSIS **9**

Basic corporate financial predictive modelling- Project analysis- cash flow analysis- cost of capital, Financial Break even modelling, Capital Budget model-Payback, NPV, IRR.

UNIT II FINANCIAL MARKET ANALYSIS 9

Estimation and prediction of risk and return (bond investment and stock investment) –Time series-examining nature of data, Value at risk, ARMA, ARCH and GARCH.

UNIT III PORTFOLIO ANALYSIS 9

Portfolio Analysis – capital asset pricing model, Sharpe ratio, Option pricing models- binomial model for options, Black Scholes model and Option implied volatility.

UNIT IV TECHNICAL ANALYSIS 9

Prediction using charts and fundamentals – RSI, ROC, MACD, moving average and candle charts, simulating trading strategies. Prediction of share prices.

UNIT V CREDIT RISK ANALYSIS 9

Credit Risk analysis- Data processing, Decision trees, logistic regression and evaluating credit risk model.

TOTAL: 45 PERIODS

OUTCOME

- The learners should be able to perform financial analysis for decision making using excel, Python and R.

REFERENCES:

1. Financial analytics with R by Mark J. Bennett, Dirk L. Hugen, Cambridge university press.
2. Haskell Financial Data Modeling and Predictive Analytics Paperback – Import, 25 Oct 2013 by Pavel Ryzhov.
3. Quantitative Financial Analytics: The Path To Investment Profits Paperback – Import, 11 Sep 2017 by Edward E Williams (Author), John A Dobelman.
4. Python for Finance - Paperback – Import, 30 Jun 2017 by Yuxing Yan (Author).
5. Mastering Python for Finance Paperback – Import, 29 Apr 2015 by James Ma Weiming.

VERTICAL 5: ENVIRONMENT AND SUSTAINABILITY

CES331 SUSTAINABLE INFRASTRUCTURE DEVELOPMENT L T P C
3 0 0 3

OBJECTIVE:

- To impart knowledge about sustainable Infrastructure development goals, practices and to understand the concepts of sustainable planning, design, construction, maintenance and decommissioning of infrastructure projects.

UNIT I SUSTAINABLE DEVELOPMENT GOALS 9

Definitions, principles and history of Sustainable Development - Sustainable development goals (SDG): global and Indian – Infrastructure Demand and Supply - Environment and Development linkages - societal and cultural demands – Sustainability indicators - Performance indicators of sustainability and Assessment mechanism - Policy frameworks and practices: global and Indian – Infrastructure Project finance – Infrastructure project life cycle - Constraints and barriers for sustainable development - future directions.

UNIT II SUSTAINABLE INFRASTRUCTURE PLANNING 9

Overview of Infrastructure projects: Housing sector, Power sector, Water supply, road, rail and port transportation sector, rural and urban infrastructure. Environmental Impact Assessment

(EIA), Land acquisition -Legal aspects, Resettlement &Rehabilitation and Development - Cost effectiveness Analysis - Risk Management Framework for Infrastructure Projects, Economic, demand, political, socio-environmental and cultural risks. Shaping the Planning Phase of Infrastructure Projects to mitigate risks, Designing Sustainable Contracts, Negotiating with multiple Stakeholders on Infrastructure Projects. Use of ICT tools in planning – Integrated planning - Clash detection in construction - BIM (Building Information Modelling).

UNIT III SUSTAINABLE CONSTRUCTION PRACTICES AND TECHNIQUES 9

Sustainability through lean construction approach - Enabling lean through information technology – Lean in planning and design - IPD (Integrated Project Delivery) - Location Based Management System - Geospatial Technologies for machine control, site management, precision control and real time progress monitoring - Role of logistics in achieving sustainable construction – Data management for integrated supply chains in construction - Resource efficiency benefits of effective logistics - Sustainability in geotechnical practice – Design considerations, Design Parameters and Procedures – Quality control and Assurance - Use of sustainable construction techniques: Precast concrete technology, Pre-engineered buildings.

UNIT IV SUSTAINABLE CONSTRUCTION MATERIALS 9

Construction materials: Concrete, steel, glass, aluminium, timber and FRP - No/Low cement concrete - Recycled and manufactured aggregate - Role of QC and durability - Sustainable consumption – Eco-efficiency - green consumerism - product stewardship and green engineering - Extended producer responsibility – Design for Environment Strategies, Practices, Guidelines, Methods, And Tools. Eco-design strategies –Design for Disassembly - Dematerialization, rematerialization, transmaterialization – Green procurement and green distribution - Analysis framework for reuse and recycling – Typical constraints on reuse and recycling - Communication of Life Cycle Information - Indian Eco mark scheme - Environmental product declarations – Environmental marketing- Life cycle Analysis (LCA), Advances in LCA: Hybrid LCA, Thermodynamic LCA - Extending LCA - economic dimension, social dimension - Life cycle costing (LCC) - Combining LCA and LCC – Case studies

UNIT V SUSTAINABLE MAINTENANCE OF INFRASTRUCTURE PROJECTS 9

Case Studies - Sustainable projects in developed countries and developing nations - An Integrated Framework for Successful Infrastructure Planning and Management - Information Technology and Systems for Successful Infrastructure Management, - Structural Health Monitoring for Infrastructure projects - Innovative Design and Maintenance of Infrastructure Facilities - Capacity Building and Improving the Governments Role in Infrastructure Implementation, Infrastructure Management Systems and Future Directions. – Use of Emerging Technologies – IoT, Big Data Analytics and Cloud Computing, Artificial Intelligences, Machine and Deep Learning, Fifth Generation (5G) Network services for maintenance .

TOTAL: 45 PERIODS

OUTCOME:

On completion of the course, the student is expected to be able to

CO1 Understand the environment sustainability goals at global and Indian scenario.

CO2 Understand risks in development of projects and suggest mitigation measures.

CO3 Apply lean techniques, LBMS and new construction techniques to achieve sustainability in infrastructure construction projects.

CO4 Explain Life Cycle Analysis and life cycle cost of construction materials.

CO5 Explain the new technologies for maintenance of infrastructure projects.

REFERENCES:

1. Charles J Kibert, Sustainable Construction : Green Building Design & Delivery, 4th Edition , Wiley Publishers 2016.

2. Steve Goodhew, Sustainable Construction Process, Wiley Blackwell,UK, 2016.
3. Craig A. Langston & Grace K.C. Ding, Sustainable Practices in the Built Environment, Butterworth Heinemann Publishers, 2011.
4. William P Spence, Construction Materials, Methods & Techniques (3e), Yesdee Publication Pvt. Ltd, 2016.
5. New Building Materials and Construction World magazine
6. Kerry Turner. R, "Sustainable Environmental Management", Principles and Practice Publisher:Belhaven Press,ISBN:1852930039.
7. Munier N, "Introduction to Sustainability", Springer2005
8. Sharma, "Sustainable Smart Cities In India: Challenges And Future Perspectives", SPRINGER, 2022.
9. Ralph Horne, Tim Grant, KarliVerghese, Life Cycle Assessment: Principles, Practice and Prospects, Csiro Publishing,2009
10. European Commission - Joint Research Centre - Institute for Environment and Sustainability: International Reference Life Cycle Data System (ILCD) Handbook - General guide for Life Cycle Assessment - Detailed guidance. Luxembourg. European Union;2010
11. Hudson, Haas, Uddin, Infrastructure management: integrating design, construction, maintenance, rehabilitation, and renovation, McGraw Hill, (1997).
12. GregerLundesjö, Supply Chain Management and Logistics in Construction: Delivering Tomorrow's Built Environment, Kogan Page Publishers, 2015.

COs- POs & PSOs MAPPING

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	2		1	1		2	3	1	1		2	1	1	2	1
2	3	1	3	2	1	2	2		1	1	1	2	2	2	2
3	2	2	3	1	1	1	1				1	1	1	3	1
4	3	1	3	2	2	1	3	1	1	1	1	2	2	2	2
5	3	1	2	2	2	2	3	1		1	1	2	2	3	2
Avg.	3	1	3	2	2	2	3	1	1	1	1	2	2	3	2

CES332 SUSTAINABLE AGRICULTURE AND ENVIRONMENTAL MANAGEMENT

L T P C
3 0 0 3

OBJECTIVES:

- To educate the students about the issues of sustainability in agroecosystems, introduce the concepts and principles of agroecology as applied to the design and management of sustainable agricultural systems for a changing world.

UNIT I AGROECOLOGY, AGROECOSYSTEM AND SUSTAINABLE AGRICULTURE CONCEPTS 9

Ecosystem definition - Biotic *Vs*. abiotic factors in an ecosystem - Ecosystem processes - Ecological services and agriculture - Problems associated with industrial agriculture/food systems - Defining sustainability - Characteristics of sustainable agriculture - Difference between regenerative and sustainable agriculture systems

UNIT II SOIL HEALTH, NUTRIENT AND PEST MANAGEMENT 9

Soil health definition - Factors to consider (physical, chemical and biological) - Composition of healthy soils - Soil erosion and possible control measures - Techniques to build healthy soil - Management practices for improving soil nutrient - Ecologically sustainable strategies for pest and disease control

UNIT III WATER MANAGEMENT 9

Soil water storage and availability - Plant yield response to water - Reducing evaporation in agriculture - Earthworks and tanks for rainwater harvesting - Options for improving the productivity of water - Localized irrigation - Irrigation scheduling - Fertigation - Advanced irrigation systems and agricultural practices for sustainable water use

UNIT IV ENERGY AND WASTE MANAGEMENT 9

Types and sources of agricultural wastes - Composition of agricultural wastes - Sustainable technologies for the management of agricultural wastes - Useful and high value materials produced using different processes from agricultural wastes - Renewable energy for sustainable agriculture

UNIT V EVALUATING SUSTAINABILITY IN AGROECOSYSTEMS 9

Indicators of sustainability in agriculture - On-farm evaluation of agroecosystem sustainability - Alternative agriculture approaches/ farming techniques for sustainable food production - Goals and components of a community food system - Case studies

TOTAL: 45 PERIODS

OUTCOME

- On completion of the course, the student is expected to be able to

CO1 Have an in-depth knowledge about the concepts, principles and advantages of sustainable agriculture

CO2 Discuss the sustainable ways in managing soil health, nutrients, pests and diseases

CO3 Suggest the ways to optimize the use of water in agriculture to promote an ecological use of resources

CO4 Develop energy and waste management plans for promoting sustainable agriculture in non-sustainable farming areas

CO5 Assess an ecosystem for its level of sustainability and prescribe ways of converting to a sustainable system through the redesign of a conventional agroecosystem

REFERENCES:

1. Approaches to Sustainable Agriculture – Exploring the Pathways Towards the Future of Farming, Oberc, B.P. & Arroyo Schnell, A., IUCN, Belgium, 2020
2. Natural bioactive products in sustainable agriculture, Singh, J. & Yadav, A.N., Springer, 2020
3. Organic Farming for Sustainable Agriculture, Nandwani, D., Springer, 2016
4. Principles of Agronomy for Sustainable Agriculture, Villalobos, F.J. & Fereres, E., Springer, 2016
5. Sustainable Agriculture for Food Security: A Global Perspective, Balkrishna, A., CRC Press, 2021
6. Sustainable Energy Solutions in Agriculture, Bundschuh, J. & Chen, G., CRC Press, 2014

CO – PO Mapping - SUSTAINABLE AGRICULTURE PRACTICES

COs	POs												PSOs		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1		2						2		2			2	2	
2		2		2	2	2							3	2	
3				2		2							3	2	3
4	3	2			2			2	2	2	2		3	2	3
5		2	3	2			1					1		2	
Avg.	3	2	3	2	2	2	1	2	2	2	2	1	3	2	3

1 – Low; 2 – Medium; 3 – High; '- "- No correlation

CES333 SUSTAINABLE BIOMATERIALS L T P C
3 0 0 3

OBJECTIVES

- To Impart knowledge of biomaterials and their properties
- To learn about Fundamentals aspects of Biopolymers and their applications
- To learn about bioceramics and biopolymers
- To introduce the students about metals as biomaterials and their usage as implants
- To make the students understand the significance of bionanomaterials and its applications.

UNIT I INTRODUCTION TO BIOMATERIALS 9

Introduction: Definition of biomaterials, requirements & classification of biomaterials- Types of Biomaterials- Degradable and resorbable biomaterials- engineered natural materials- Biocompatibility-Hydrogels-pyrolitic carbon for long term medical implants-textured and porous materials-Bonding types- crystal structure-imperfection in crystalline structure-surface properties and adhesion of materials –strength of biological tissues-performance of implants-tissue response to implants- Impact and Future of Biomaterials

UNIT II BIO POLYMERS 9

Molecular structure of polymers -Molecular weight - Types of polymerization techniques– Types of polymerization reactions- Physical states of polymers- Common polymeric biomaterials -Polyethylene -Polymethylmethacrylate (PMMA-Polylactic acid (PLA) and polyglycolic acid (PGA) -Polycaprolactone (PCL) - Other biodegradable polymers – Polyurethan- reactions polymers for medical purposes - Collagens- Elastin- Cellulose and derivatives-Synthetic polymeric membranes and their biological applications

UNIT III BIO CERAMICS AND BIOCOMPOSITES 9

General properties- Bio ceramics -Silicate glass - Alumina (Al2O3) -Zirconia (ZrO2)-Carbon-Calcium phosphates (CaP)- Resorbable Ceramics- surface reactive ceramics- Biomedical Composites-Polymer Matrix Compsite(PMC)-Ceramic Matrix Composite(CMC)-Metal Matrix Composite (MMC)–glass ceramics - Orthopedic implants-Tissue engineering scaffolds

UNIT IV METALS AS BIOMATERIALS 9

Biomedical metals-types and properties-stainless steel-Cobalt chromium alloys-Titanium alloys-Tantalum-Nickel titanium alloy (Nitinol)- magnesium-based biodegradable alloys-

surface properties of metal implants for osteointegration-medical application-corrosion of metallic implants – biological tolerance of implant metals

UNIT V NANOBIOMATERIALS 9

Meatllic nanobiomaterials–Nano polymers-Nanoceramics- Nanocomposites -Carbon based nano biomaterials - transport of nanoparticles- release rate-positive and negative effect of nanosize-nano fibres-Nano and micro features and their importance in implant performance-Nano surface and coats-Applications nano antibiotics-Nanomedicines- Biochips – Biomimetics- BioNEMs -Biosensor**-**Bioimaging/Molecular Imaging**-** challenges and future perspective.

TOTAL : 45 PERIODS

OUTCOMES

- Students will gain familiarity with Biomaterials and they will understand their importance.
- Students will get an overview of different biopolymers and their properties
- Students gain knowledge on some of the important Bioceramics and Biocomposite materials
- Students gain knowledge on metals as biomaterials
- Student gains knowledge on the importance of nanobiomaterials in biomedical applications.

REFERENCES

1. C. Mauli Agrawal, Joo L. Ong, Mark R. Appleford, Gopinath Mani “Introduction to Biomaterials Basic Theory with Engineering Applications” Cambridge University Press, 2014.
2. Donglu shi “Introduction to Biomaterials” Tsinghua University press, 2006.
3. Joon Park, R.S.Lakes “Biomaterials An Introduction” third edition, Springer 2007.
4. M.Jaffe,W.Hammond, P.Tolias and T.Arinzeh “Characterization of Biomaterials” Wood head publishing, 2013.
5. Buddy D.Ratner and Allan S.Hoffman Biomaterials Science “An Introduction to Material in Medicine” Third Edition, 2013.
6. VasifHasirci, NesrinHasirci “Fundamentals of Biomaterials” Springer, 2018
7. Leopoido Javier Rios Gonzalez. “Handbook of Research on Bioenergy and Biomaterials: Consolidated and green process” Apple academic press, 2021.
8. Devarajan Thangadurai, Jeyabalan Sangeetha, Ram Prasad “Functional Bionanomaterials” springer, 2020.
9. Sujata.V.Bhat Biomaterials; Narosa Publishing house, 2002.

CES334 MATERIALS FOR ENERGY SUSTAINABILITY L T P C
3 0 0 3

OBJECTIVES

- To familiarize the students about the challenges and demands of energy sustainability
- To provide fundamental knowledge about electrochemical devices and the materials used.
- To introduce the students to various types of fuel cell

- To enable students to appreciate novel materials and their usage in photovoltaic application
- To introduce students to the basic principles of various types Supercapacitors and the materials used.

UNIT I SUSTAINABLE ENERGY SOURCES 9

Introduction to energy demand and challenges ahead – sustainable source of energy (wind, solar etc.) – electrochemical energy systems for energy harvesting and storage – materials for sustainable electrochemical systems building – India centric solutions based on locally available materials – Economics of wind and solar power generators vs. conventional coal plants – Nuclear energy

UNIT II ELECTROCHEMICAL DEVICES 9

Electrochemical Energy – Difference between primary and secondary batteries – Secondary battery (Li-ion battery, Sodium-ion battery, Li-S battery, Li-O_2 battery, Nickel Cadmium, Nickel Metal Hydride) – Primary battery (Alkaline battery, Zinc-Carbon battery) – Materials for battery (Anode materials – Lithiated graphite, Sodiated hard carbon, Silicon doped graphene, Lithium Titanate) (Cathode Materials – S, $LiCoO_2$, $LiFePO_4$, $LiMn_2O_4$) – Electrolytes for Lithium-ion battery (ethylene carbonate and propylene carbonate based)

UNIT III FUEL CELLS 9

Principle of operation of fuel cells – types of fuel cells (Proton exchange membrane fuel cells, alkaline fuel cell, direct methanol fuel cells, direct borohydride fuel cells, phosphoric acid fuel cells, solid oxide fuel cells, and molten carbonate fuel cells) – Thermodynamics of fuel cell – Fuel utilization – electrolyte membrane (proton conducting and anion conducting) – Catalysts (Platinum, Platinum alloys, carbon supported platinum systems and metal oxide supported platinum catalysts) – Anatomy of fuel cells (gas diffusion layer, catalyst layer, flow field plate, current conductors, bipolar plates and monopolar plates).

UNIT IV PHOTOVOLTAICS 9

Physics of the solar cell – Theoretical limits of photovoltaic conversion – bulk crystal growth of Si and wafering for photovoltaic application - Crystalline silicon solar cells – thin film silicon solar cells – multijunction solar cells – amorphous silicon based solar cells – photovoltaic concentrators – Cu(InGa)Se_2 solar cells – Cadium Telluride solar cells – dye sensitized solar cells – Perovskite solar cells – Measurement and characterization of solar cells - Materials used in solar cells (metallic oxides, CNT films, graphene, OD fullerenes, single-multi walled carbon nanotubes, two-dimensional Graphene, organic or Small molecule-based solar cells materials - copper-phthalocyanine and perylenetetracarboxylicbis - benzine – fullerenes - boron subphthalocyanine- tin (II) phthalocyanine)

UNIT V SUPERCAPACITORS 9

Supercapacitor –types of supercapacitors (electrostatic double-layer capacitors, pseudo capacitors and hybrid capacitors) - design of supercapacitor-three and two electrode cell-parameters of supercapacitor- Faradaic and non - Faradaic capacitance – electrode materials (transition metal oxides (MO), mixed metal oxides, conducting polymers (CP), Mxenes, nanocarbons, non-noble metal, chalcogenides, hydroxides and 1D-3D metal-organic frame work (MOF), activated carbon fibres (ACF)- Hydroxides-Based Materials - Polyaniline (PANI), a ternary hybrid composite- conductive polypyrrole hydrogels – Different types of nanocomposites for the SC electrodes (carbon–carbon composites, carbon-MOs composites, carbon-CPs composites and MOs-CPs composites) - Two-Dimensional (2D) Electrode Materials - 2D transition metal carbides, carbonitrides, and nitrides.

TOTAL : 45 PERIODS

OUTCOMES

- Students will acquire knowledge about energy sustainability.
- Students understand the principles of different electrochemical devices.
- Students learn about the working of fuel cells and their application.
- Students will learn about various Photovoltaic applications and the materials used.
- The students gain knowledge on different types of supercapacitors and the performance of various materials

REFERENCES

1. Functional materials for sustainable energy applications; John A. Kilner, Stephen J. Skinner, Stuart J. C. Irvine and Peter P. Edwards.
2. Hand Book of Fuel Cells: Fuel Cell Technology and Applications, Wolf Vielstich, Arnold Lamm, Hubert Andreas Gasteiger, Harumi Yokokawa, Wiley, London 2003.
3. B.E. Conway, Electrochemical supercapacitors: scientific fundamentals and technological applications, Kluwer Academic / Plenum publishers, New York, 1999.
4. T.R. Crompton, Batteries reference book, Newners, 3rd Edition, 2002.
5. Materials for Supercapacitor applications; B.Viswanathan. M.Aulice Scibioh
6. Electrode Materials for Supercapacitors: A Review of Recent Advances, Parnia Forouzandeh, Vignesh Kumaravel and Suresh C. Pillai, catalysts 2020.
7. Recent advances, practical challenges, and perspectives of intermediate temperature solid oxide fuel cell cathodes Amanda Ndubuisi, Sara Abouali, Kalpana Singh and VenkataramanThangadurai, J. Mater. Chem. A, 2022.
8. Review of next generation photovoltaic solar cell technology and comparative materialistic development Neeraj Kant, Pushpendra Singh, Materials Today: Proceedings, 2022.

CES335 GREEN TECHNOLOGY L T P C
3 0 0 3

COURSE OBJECTIVE:

- To acquire knowledge on green systems and the environment, energy technology and efficiency, and sustainability.
- To provide green engineering solutions to energy demand, reduced energy footprint.

UNIT I PRINCIPLES OF GREEN CHEMISTRY 9

Historical Perspectives and Basic Concepts. The twelve Principles of Green Chemistry and green engineering. Green chemistry metrics- atom economy, E factor, reaction mass efficiency, and other green chemistry metrics, application of green metrics analysis to synthetic plans.

UNIT II POLLUTION TYPES 9

Pollution – types, causes, effects, and abatement. Waste – sources of waste, different types of waste, chemical, physical and biochemical methods of waste minimization and recycling.

UNIT III GREEN REAGENTS AND GREEN SYNTHESIS 9

Environmentally benign processes- alternate solvents- supercritical solvents, ionic liquids, water as a reaction medium, energy-efficient design of processes- photo, electro and sono chemical methods, microwave-assisted reactions

UNIT IV DESIGNING GREEN PROCESSES 9

Safe design, process intensification, in process monitoring. Safe product and process design – Design for degradation, Real-time Analysis for pollution prevention, inherently safer chemistry for accident prevention

UNIT V GREEN NANOTECHNOLOGY 9

Nanomaterials for water treatment, nanotechnology for renewable energy, nanotechnology for environmental remediation and waste management, nanotechnology products as potential substitutes for harmful chemicals, environmental concerns with nanotechnology

TOTAL: 45 PERIODS

COURSE OUTCOMES

CO1: To understand the principles of green engineering and technology
CO2: To learn about pollution using hazardous chemicals and solvents
CO3: To modify processes and products to make them green and safe.
CO4: To design processes and products using green technology
CO5 – To understand advanced technology in green synthesis

TEXT BOOKS

1. Green technology and design for the environment, Samir B. Billatos, Nadia A. Basaly, Taylor & Francis, Washington, DC, ©1997
2. Green Chemistry – An introductory text - M. Lancaster, RSC,2016.
3. Green chemistry metrics - Alexi Lapkin and david Constable (Eds) , Wiley publications,2008

REFERENCE BOOKS

1. Environmental chemistry, Stanley E Manahan, Taylor and Francis, 2017

CES336 ENVIRONMENTAL QUALITY MONITORING AND ANALYSIS L T P C
3 0 0 3

OBJECTIVES:

- to understand and study the complexity of the environment in relation to pollutants generated due to industrial activity.
- To analyze the quality of the environmental parameters and monitor the same for the purpose of environmental risk assessment.

UNIT I ENVIRONMENTAL MONITORING AND STANDARDS 9

Introduction- Environmental Standards- Classification of Environmental Standards- Global Environmental Standards- Environmental Standards in India- Ambient air quality standards- water quality standard- Environmental Monitoring-Need for environmental monitoring- Concepts of environmental monitoring- Techniques of Environmental Monitoring.

UNIT II MONITORING OF ENVIRONMENTAL PARAMETERS 9

Current Environmental Issues- Global Environmental monitoring programme-International conventions- Application of Environmental Monitoring- Atmospheric Monitoring - screening parameters – Significance of environmental sampling- sampling methods – water sampling - sampling of ambient air-sampling of flue gas.

UNIT III ANALYTICAL METHODS FOR ENVIRONMENTAL MONITORING 9

Classification of Instrumental Method- Analysis of Organic Pollutants by Spectrophotometric methods -Determination of nitrogen, phosphorus and, chemical oxygen demand (COD) in sewage; Biochemical oxygen demand (BOD)- Sampling techniques for air pollution measurements; analysis of particulates and air pollutants like oxides of nitrogen, oxides of sulfur, carbon monoxide, hydrocarbon; Introduction to advanced instruments for environmental analysis

UNIT IV ENVIRONMENTAL MONITORING PROGRAMME (EMP) & RISKASSESSMENT 9

Water quality monitoring programme- national water quality monitoring- Parameters for National Water Quality Monitoring- monitoring protocol; Process of risk assessment- hazard identification- exposure assessment- dose-response assessment; risk characterization.

UNIT V AUTOMATED DATA ACQUISITION AND PROCESSING 9

Data Acquisition for Process Monitoring and Control - The Data Acquisition System - Online Data Acquisition, Monitoring, and Control - Implementation of a Data Management System - Review of Observational Networks -Sensors and transducers- classification of transducers- data acquisition system- types of data acquisition systems- data management and quality control; regulatory overview.

TOTAL: 45 PERIODS

COURSE OUTCOMES

After completion of this course, the students will know

CO1 Basic concepts of environmental standards and monitoring.
CO2 the ambient air quality and water quality standards;
CO3 the various instrumental methods and their principles for environmental monitoring
CO4 The significance of environmental standards in monitoring quality and sustainability of the environment.
CO5 the various ways of raising environmental awareness among the people.
CO6 Know the standard research methods that are used worldwide for monitoring the environment.

TEXTBOOKS

1. Environmental monitoring Handbook, Frank R. Burden, © 2002 by The McGraw-Hill Companies, Inc.
2. Handbook of environmental analysis: chemical pollutants in the air, water, soil, and soild wastes / Pradyot Patnaik, © 1997 by CRC Press, Inc

REFERENCES

1. Environmental monitoring / edited by G. Bruce Wiersma, © 2004 by CRC Press LLC.
2. H. H. Willard, L. L. Merit, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis, CBP Publishers and Distributors, New Delhi, 1988.
3. Heaslip, G. (1975) Environmental Data Handling. John Wiley & Sons. New York.

CO's- PO's & PSO's MAPPING

Course Outcomes	Program Outcomes														
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	1	1	1	-	-	-	-	-	-	-	-	-	3	-	-
CO2	1	1	1	1	1	-	-	-	1	-	2	2	2	1	1
CO3	1	1	2	1	1	-	-	-	2	-	1	1	1	-	-
CO4	1	2	3	3	1	-	-	-	2	-	3	3	1	-	-
CO5	1	1	3	2	1	-	-	-	3	-	3	1	2	-	-
CO6	3	2	3	3	2	-	-	-	3	-	3	3	3	1	1
Over all	3	2	3	3	2	-	-	-	3	-	3	3	3	1	1

CES337 INTEGRATED ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT

L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To create awareness on the energy scenario of India with respect to world
2. To understand the fundamentals of energy sources, energy efficiency and resulting environmental implications of energy utilisation
3. Familiarisation on the concept of sustainable development and its benefits
4. Recognize the potential of renewable energy sources and its conversion technologies for attaining sustainable development
5. Acquainting with energy policies and energy planning for sustainable development

UNIT I ENERGY SCENARIO 9

Comparison of energy scenario – India and World (energy sources, generation mix, consumption pattern, T&D losses, energy demand, per capita energy consumption) – energy pricing – Energy security.

UNIT II ENERGY AND ENVIRONMENT 9

Conventional Energy Sources - Emissions from fuels – Air, Water and Land pollution – Environmental standards - measurement and controls

UNIT III SUSTAINABLE DEVELOPMENT 9

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG) - Social development: Poverty, conceptual issues and measures, impact of poverty. Globalization and Economic growth - Economic development: Economic inequalities, Income and growth.

UNIT IV RENEWABLE ENERGY TECHNOLOGY 9

Renewable Energy – Sources and Potential – Technologies for harnessing from Solar, Wind, Hydro, Biomass and Oceans – Principle of operation, relative merits and demerits

UNIT V ENERGY PLANNING FOR SUSTAINABLE DEVELOPMENT 9

National & State Energy Policy - National solar mission - Framework of Central Electricity Authority - National Hydrogen Mission - Energy and climate policy - State Energy Action Plan, RE integration, Road map for ethanol blending, Energy Efficiency and Energy Mix

TOTAL: 45 PERIODS

COURSE OUTCOMES:

Upon completion of this course, the students will be able to

1. Understand the world and Indian energy scenario
2. Analyse energy projects, its impact on environment and suggest control strategies
3. Recognise the need of Sustainable development and its impact on human resource development
4. Apply renewable energy technologies for sustainable development
5. Fathom Energy policies and planning for sustainable development.

REFERENCES:

1. Energy Manager Training Manual (4Volumes) available at http://www.em-ea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004
2. Robert Ristirer and Jack P. Kraushaar, “Energy and the environment”, Willey, 2005.
3. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 2012
4. Twidell, J.W. & Weir A., “Renewable Energy Resources”, EFNSpon Ltd., UK, 2015.
5. Dhandapani Alagiri, Energy Security in India Current Scenario, The ICFAI University Press, 2006.
6. M.H. Fulekar,Bhawana Pathak, R K Kale,“Environment and Sustainable Development” Springer,2016
7. https://www.niti.gov.in/verticals/energy

CES338 ENERGY EFFICIENCY FOR SUSTAINABLE DEVELOPMENT L T P C
3 0 0 3

COURSE OBJECTIVES:

1. To understand the types of energy sources, energy efficiency and environmental implications of energy utilisation
2. To create awareness on energy audit and its impacts
3. To acquaint the techniques adopted for performance evaluation of thermal utilities
4. To familiarise on the procedures adopted for performance evaluation of electrical utilities
5. To learn the concept of sustainable development and the implication of energy usage

UNIT I ENERGY AND ENVIRONMENT 9

Primary energy sources - Coal, Oil, Gas – India Vs World with respect to energy production and consumption, Climate Change, Global Warming, Ozone Depletion, UNFCCC, COP

UNIT II ENERGY AUDITING 9

Need and types of energy audit. Energy management (audit) approach-understanding energy costs, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirements, fuel & energy substitution, energy audit instruments.

UNIT III ENERGY EFFICIENCY IN THERMAL UTILITIES 9

Energy conservation avenues in steam generation and utilisation, furnaces, Thermic Fluid Heaters. Insulation and Refractories - Commercial waste heat recovery devices: recuperator, regenerator, heat pipe, heat exchangers (Plate, Shell & Tube), heat pumps, and thermocompression

UNIT IV ENERGY CONSERVTION IN ELECTRICAL UTILITIES 9

Demand side management - Power factor improvement – Energy efficient transformers - Energy conservation avenues in Motors, HVAC, fans, blowers, pumps, air compressors, illumination systems and cooling towers

UNIT V SUSTAINABLE DEVELOPMENT 9

Sustainable Development: Concepts and Stakeholders, Sustainable Development Goal (SDG). Globalization and Economic growth. Economic development: Economic inequalities, Income and growth. Social development: Poverty, conceptual issues and measures, impact of poverty,

TOTAL: 45 PERIODS

OURSE OUTCOMES:

Upon completion of this course, the students will be able to

1. Understand the prevailing energy scenario
2. Familiarise on energy audits and its relevance
3. Apply the concept of energy audit on thermal utilities
4. Employ relevant techniques for energy improvement in electrical utilities
5. Understand Sustainable development and its impact on human resource development

REFERENCES:

1. Energy Manager Training Manual (4Volumes) available at http://www.em-ea.org/gbook1.asp, a website administered by Bureau of Energy Efficiency (BEE), a statutory body under Ministry of Power, Government of India.2004
2. Eastop.T.D& Croft D.R, “Energy Efficiency for Engineers and Technologists”, Logman Scientific & Technical, ISBN-0-582-03184, 1990
3. W.R. Murphy and G. McKay “Energy Management” Butterworths, London 1987
4. Pratap Bhattacharyya, “Climate Change and Greenhouse Gas Emission”, New India Publishing Agency- Nipa,2020
5. Matthew John Franchetti , Defne Apul “Carbon Footprint Analysis: Concepts, Methods, Implementation, and Case Studies” CRC Press,2012
6. Robert A. Ristinen, Jack J. Kraushaar, Jeffrey T. Brack, “Energy and the Environment”, 4th Edition,Wiley,2022
7. M.H. Fulekar,Bhawana Pathak, R K Kale,“Environment and Sustainable Development” Springer,2016
8. Sustainable development in India: Stocktaking in the run up to Rio+20: Report prepared by TERI for MoEF, 2011.