Curriculum and Syllabi

B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

SEMESTERS I to VIII

Regulations 2022

Programme: B.E. ELECTRONICS AND COMMUNICATION ENGINEERING

2022 Regulations

(2022 Batch onwards)

Curriculum for Semesters I to VIII

SEMESTER I

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22HS101	English for Communication	3	0	2	5	4	60 / 40	HS
2.	22PH101	Engineering Physics	3	0	2	5	4	60 / 40	BS
3.	22CS101	Problem Solving Techniques I	3	0	2	5	4	60 / 40	ES
4.	22ES101	Innovation and Design Thinking	1	0	2	3	2	0 / 100	ES
5.	22EE101	Circuit Theory	3	0	2	5	4	60 / 40	PC
Theory Courses									
6.	22MA101	Matrices and Calculus	3	1	0	4	4	60 / 40	BS
7.	22AC101	Heritage of Tamil	1	0	0	1	1	0 / 100	AC
8.	22EEC101	Aptitude and Soft Skills	1	0	0	1	1	0 / 100	EEC
Mandatory Course									
9.		Student Induction Programme							MC

SEMESTER II

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22CH101	Engineering Chemistry	3	0	2	5	4	60 / 40	BS
2.	22CS201	Problem Solving Techniques II	3	0	2	5	4	60 / 40	ES

Theory Courses									
3.	22MA201	Numerical Methods	3	1	0	4	4	60 / 40	BS
4.	22AC201	Tamils and Technology	1	0	0	1	1	0 / 100	AC
5.	22EEC201	Aptitude and Soft Skills II	1	0	0	1	1	0 / 100	EEC
6.	22EC201	Electron Devices	3	0	0	3	3	60 / 40	ES
7.	22EC202	Electrical Technology	3	0	0	3	3	60 / 40	PC
8.	22HS203	Universal Human Values	2	0	0	2	2	0 / 100	HS
Practical Course									
9.	22ES201	Engineering Practice Laboratory	0	0	4	4	2	40 / 60	ES

SEMESTER III

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22EC301	Digital Logic Circuit Design	3	0	2	5	4	60 / 40	PC
2.	22EC302	Electronic Circuits	3	0	2	5	4	60 / 40	PC
3.	22CS301	Data Structures	3	0	2	5	4	60 / 40	ES
Theory Courses									
4.	22MA301	Transforms and Partial Differential Equation	3	1	0	4	4	60 / 40	BS
5.	22EC303	Electromagnetic Engineering	3	0	0	3	3	60 / 40	ES
6.	22EC304	Control Systems	3	0	0	3	3	60 / 40	PC
Practical Course									
7.	22EEC301	Industrial Training / Internship – I	0	0	0	2 Weeks	1	0/100	EEC

SEMESTER IV

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22CS405	Networks and Security	3	0	2	5	4	60 / 40	PC
2.	22CS403	Database Management Systems	3	0	2	5	4	60 / 40	ES
3.	22EC401	Linear Integrated Circuits	3	0	2	5	4	60 / 40	PC
Theory Courses									
4.	22MA303	Probability and Statistics	3	1	0	4	4	60 / 40	BS
5.	22EC402	Signals and Systems	3	1	0	4	4	60 / 40	PC
Practical Course									
6.	22EC403	Arduino Programming Lab	0	0	2	4	1	40 / 60	PC
Mandatory Course									
7.	22MC401	Indian Constitution					-	0/100	MC

SEMESTER V

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Course									
1.	22CS302	Problem Solving Techniques III	3	0	2	5	4	60 / 40	ES
2.	22EC501	Communication Systems	3	0	2	5	4	60 / 40	PC
Elective Courses									
3.		Professional Elective - I					3	60 / 40	PE
4.		Professional Elective - II					3	60 / 40	PE

5.		Open Elective - I					3	60 / 40	OE
6.		Open Elective - II					3	60 / 40	OE
Practical Course									
7.	22EEC501	Industrial Training / Internship - II	0	0	0	2 Weeks	1	0 / 100	EEC
Mandatory Course									
8.	22MC501	Essence of Indian Traditional Knowledge					-	0 / 100	MC

SEMESTER VI

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Course									
1.	22EC601	Digital Signal Processing	3	0	2	5	4	60 / 40	PC
2.	22EC602	VLSI Design	3	0	2	5	4	60 / 40	PC
Elective Courses									
3.		Professional Elective - III					3	60 / 40	PE
4.		Professional Elective - IV					3	60 / 40	PE
5.		Open Elective - III					3	60 / 40	OE
6.		Open Elective - IV					3	60 / 40	OE

SEMESTER VII

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Cum Practical Courses									
1.	22EC701	IOT Design	3	0	2	5	4	60 / 40	PC
2.	22EC702	Optical Communication	3	0	2	5	4	60 / 40	PC

Theory Courses									
3.	22EC703	Antenna and Microwave Engineering	3	0	0	3	3	60 / 40	PC
4.	22HS601	Environmental Science and Engineering	3	0	0	3	3	60 / 40	HS
Elective Courses									
5.		Open Elective – V					3	60 / 40	OE
Practical Course									
7.	22EEC701	Project Work – Phase I	0	0	4	4	2	0/100	EEC

SEMESTER VIII

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
Theory Courses									
1.	22MG701	Principles of Management	3	0	0	3	3	60 / 40	HS
Elective Course									
2.		Professional Elective - V					3	60 / 40	PE
Practical Course									
3.	22EEC801	Project Work – Phase II	0	0	20	20	10	60/40	EEC

Total Credits: 168

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SUMMARY

S.No	SUBJECT AREA	CREDITS AS PER SEMESTER								CREDITS TOTAL
		I	II	III	IV	V	VI	VII	VIII	
1	**HS**	4	2					3	3	**12**
2	**BS**	8	8	4	4					**24**
3	**ES**	6	9	7	4	4				**30**
4	**PC**	4	3	11	13	4	8	11		**54**
5	**PE**					6	6		3	**15**
6	**OE**					6	6	3		**15**
7	**EEC**	1	1	1		1		2	10	**16**
8	**AC**	1	1							**2**
	Total	**24**	**24**	**23**	**21**	**21**	**20**	**19**	**16**	**168**
9	**MC (Non Credit)**	**~**			**~**	**~**				

HUMANITIES AND SOCIAL SCIENCES (HS)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22HS101	English for Communication	3	0	2	5	4	60 / 40	HS
2.	22HS203	Universal Human Values	2	0	0	2	2	0 / 100	HS
3.	22HS601	Environmental Science and Engineering	3	0	0	3	3	60 / 40	HS
4.	22MG701	Principles of Management	3	0	0	3	3	60 / 40	HS

BASIC SCIENCES (BS)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PH101	Engineering Physics	3	0	2	5	4	60 / 40	BS
2.	22MA101	Matrices and Calculus	3	1	0	4	4	60 / 40	BS
3.	22CH101	Engineering Chemistry	3	0	2	5	4	60 / 40	BS
4.	22MA201	Numerical Methods	3	1	0	4	4	60 / 40	BS
5.	22MA301	Transforms and Partial Differential Equation	3	1	0	4	4	60 / 40	BS
6.	22MA303	Probability and Statistics	3	1	0	4	4	60 / 40	BS

ENGINEERING SCIENCES (ES)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22CS101	Problem Solving	3	0	2	5	4	60 / 40	ES

		Techniques I							
2.	22ES101	Innovation and Design Thinking	1	0	2	3	2	0 / 100	ES
3.	22CS201	Problem Solving Techniques II	3	0	2	5	4	60 / 40	ES
4.	22EC201	Electron Devices	3	0	0	3	3	60 / 40	ES
5.	22ES201	Engineering Practice Laboratory	0	0	4	4	2	40 / 60	ES
6.	22CS301	Data Structures	3	0	2	5	4	60 / 40	ES
7.	22EC303	Electromagnetic Engineering	3	0	0	3	3	60 / 40	ES
8.	22CS403	Database Management Systems	3	0	2	5	4	60 / 40	ES
9.	22CS302	Problem Solving Techniques III	3	0	2	5	4	60 / 40	ES

PROFESSIONAL CORE (PC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22EE101	Circuit Theory	3	0	2	5	4	60 / 40	PC
2.	22EC202	Electrical Technology	3	0	0	3	3	60 / 40	PC
3.	22EC301	Digital Logic Circuit Design	3	0	2	5	4	60 / 40	PC
4.	22EC302	Electronic Circuits	3	0	2	5	4	60 / 40	PC
5.	22EC304	Control Systems	3	0	0	3	3	60 / 40	PC
6.	22CS405	Networks and Security	3	0	2	5	4	60 / 40	PC
7.	22EC401	Linear Integrated Circuits	3	0	2	5	4	60 / 40	PC
8.	22EC402	Signals and Systems	3	1	0	4	4	60 / 40	PC
9.	22EC403	Arduino	0	0	2	4	1	40 / 60	PC

		Programming Lab							
10.	22EC501	Communication Systems	3	0	2	5	4	60 / 40	PC
11.	22EC601	Digital Signal Processing	3	0	2	5	4	60 / 40	PC
12.	22EC602	VLSI Design	3	0	2	5	4	60 / 40	PC
13.	22EC701	IOT Design	3	0	2	5	4	60 / 40	PC
14.	22EC702	Optical Communication	3	0	2	5	4	60 / 40	PC
15.	22EC703	Antenna and Microwave Engineering	3	0	0	3	3	60 / 40	PC

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22EEC101	Aptitude and Soft Skills	1	0	0	1	1	0 / 100	EEC
2.	22EEC201	Aptitude and Soft Skills II	1	0	0	1	1	0 / 100	EEC
3.	22EEC301	Industrial Training / Internship – I	0	0	0	2 Weeks	1	0/100	EEC
4.	22EEC501	Industrial Training / Internship - II	0	0	0	2 Weeks	1	0 / 100	EEC
5.	22EEC701	Project Work – Phase I	0	0	4	4	2	0/100	EEC
6.	22EEC801	Project Work – Phase II	0	0	20	20	10	60/40	EEC

AUDIT COURSES (AC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22AC101	Heritage of Tamil	1	0	0	1	1	0 / 100	AC

2.	22AC201	Tamils and Technology	1	0	0	1	1	0 / 100	AC

NON CREDIT MANDATORY COURSES (NCMC)

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.		Student Induction Programme							MC
2.	22MC401	Indian Constitution					-	0/100	MC
3.	22MC501	Essence of Indian Traditional Knowledge					-	0/100	MC

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Professional Electives

Professional Elective I

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC01	Transmission lines and RF Systems	3	0	0	3	3	60/40	PE
2.	22PEC02	RF Transceivers	2	0	2	4	3	60/40	PE
3.	22PEC03	Signal Integrity	2	0	2	4	3	60/40	PE
4.	22PEC04	Antenna Design	2	0	2	4	3	60/40	PE
5.	22PEC05	MICs and RF System Design	2	0	2	4	3	60/40	PE
6.	22PEC06	EMI/EMC Pre Compliance Testing	2	0	2	4	3	60/40	PE
7.	22PEC07	RF ID System Design & Testing	2	0	2	4	3	60/40	PE

Professional Elective II

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC08	Microprocessor and Microcontroller	3	0	0	3	3	60/40	PE
2.	22PEC09	Microcontroller Based System Design	3	0	0	3	3	60/40	PE
3.	22PEC10	Nano Technology and its Applications	3	0	0	3	3	60/40	PE
4.	22PEC11	Embedded Systems	3	0	0	3	3	60/40	PE

5.	22PME03	Robotics	3	0	0	3	3	60/40	PE
6.	22PEC12	Sensors and Actuators	3	0	0	3	3	60/40	PE
7.	22PEC13	Analog IC Design	2	0	2	4	3	60/40	PE

Professional Elective III

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC14	Wireless Communication	3	0	0	3	3	60/40	PE
2.	22PEC15	Adhoc and Wireless Sensor Networks	3	0	0	3	3	60/40	PE
3.	22PEC16	4G/5G Communication Networks	2	0	2	4	3	60/40	PE
4.	22PCS32	Software defined Networks	2	0	2	4	3	60/40	PE
5.	22PEC17	Massive MIMO Networks	2	0	2	4	3	60/40	PE
6.	22PEC18	Wireless Broad Band Networks	3	0	0	3	3	60/40	PE
7.	22PEC19	Modern Digital Communication Techniques	3	0	0	3	3	60/40	PE

Professional Elective IV

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC20	Machine Learning	3	0	0	3	3	60/40	PE
2.	22PEC21	Soft Computing Techniques	3	0	0	3	3	60/40	PE
3.	22PCS20	Blockchain Technologies	2	0	2	4	3	60/40	PE

4.	22PCS12	Neural Networks and Deep Learning	2	0	2	4	3	60/40	PE
5.	22PEC22	Artificial Intelligence	3	0	0	3	3	60/40	PE
6.	22PCS09	Data Analytics and Visualization	2	0	2	4	3	60/40	PE
7.	22PBM25	Computational Neuroscience	3	0	0	3	3	60/40	PE

Professional Elective V

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC23	Radar Technologies	3	0	0	3	3	60/40	PE
2.	22PEC24	Avionics Systems	3	0	0	3	3	60/40	PE
3.	22PEC25	Satellite Communication	3	0	0	3	3	60/40	PE
4.	22PEC26	Positioning and Navigation Systems	3	0	0	3	3	60/40	PE
5.	22PEC27	Remote Sensing	3	0	0	3	3	60/40	PE
6.	22PEC28	Rocketry and Space Mechanics	3	0	0	3	3	60/40	PE
7.	22PEC29	MEMS and Applications	3	0	0	3	3	60/40	PE
8.	22PEC30	Biomedical Instrumentation	3	0	0	3	3	60/40	PE

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Open Electives

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22OCS03	Cloud Computing	3	0	0	3	3	60 / 40	OE
2.	22OCS09	Cryptography and Network Security	3	0	0	3	3	60 / 40	OE
3.	22OEC03	Digital Marketing	3	0	0	3	3	60 / 40	OE
4.	22OAG04	Disaster Management	3	0	0	3	3	60 / 40	OE
5.	22OCS15	Distributed Systems	3	0	0	3	3	60 / 40	OE
6.	22OEC05	E Vehicles	3	0	0	3	3	60 / 40	OE
7.	22OAG05	Energy Conservation and Management	3	0	0	3	3	60 / 40	OE
8.	22OEC09	Engineering Economics and Financial Accounting	3	0	0	3	3	60 / 40	OE
9.	22OEC10	Fire Safety Engineering	3	0	0	3	3	60 / 40	OE
10.	22OEC11	Foundation Skills In Integrated Product Development	3	0	0	3	3	60 / 40	OE
11.	22OCS16	Game Design and Development	3	0	0	3	3	60 / 40	OE
12.	22OBM10	Hospital Management	3	0	0	3	3	60 / 40	OE
13.	22OHS03	Human Rights	3	0	0	3	3	60 / 40	OE
14.	22OME15	Industrial Safety	3	0	0	3	3	60 / 40	OE
15.	22OME16	Intellectual Property Rights	3	0	0	3	3	60 / 40	OE
16.	22OCS24	Introduction to Theory of Computation	3	0	0	3	3	60 / 40	OE

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
17.	22OAG13	IT in Agriculture	3	0	0	3	3	60 / 40	OE
18.	22OME18	Lean Six Sigma	3	0	0	3	3	60 / 40	OE
19.	22OBM16	Medical Electronics	3	0	0	3	3	60 / 40	OE
20.	22OEC16	Mobile Communication	3	0	0	3	3	60 / 40	OE
21.	22OME22	Operations Research	3	0	0	3	3	60 / 40	OE
22.	22OBM17	Professional Ethics	3	0	0	3	3	60 / 40	OE
23.	22OME28	Quality Engineering	3	0	0	3	3	60 / 40	OE
24.	22OME30	Renewable Energy Resources	3	0	0	3	3	60 / 40	OE
25.	22OBM19	Research methodology	3	0	0	3	3	60 / 40	OE
26.	22OEC23	Space Science	3	0	0	3	3	60 / 40	OE
27.	22OME34	Total Quality Management	3	0	0	3	3	60 / 40	OE
28.	22OAG16	Urban Agriculture	3	0	0	3	3	60 / 40	OE
29.	22OAG17	Waste Water Treatment	3	0	0	3	3	60 / 40	OE
30.	22OCS28	Web Technology	3	0	0	3	3	60 / 40	OE

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Verticals

Vertical I : Semiconductor Chip Design and Testing

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC31	Wide Bandgap Devices	2	0	2	4	3	60/40	PE
2.	22PEC32	Validation and Testing Technology	2	0	2	4	3	60/40	PE
3.	22PEC33	Low Power IC Design	2	0	2	4	3	60/40	PE
4.	22PEC34	VLSI Testing and Design For Testability	2	0	2	4	3	60/40	PE
5.	22PEC35	Mixed Signal IC Design Testing	2	0	2	4	3	60/40	PE
6.	22PEC13	Analog IC Design	2	0	2	4	3	60/40	PE

Vertical II : Signal Processing

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC36	Advanced Digital Signal Processing	2	0	2	4	3	60/40	PE
2.	22PEC37	Image Processing	3	0	0	3	3	60/40	PE
3.	22PEC38	Speech Processing	2	0	2	4	3	60/40	PE
4.	22PEC39	Software Defined Radio	2	0	2	4	3	60/40	PE
5.	22PEC40	DSP Architecture	2	0	2	4	3	60/40	PE

		and Programming							
6.	22PCS43	Computer Vision	2	0	2	4	3	60/40	PE

Vertical III : RF Technologies

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC02	RF Transceivers	2	0	2	4	3	60/40	PE
2.	22PEC03	Signal Integrity	2	0	2	4	3	60/40	PE
3.	22PEC04	Antenna Design	2	0	2	4	3	60/40	PE
4.	22PEC05	MICs and RF System Design	2	0	2	4	3	60/40	PE
5.	22PEC06	EMI/EMC Pre Compliance Testing	2	0	2	4	3	60/40	PE
6.	22PEC07	RF ID System Design & Testing	2	0	2	4	3	60/40	PE

Vertical IV : Bio Medical Technologies

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PBM63	Wearable Devices	3	0	0	3	3	60/40	PE
2.	22PBM70	Human Assist Devices	3	0	0	3	3	60/40	PE
3.	22PBM72	Therapeutic Equipment	3	0	0	3	3	60/40	PE
4.	22PBM60	Medical Imaging Systems	3	0	0	3	3	60/40	PE
5.	22PBM61	Brain Computer Interface and Applications	3	0	0	3	3	60/40	PE
6.	22PBM64	Body Area Networks	3	0	0	3	3	60/40	PE

Vertical V : Underwater Technologies

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC41	Underwater Instrumentation System	3	0	0	3	3	60/40	PE
2.	22PEC42	Underwater Imaging Systems and Image Processing	2	0	2	4	3	60/40	PE
3.	22PEC43	Underwater Communication	2	0	2	4	3	60/40	PE
4.	22PEC44	Ocean Observation Systems	2	0	2	4	3	60/40	PE
5.	22PEC45	Underwater Navigation Systems	3	0	0	3	3	60/40	PE
6.	22PEC46	Ocean Acoustics	2	0	2	4	3	60/40	PE

Vertical VI : Sensor Technologies and IoT

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC47	IoT Processors	2	0	2	4	3	60/40	PE
2.	22PEC48	IoT Based System Design	3	0	0	3	3	60/40	PE
3.	22PEC49	Wireless Sensor Network Design	3	0	0	3	3	60/40	PE
4.	22PEC50	Industrial IoT and Industry 4.0	2	0	2	4	3	60/40	PE
5.	22PEC51	MEMS Design	2	0	2	4	3	60/40	PE
6.	22PEC52	Fundamentals of Nanoelectronics	2	0	2	4	3	60/40	PE

Vertical VII : Space Technologies

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC23	Radar Technologies	3	0	0	3	3	60/40	PE
2.	22PEC24	Avionics Systems	3	0	0	3	3	60/40	PE
3.	22PEC26	Positioning and Navigation Systems	3	0	0	3	3	60/40	PE
4.	22PEC25	Satellite Communication	3	0	0	3	3	60/40	PE
5.	22PEC27	Remote Sensing	3	0	0	3	3	60/40	PE
6.	22PEC28	Rocketry and Space Mechanics	3	0	0	3	3	60/40	PE

Vertical VIII : High Speed Communications

S. No	Course Code	Course	L	T	P	Total Contact Periods/Week	Credits	External / Internal	Category
1.	22PEC53	Optical Communication & Networks	3	0	0	3	3	60/40	PE
2.	22PEC18	Wireless Broad Band Networks	3	0	0	3	3	60/40	PE
3.	22PEC16	4G/5G Communication Networks	2	0	2	4	3	60/40	PE
4.	22PCS32	Software Defined Networks	2	0	2	4	3	60/40	PE
5.	22PEC17	Massive MIMO Networks	2	0	2	4	3	60/40	PE
6.	22PEC54	Advanced Wireless Communication Techniques	3	0	0	3	3	60/40	PE

22HS101	ENGLISH FOR COMMUNICATION	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To improve the communicative competence of learners.
2. To help learners use language effectively in academic /work contexts.
3. To build on students' English language skills by engaging them in listening, speaking and grammar learning activities that are relevant to authentic contexts.
4. To develop learners' ability to read and write complex texts, summaries, articles, blogs, definitions, essays and user manuals.
5. To use language efficiently in expressing their opinions via various media.

Course Content:

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 15

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 - Self Introduction; Introducing a friend; Conversation - politeness strategies; Telephone conversation; Leave a voicemail; Leave a message with another person; asking for information to fill details in a form.

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 15

Listening - Listening to podcast, anecdotes / stories / event narration; documentaries and interviews with celebrities.

Speaking - Narrating personal experiences / events; Interviewing a celebrity; Reporting / and summarising of documentaries / podcasts/ interviews.

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 15

Listening - Listen to a product and process descriptions; a classroom lecture; and advertisements about a product.

Speaking - Picture description; Giving instruction to use the product; Presenting a product; and Summarising a lecture.
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 ND RECOMMENDATIONS 12

Listening - Listening to TED Talks; Scientific lectures; and educational videos.
Speaking - Small Talk; Mini presentations and making recommendations.
Reading - Newspaper articles; Journal reports-and Non Verbal Communication (tables, pie charts etc.,)
Writing - Note-making / Note-taking (*Study skills to be taught, not tested); Writing recommendations; Transferring information from nonverbal (chart, graph etc., to verbal mode)
Grammar - Articles; Pronouns - Possessive & Relative pronouns.
Vocabulary - Collocations; Fixed / Semi fixed expressions.

UNIT V EXPRESSION 15

Listening - Listening to debates/ discussions; different viewpoints on an issue; and panel discussions.
Speaking - group discussions, Debates, and Expressing opinions through Simulations & Role-play.
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 LECTURE CUM PRACTICALPERIODS 75Periods

Expected Course Outcome:

1. To listen and comprehend complex academic texts.
2. To read and infer the denotative and connotative meanings of technical texts.
3. To write definitions, descriptions, narrations and essays on various topics.
4. To speak fluently and accurately in formal and informal communicative contexts.
5. To express their opinions effectively in both oral and written medium of communication.

Text Book(s):

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.VeenaSelvam, Dr. Sujatha Priyadarshini, Dr.Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

Reference Books:

1. Technical Communication – Principles And Practices, Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
2. A Course Book On Technical English ByLakshminarayanan, Scitech Publications (India) Pvt. Ltd.
3. English For Technical Communication (With CD) By AyshaViswamohan, 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.

22PH101	**ENGINEERING PHYSICS**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To make the students effectively achieve an understanding of mechanics and properties of matter.
2. To enable the students to gain knowledge of electromagnetic waves.
3. To introduce the basics of solid-state physics.
4. Equipping the students to successfully understand the importance of optics and Laser.
5. To motivate the students towards the applications of quantum mechanics.
6. To learn problem solving skills related to physics principles and interpretation of experimental data.
7. To determine error in experimental measurements and techniques used to minimize such error.

Course Content:

UNIT I MECHANICS AND PROPERTIES OF MATTER 9

*Mechanics:*Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy-moment of inertia and its theorem- gyroscope - torsional pendulum.

*Elasticity:*Elastic modules – Poisson's ratio – relation between them – determination of Young's modulus by uniform and non-uniform bending- I section girders.

UNIT II ELECTROMAGNETIC WAVES 9

Maxwell's equations (Basics) - Charged particles in uniform and constant electric field – Charged particles in an alternating electric field- 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 SOLID STATE PHYSICS 9

Elements of crystallography; diffraction methods for structure determination; bonding in solids; lattice vibrations and thermal properties of solids; free electron theory; band theory of solids:

nearly free electron and tight binding models; metals, semiconductors and insulators; conductivity, mobility and effective mass; optical, dielectric and magnetic properties of solids; elements of superconductivity: Type-I and Type II superconductors, Meissner effect, London equation.

UNIT IV OPTICS & LASER 9

Classification of optical materials – carrier generation and recombination processes - insulators and semiconductors (concepts only) - photo current in a P-N diode – solar cell - LED– Laser diodes – Optical data storage techniques.

Laser (Basics)– Einstein's coefficient- Types of Laser- He- Ne Laser - CO_2 laser, Nd-YAG laser, semiconductor laser – MASER Introduction - Holography: Principle and construction - Reconstruction of Holography.

UNIT V QUANTUM MECHANICS & NANODEVICES 9

Compton effect - The Schrodinger equation (Time dependent and time independent forms)- particle in an infinite potential well: 1D,2D and 3D Boxes.

NanoDevices: Introduction - quantum confinement – quantum structures: quantum wells, wires and dots — band gap of nanomaterials. Tunneling – Single electron phenomena: Coulomb blockade - resonant- tunneling diode – single electron transistor – quantum cellular automata - Quantum system for information processing.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome:

1. Understand the importance of mechanics and properties of matter
2. Express their knowledge in electromagnetic waves.
3. Demonstrate a strong foundational knowledge in solid state physics.
4. Gain the knowledge in optics and Laser.
5. Understand the importance of quantum physics and Nanodevices.
6. Understand the functioning of various physics laboratory equipment.
7. Use graphical models to analyze laboratory data.
8. Use mathematical models as a medium for quantitative reasoning and describing physical reality.

Text Book(s):

1. D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2. Brijlal and N. Subramaniam "Properties of Matter", Eurasia Publishing House Limited, 1993.
3. E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ. Press.
4. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGrawHill (Indian Edition), 2017.
5. Parag K. Lala, Quantum Computing: A Beginner's Introduction, McGraw-Hill Education (Indian Edition), 2020.

Reference Books:

1. R.Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition),

2009.
2. Paul A. Tipler, Physics – 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. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson Education (Indian Edition) 2009.

Web Links:

1. https://bayanbox.ir/view/7764531208313247331/Kleppner-D.-Kolenkow-R.J.-Introduction-to-Mechanics-2014.pdf
2. https://physicaeducator.files.wordpress.com/2017/11/electricity_and_magnetism-by-purcell-3ed-ed.pdf
3. https://safehandsakola.org/downloads/Physics/Concepts%20of%20Modern%20Physics%20-Arthur%20Beiser.pdf
4. https://web.pdx.edu/~pmoeck/books/Tipler_Llewellyn.pdf
5. https://farside.ph.utexas.edu/teaching/qmech/qmech.pdf
6. https://web.pdx.edu/~pmoeck/phy381/workbook%20nanoscience.pdf

List of Experiments:

1.	Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.	**3**
2.	Uniform bending – Determination of Young's modulus.	**3**
3.	Laser- Determination of the wavelength of the laser using grating.	**3**
4.	Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids.	**3**
5.	Melde's string experiment	**3**
6.	Simple harmonic oscillations of cantilever.	
7.	Non-uniform bending - Determination of Young's modulus.	
8.	Laser-Determination of particle size and acceptance angle of the laser.	
9.	Determination of wavelength of mercury spectrum – spectrometer grating.	
10.	Determination of thickness of a thin wire – Air wedge method.	

TOTAL PRACTICAL PERIODS 30Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75Periods

22CS101	PROBLEM SOLVING TECHNIQUES I	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

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).

UNIT II DATA TYPES, EXPRESSIONS, STATEMENTS 9

Python interpreter and interactive mode, debugging; values and types: int, float, boolean, string , and list; variables, expressions, statements, tuple assignment, precedence of operators, comments;

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.

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;

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;

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome:

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Write simple Python programs using conditionals and loops for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries etc.

6. Read and write data from/to files in Python programs.

Text Book(s):

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

Reference Books:

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and MadhavanMukund, “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. Martin C. Brown, “Python: The Complete Reference”, 4th Edition, Mc-Graw Hill, 2018.

Web Links:

1. https://www.python.org/

List of Experiments:

1.	Exchange the values of two variables	**3**
2.	Circulate the values of n variables, distance between two points.	**3**
3.	Square root, gcd, Exponentiation.	**3**
4.	Linear search, binary search.	**3**
5.	Simple sorting, histogram, Students marks statement.	**3**
6.	Retail bill preparation.	**3**
7.	Word count, copy file.	**3**
8.	Voter’s age validation, Marks range validation (0-100).	**3**
9.	Mini Project – 1	**3**
10.	Mini Project –2	**3**
	TOTAL PRACTICAL PERIODS	**30Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75Periods**

22ES101	INNOVATION AND DESIGN THINKING	L	T	P	C
		1	0	2	2

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To explain the concept of design thinking for product and service development
2. To explain the fundamental concept of innovation and design thinking
3. To discuss the methods of implementing design thinking in the real world.

Course Content:

UNIT I PROCESS OF DESIGN 3

Understanding Design thinking - Shared model in team-based design – Theory and practice in Design thinking – Explore presentation signers across globe – MVP or Prototyping.

UNIT II TOOLS OF DESIGN THINKING 3

Real-Time design interaction captures and analysis – Enabling efficient collaboration in digital space – Empathy for design – Collaboration in distributed Design.

UNIT III DESIGN THINKING IN IT 3

Design Thinking to Business Process modelling, Finding pain points.

UNIT IV DT FOR STRATEGIC INNOVATIONS 3

Growth – Story telling representation – Strategic Foresight - Change – Sense Making - experience design - Standardization – Humanization - Creative Culture.

UNIT V DESIGN THINKING WORKSHOP 3

Design Thinking Workshop Empathize, Design, Ideate, Prototype and Test.

TOTAL LECTURE CUM PRACTICAL HPERIODS 15 Periods

Expected Course Outcome:

1. To immerse students into the world of innovation as a systematic process of tackling relevant business and/or social problems.
2. To provide a social and thinking space for the recognition of innovation challenges and the design of creative.
3. To expose the student with state of the art perspectives, ideas, concepts, and solutions related to the design and execution of innovation driven projects using design thinking principles.
4. To develop an advance innovation and growth mindset form of problem identification and reframing, foresight, hindsight and insight generation.

Text Book(s):

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design",Cengage learning (International edition) Second Edition, 2013.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.

3. HassoPlattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011.
4. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Business or Design School", John Wiley & Sons 2013.

Reference Books:

1. Yousef Haik and Tamer M.Shahin, “Engineering Design Process”, CengageLearning, Second Edition, 2011.
2. Book - Solving Problems with Design Thinking - Ten Stories of What Works (Columbia Business School Publishing) Hardcover – 20 Sep 2013 by Jeanne Liedtka (Author), Andrew King (Author), Kevin Bennett (Author).

22EE101	**CIRCUIT THEORY**	**L**	**T**	**P**	**C**
		3	**0**	**2**	**4**

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand DC and AC circuits.
2. To learn network theorems and two port networks for circuit analysis.
3. To explore the transient and resonance response of different electrical circuit.

Course Content:

UNIT I BASIC CIRCUITS ANALYSIS 15

Ohm’s Law – Kirchhoff’s laws - Resistors & Capacitors in series and parallel circuits - voltageand current division, dependent and independent sources-source transformation – star delta conversion- Mesh current and nodevoltagemethod of analysis forD.C Circuits.

UNIT II NETWORK THEOREMS FOR DC CIRCUITS 15

Thevenin’s and Norton Theorem – Superposition Theorem – Maximum power transfer theorem – Reciprocity Theorem - Millman’s Theorem.

UNIT III AC CIRCUITS 15

Representationofsinusoidalwaveforms,peakandrmsvalues,phasorrepresentation,realpower, reactive power,apparentpower, powerfactor.Analysisof single-phaseACcircuitsconsisting of R, L, C, RL, RC, RLC combinations (Series and Parallel), Mesh and Nodal analysis for AC circuits- Three phase balancedcircuits– voltage, current, powerrelations in star and deltaconnections.

UNIT IV RESONANCE AND COUPLED CIRCUITS 15

Seriesandparallelresonance–frequencyresponse–QualityfactorandBandwidth–Inductance - Self and mutual inductance – Coefficient of coupling – Tuned circuits – Single tuned circuits - DoubleTuned Circuits.

UNIT V TRANSIENT RESPONSE FOR DC CIRCUITS 15

TransientresponseofRL,RCandRLCCircuitsusingLaplacetransformforDCinput–

Characterizationoftwo portnetworks in terms ofZ, Yand Hparameters, An introduction to Network Topology, Trees and General Nodal analysis, Links and Loop analysis.

TOTAL LECTURE PERIODS 75 Periods

Expected Course Outcome:

1. Comprehend and design DC circuits.
2. Apply circuit theorems in real time.
3. Derive the sinusoidal steady-state (single-phase and three-phase) response of AC Circuits.
4. Analyse the Resonance response of electrical circuits.
5. Analyse the Transient response of electrical circuits.

Text Book(s):

1. William H. HaytJr, Jack E. Kemmerly and Steven M. Durbin, "Engineering Circuits Analysis", McGraw Hill publishers, 9thedition, New Delhi, 2020.
2. Joseph A. Edminister, Mahmood Nahvi, "Electric circuits", Schaum's series, McGraw-Hill, , 2019.

Reference Books:

1. Chakrabarti A, "Circuits Theory" (Analysis and synthesis), Dhanpat Rai& Sons, New Delhi, 2020.
2. Charles K. Alexander, Mathew N.O. Sadiku, "Fundamentals of Electric Circuits", Second Edition, McGraw Hill, 2019.
3. Sudhakar A and Shyam Mohan SP, "Circuits and Networks Analysis and Synthesis", McGraw Hill, 2015.

Web Links:

1. http://vlab.co.in/
2. http://electrical4u.com
3. http://network_analysis_(electrical_circuits)#Two_port_parameters

List of Experiments:

1.	Verification of Ohm's Law.	**3**
2.	Verifications ofKVL&KCL.	**3**
3.	VerificationsofThevenin's theorem.	**3**
4.	VerificationsofNortontheorem.	**3**
5.	VerificationofSuperpositionTheorem.	**3**
6.	Verification ofMaximumpowertransferTheorem.	**3**
7.	Verification of Reciprocity Theorem.	**3**
8.	Determinationof Resonance Frequencyof Series&ParallelRLCCircuits.	**3**
9.	Transientanalysisof RL andRC circuits.	**3**
10.	Three phase power measurement using two wattmeter methods.	**3**

TOTAL PRACTICAL PERIODS 30Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75Periods

22MA101	MATRICES AND CALCULUS	L	T	P	C
		3	1	0	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

UNIT I MATRICES 12

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 12

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 12

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 12

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

UNIT V MULTIPLE INTEGRALS 12

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 LECTURE CUM TUTORIAL PERIODS 60 Periods

Expected Course Outcome:

1. At the end of the course the students will be able to Use the matrix algebra methods for solving practical problems.
2. Apply differential calculus tools in solving various application problems.
3. Able to use differential calculus ideas on several variable functions.
4. Apply different methods of integration in solving practical problems.
5. Apply multiple integral ideas in solving areas, volumes and other practical problems.

Text Book(s):

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.

Reference Books:

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.

Web Links:

1. https://www.pdfdrive.com/higher-engineering-mathematics-d18621876.html
2. https://www.pdfdrive.com/advanced-engineering-mathematics-d166759888.html
3. https://theswissbay.ch/pdf/Gentoomen%20Library/Maths/Calculus/Calculus%20-%20Early%20Transcendentals%206e.pdf

22AC101	HERITAGE OF TAMIL	L	T	P	C
		1	0	0	1

Pre-requisite Nil **Syllabus Version** V 0.1

Course Content:

UNIT I INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION 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 NARRATION AND SUMMATION 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 DESCRIPTION OF A PROCESS / PRODUCT 3

Therukoothu, Karagattam, VilluPattu, KaniyanKoothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

UNIT IV CLASSIFICATION ND RECOMMENDATIONS 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 EXPRESSION 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 LECTURE PERIODS 15Periods

Text cum Reference Book(s):

1. தமிழகவரலொறு – மக்களும்பண்பொடும் – கக.கக. பிள்ளள (தவளியீடு:
   தமிழ்நொடுபொடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் – முளனவர்இல. சுந்தரம். (விகடன்பிரசுரம்).
3. கீழடி – ளவளகநதிக்களரயில்சங்ககொலநகரநொகரிகம் (ததொல்லியல்துளறதவளியீடு)
4. தபொருளந – ஆற்றங்களரநொகரிகம்.

(ததொல்லியல்துளறதவளியீடு)

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: 38 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.

22EEC101	**APTITUDE AND SOFT SKILLS**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To enhance students' cognitive prowess and mental potential.
2. To improve students' mental aptitude relevant to their academic choices, vocational preferences, job profiles and their ability to succeed.
3. To measure a range of skills such as language comprehension, logical thinking and numerical ability.
4. To get familiar with the method of solving aptitude and multi-choice questions.

Course Content:

UNIT I FUNDAMENTALS OF APTITUDE 2

English diagnostic test - EDT - Logical Reasoning-Puzzles - Factors influencing positive mind set- Importance of self-confidence and self-esteem.

UNIT II SPEAKING SKILLS 3

Effective communication – Barriers & Strategies – Day to Day conversation -Improving responding capacity – Extempore speech practice – Speech assessment. Arithmetic aptitude – Simplification.

UNIT III READING SKILLS 2

Reading Op-Ed columns and commentary – skimming and scamming methods -speed reading. Logical Reasoning-verbal analogies.

UNIT IV GREETINGS **2**

Greetings and expressions- expressing gratitude and apologies -*expressions* of courtesy. Arithmetic aptitude – Percentages.

UNIT V ETIQUETTE **3**

Etiquette- Respect, Consideration& Honesty-oral presentation-role of audio/video visual aids. Logical Reasoning – Non-verbal - Arithmetic aptitude – Introduction to numbers.

TOTAL LECTURE PERIODS 12Periods

Expected Course Outcome:

1. Students will be able to understand what he is good at and what they can be good at.
2. The vast scope and dynamics of aptitude classes ensured a streamlined process for the students to make career choices, academic pursuits, and professional growth.
3. The soft skills classes make the students scalable and standardized and help the students to outperform a large number of applicants in the market.
4. The soft skills classes help students to identify their leadership styles and work effectively as a team.

Text Book(s):

1. English for Job Seekers (Language and Soft Skills for the Aspiring) by GeethaRajeevan, C.L.N. Prakash) Cambridge University Press pvt,Ltd.
2. New International Business English by Leo Jones and Richard Alexander. Cambridge University Press pvt,Ltd.
3. Quantitative Aptitude for Competitive Examinations by R S Aggarwal, S. CHAND Publishers.
4. A Modern Approach To Logical Reasoning by R S Aggarwal, S. CHAND Publishers.

Reference Books:

1. A New Approach to REASONING Verbal & Non-Verbal Paperback – 1 January 2014 by B.S. Sijwalii&InduSijwali.
2. How to prepare for quantitative aptitude for the CAT 6^{th} edition by Arunsharma published on May, 2014 by Mcgraw Hill Education publishers.
3. Magical Book on Quicker Maths by M Tyra and K Kundan.
4. Shortcuts in Reasoning (Verbal, Non-Verbal, Analytical & Critical) for Competitive Exams 3rd Edition by Disha Experts.
5. Everyday Etiquette: How to Navigate 101 Common and Uncommon Social Situations. Published by St. Martin's Griffin; First edition.

22CY101	ENGINEERING CHEMISTRY	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To inculcate sound understanding of water softening methods and desalination techniques.
2. To make the students conversant with basics of polymer chemistry.
3. To develop an understanding of the basic concepts of phase rule and its applications to single and two component systems.
4. To facilitate the understanding of different types of fuels, their preparation, properties.
5. To familiarize the students with the operating principles, working processes and applications of energy Conversion and storage devices.
6. To induce the students to familiarize with electroanalytical techniques such as, potentiometer and conductometry in the determination of impurities in aqueous solutions.

Course Content:

UNIT I WATER TECHNOLOGY 9

Hardness of water- types - disadvantages of using hard water in industries – estimation of total, permanent and temporary hardness of water by EDTA method -Boiler troubles (scale and sludge)- Boiler feed water treatment – external conditioning - demineralization process - desalination by reverse osmosis – potable water treatment - breakpoint of chlorination.

UNIT II POLYMER AND COMPOSITES 9

Polymer: types – addition and condensation polymerization – mechanism of free radical addition polymerization – copolymers – plastics: classification – thermoplastics and thermosetting plastics, preparation, properties and uses of commercial plastics – PVC, Bakelite.

Composites: definition, types of composites – polymer matrix composites(PMC)– fibre reinforced plastics (FRP) - applications.

UNIT III ALLOYS AND PHASERULE 9

Alloys: Properties of alloys- significance of alloying, functions and effect of alloying elements- Nichrome and stainless steel (18/8) – heat treatment of steel.

Phase rule: definition of terms with examples, one component system -water system – reduced phase rule – two component systems – lead-silver system –Pattinson process, Cu-Ni system.

UNIT IV ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear fission – controlled nuclear fission – nuclear fusion – nuclear chain reactions – nuclear energy – light water nuclear power plant – breeder reactor – solar energy conversion – solar cells – wind energy.

Batteries, fuel cells and super capacitors: Types of batteries – primary battery (dry cell) secondary battery (lead acid battery, lithium-ion-battery) fuel cells – H_2-O_2 fuel cell- super capacitors.

UNIT V FUELS AND COMBUSTION 9

Fuels: Classification of fuels – coal – proximate and ultimate analysis – carbonization – manufacture of metallurgical coke (Otto Hoffmann method) – petroleum – refining – manufacture of synthetic petrol (Bergius process) – knocking – octane number – diesel oil – cetane number – compressed natural gas (CNG) – liquefied petroleum gases (LPG) – power alcohol and biodiesel.

Combustion of fuels: Calorific values – calculations – theoretical air requirement – ignition temperature – spontaneous ignitiontemperature– flue gas analysis (chromatography and gas sensors).

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome:

1. To analyse the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
2. Discuss the types of polymer formation and composites.
3. To apply the knowledge of phase rule and alloys for material selection requirements.
4. To recommend suitable fuels for engineering processes and applications.
5. To recognize different forms of energy resources and apply them for suitable applications in energy sectors.
6. To quantitatively analyse the impurities in solution by electro analytical techniques.

Text Book(s):

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

Reference Books:

1. O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.
2. Friedrich Emich, “Engineering Chemistry”, Scientific International PVT, LTD, New Delhi, 2014.
3. ShikhaAgarwal, “Engineering Chemistry-Fundamentals and Applications”, Cambridge University Press, Delhi, Second Edition, 2019.
4. 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.

List of Experiments:

1. Determination of total, temporary & permanent hardness of water by EDTA method. **3**
2. Determination of chloride content of water sample by Argentometric **3**

method.

3.	Estimation of copper content of the given solution by Iodometry.	**3**
4.	Determination of alkalinity in water sample.	**3**
5.	Determination of DO content of water sample by Winkler's Method.	**3**
6.	Estimation of Phase change in a solid.	**3**
7.	Determination of molecular weight of polyvinyl alcohol using Ostwald viscometer.	**3**
8.	Determine strength of given hydrochloric acid using pH meter.	**3**
9.	Determine strength of acids in a mixture of acids using conductivity meter.	**3**
10.	Determine iron content of the given solution using potentiometer.	**3**
	TOTAL PRACTICAL PERIODS	**30Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75Periods**

Course Code	PROBLEM SOLVING TECHNIQES - II	L	T	P	C
22CS201		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

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.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Demonstrate knowledge on C Programming constructs
2. Develop simple applications in C using basic constructs
3. Design and implement applications using arrays and strings
4. Develop and implement modular applications in C using functions.
5. Develop applications in C using structures and pointers.
6. Design applications using sequential and random access file processing.

Text Book(s):

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.

Reference Books:

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.

List of Experiments:

1.	Write a C program to calculate and display the area of a rectangle using the input values entered by the user.	**3**
2.	Write a C program to sort an array of integers using selection sort technique.	**3**
3.	Write a C program to concatenate two strings entered by the user and display the resultant string.	**3**
4.	Write a C program to find the factorial of a number using recursion.	**3**
5.	Write a C program to swap two numbers using call by value and call by reference.	**3**
6.	Write a C program to create a structure named student with the fields roll no, name, and marks in three subjects. Initialize the structure with the values entered by the user and display the details.	**3**
7.	Write a C program to read data from a text file and display it on the screen.	**3**
8.	Write a C program to implement a singly linked list and display its elements.	**3**
9.	Write a C program to open a binary file, write data to it, and read data from it.	**3**
10.	Write a C program to implement a stack using an array and perform push, pop, and display operations.	**3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipment: (for batch of 30 students)

1.	Standalone Computer	30 nos
2.	TURBO C	-

22MA201	NUMERICAL METHODS	L	T	P	C
		3	1	0	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the basic concepts of solving algebraic and transcendental equations.
2. To introduce the numerical techniques of interpolation in various intervals in real life situations.
3. To acquaint the student with understanding of numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
4. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.
5. To understand the knowledge of various techniques and methods of solving various types of partial differential equations.

Course Content:

UNIT I SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Solution of algebraic and transcendental equations - Fixed point iteration method– Newton Raphson method - Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel - Eigenvalues of a matrix by Power method and Jacobi's method for symmetric matrices.

UNIT II INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines - Interpolation with equal intervals - Newton's forward and backward difference formulae.

UNIT III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule – Romberg's Method - Two point and three-point Gaussian quadrature formulae – Evaluation of double integrals by Trapezoidal and Simpson's 1/3 rules.

UNIT IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods - Taylor's series method - Euler's method - Modified Euler's method – Fourth order Runge - Kutta method for solving first order equations - Multi step methods - Milne's and Adams - Bash forth predictor corrector methods for solving first order equations.

UNIT V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS **9+3**

Finite difference methods for solving second order two - point linear boundary value problems - One dimensional heat flow equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL LECTURE PERIODS 60 Periods

Expected Course Outcome:

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

1. Understand the basic concepts and techniques of solving algebraic and transcendental equations.
2. Appreciate the numerical techniques of interpolation and error approximations in various intervals in real life situations.
3. Apply the numerical techniques of differentiation and integration for engineering problems.
4. Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
5. Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

Text Book(s):

1. Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2. Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.

Reference Books:

1. Brian Bradie, "A Friendly Introduction to Numerical Analysis", Pearson Education, Asia, New Delhi, 2007.
2. Gerald. C. F. and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia,6th Edition, New Delhi, 2006.
3. Mathews, J.H. "Numerical Methods for Mathematics, Science and Engineering", 2nd Edition, Prentice Hall, 1992.
4. Sankara Rao. K., "Numerical Methods for Scientists and Engineers", Prentice Hall of India Pvt. Ltd, 3rd Edition, New Delhi, 2007.
5. Sastry, S.S, "Introductory Methods of Numerical Analysis", PHI Learning Pvt. Ltd, 5thEdition, 2015.

22AC201	TAMILS AND TECHNOLOGY	L	T	P	C
		1	0	0	1

Pre-requisite Nil **Syllabus Version** V 0.1

Course Content:

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 LECTURE PERIODS 15 Periods

Text cum Reference Books:

1. தமிழகவரலொறு – மக்களும்பண்பொடும் – மக.மக. பிள்மள (தவளியீடு: தமிழ்நொடுபொடநூல்மற்றும்கல்வியியல்பணிகள்கழகம்).
2. கணினித்தமிழ் – முமனவர்இல. சுந்தரம் . (விகடன்பிரசுரம்).
3. கீழடி – மவமகநதிக்கமரயில்ெங்ககொலநகரநொகரிகம் (ததொல்லியல்துமறதவளியீடு)

4. தபொருமந – ஆற்றங்கமரநொகரிகம். (ததொல்லியல்துமறதவளியீடு)

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) (Published by: The Author)

11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

22EEC201	**APTITUDE AND SOFT-SKILLS 2**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**1**

Pre-requisite	Nil	**Syllabus Version**	V 0.1

Course Objectives:

- To enhance Cognitive Abilities Improving critical thinking, problem-solving and decision-making skills to achieve better academic and professional outcomes.
- Boosting Soft Skills and Developing interpersonal, communication and time-management skills to excel in personal and professional relationships.
- Enhancing verbal and written communication skills to promote effective collaboration and build relationships.
- Developing self-awareness, empathy, and social skills to navigate complex interpersonal situations and increase team morale.

Course Content:

UNIT I APTITUDE **3**

Personality Assessment - SWOT analysis - Adaptability and Flexibility - Team building activity - Numerical Reasoning - calculations, identify patterns, and problem solving.

UNIT II SPEAKING SKILLS **3**

Core Components of Effective Communication - Non-Verbal Communication - active listening

and written communication - Business English - Communication enhancement activities - Abstract Reasoning - shapes, symbols, or images - Visual Reasoning.

UNIT III READING SKILLS **3**

Vocabulary Building – Comprehension – Fluency - Critical Reading - Reading for Information - Group problem-solving activities -Critical thinking and analysis -Creative problem solving - Decision making and evaluation -Deductive reasoning and connectives - Logical puzzles and games.

UNIT IV FLOW STATE **3**

S.M.A.R.T Goal Setting - Developing action plans - Overcoming Obstacles - Review and Reflection - Habit Building -Identifying Habits - Maintaining Habits -Habit Stacking Arithmetic aptitude - Number system.

UNIT V EMOTIONAL QUOTIENT **3**

Emotional Intelligence - Empathy and interpersonal skills - Self-awareness and self-regulation - Motivation and drive - Social awareness and relationship management - Quantitative aptitude - Equations - Word problems.

TOTAL LECTURE PERIODS **15 Periods**

Expected Course Outcome:

- Increased efficiency, productivity and performance in academic and professional settings.
- Enhanced communication, collaboration and teamwork among students.
- Increased ability to identify, analyze and solve complex problems in personal and professional settings.
- Improved self-awareness, emotional intelligence and interpersonal skills leading to better personal and professional relationships.

Text Book(s):

- Quantitative Aptitude for Competitive Examinations - 2022/edition-S Chand Publishing-Paperback_Edition-2022.
- Fast Track Objective Arithmetic by Rajesh Verma, January 2018 edition.
- How to Talk to Anyone: 92 Little Tricks for Big Success in Relationships, Publisher: Harper Element; New edition.
- Emotional Intelligence by Daniel Goleman, Bloomsbury Publishing India Private Limited; new edition, January 1995.

Reference Books:

- How to Prepare for Quantitative Aptitude for CAT by Arun Sharma, McGraw Hill Education; Eighth edition.

- The Pearson Guide to Quantitative Aptitude for Competitive Examinations by Dinesh Khattar
- Crucial Conversations by Al Switzler, Joseph Grenny, and Ron McMillan, Brilliance Audio; Abridged, Updated edition, August 2013.
- Nonviolent Communication by Marshall B. Rosenberg, Puddle Dancer Press; 3rd edition, September 2015.

22HS203	UNIVERSAL HUMAN VALUES	L	T	P	C
		2	0	0	2

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

The Course prepares second semester engineering and Technology students to:

1. Understand the importance of "VALUES" and "SKILLS" working together to ensure long-term happiness and prosperity.
2. Developing a holistic view on life, careers, happiness, and prosperity based on an accurate understanding of human reality and the rest of existence.
3. Attention to realistic ramifications of such a holistic view in terms of moral behaviour, reliable and gratifying human relationship with nature, and ethical human conduct.

Course Content:

UNIT I COURSE INTRODUCTION – AND VALUE EDUCATION 6

Introduction to human virtues, recognizing the need, fundamental guidelines, Content and Process on Value Education. Self-exploration-Wealth vs Prosperity, Understanding Needs of Self and Body.

UNIT II KNOWINGHUMANHAPPINESSAND MY HAPPINESS 6

Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

UNIT III FAMILY AND SOCIETY HARMONY AND HUMAN RELATIONSHIP 6

Thebasicunitofhumaninteraction,"trust"-thecorevalueofRelations,"respect"-understoodascorrectevaluation,differentemotions,justiceinrelationships,harmonyinsociety,avisionofUndivided Society (Akhand Samaj), Universal Order (Sarvabhaum Vyawastha)- from family to world family! - Practice Exercises and Case Studies will be taken up in Practice Sessions.

UNIT IV WHOLE EXISTENCE AS CO-EXISTENCE AND CONCORD OF NATURE 6

Concord innature, link,self-monitoring,understandingofmutualfulfilmentinthefourordersofnature,recognizingexistenceascoexistenceonalllevels,holisticawarenessof happiness inexistence.

UNIT V HOLISTICUNDERSTANDINGOFHAPPINESS OF UNIVERSAL HUMAN VALUES 6

Inferenceoftheaboveholisticunderstandingofhappiness of universal human values. Acceptinghumanvaluesnaturally. Finalityofethicalhumanbehaviour.

AHumanisticConstitutionandaHumanisticWorldOrder. Ability in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical, Strategies for Transition.

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome:

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

1. Thebigpictureoflife
2. SociallyResponsibleBehavior
3. Environmentallyfriendlywork
4. EthicalHumanBehaviour
5. Havetheabilityandskillstomaintaingoodhealthandhygiene
6. Recognizeandpursueexcellence(merit)andappreciateeveryone

Reference Books:

1.Vivekananda - Romain Rolland (English).
2.Gandhi - Romain Rolland (English).
3.Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991 15. Donella H. 4.Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, Limits to Growth – Club of Rome's report, Universe Books.
5.A Nagraj, 1998, Jeevan Vidya Ek Parichay, Divya Path Sansthan, Amarkantak.

Reference Links:

1.https://www.youtube.com/channel/UCQxWr5QB_eZUnwxSwxXEkQw

2.https://fdp-si.aicte-india.org/8dayUHV_download.php

3. https://www.youtube.com/watch?v=8ovkLRYXIjE

4.https://www.youtube.com/watch?v=OgdNx0X923I

5.https://www.youtube.com/watch?v=nGRcbRpvGoU

6.https://www.youtube.com/watch?v=sDxGXOgYEKM

22EC201	ELECTRON DEVICES	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

To acquaint the students with the construction, theory and operation of the basic electronic devices such as PN junction diode, Bipolar and Field effect Transistors, Power control devices, LED, LCD and other Opto-electronic devices

Course Content:

UNIT I SEMICONDUCTOR DIODE 9

PN junction diode, Current equations, Energy Band diagram, Diffusion and drift current densities, forward and reverse bias characteristics, Transition and Diffusion Capacitances, Switching Characteristics, Breakdown in PN Junction Diodes.

UNIT II BIPOLAR JUNCTION TRANSISTORS 9

NPN -PNP -Operations-Early effect-Current equations – Input and Output characteristics of CE, CB, CC - Hybrid -π model - h-parameter model, Ebers Moll Model- Gummel Poon-model, Multi Emitter Transistor.

UNIT III FIELD EFFECT TRANSISTORS 9

JFETs – Drain and Transfer characteristics,-Current equations-Pinch off voltage and its significance-MOSFET- Characteristics- Threshold voltage -Channel length modulation, DMOSFET, E-MOSFET-Characteristics – Comparison of MOSFET with JFET.

UNIT IV SPECIAL SEMICONDUCTOR DEVICES 9

Metal-Semiconductor Junction- MESFET, FINFET, PINFET, CNTFET, DUAL GATE MOSFET, Schottky barrier diode-Zener diode-Varactor diode –Tunnel diode- Gallium Arsenide device, LASER diode, LDR.

UNIT V POWER DEVICES AND DISPLAY DEVICES 9

UJT, SCR, Diac, Triac, Power BJT- Power MOSFET- DMOS-VMOS. LED, LCD, Photo transistor, Opto Coupler, Solar cell, CCD.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Describe the principle and characteristics of semiconductor diode.
2. Analyze various transistor configurations.
3. Understand the Construction and Operation of Field Effect Transistors.
4. Describe the principle of operation and characteristics of special Semiconductor diodes.

5. Discuss the operation of various semiconductor photo devices and power electronic devices.

Text Book(s):

1. Donald A Neaman, "Semiconductor Physics and Devices", Fourth Edition, Tata Mc GrawHill Inc. 2012.
2. Salivahanan. S, Suresh Kumar. N, Vallavaraj.A, "Electronic Devices and circuits", Third Edition, Tata McGraw- Hill, 2008.

Reference Books:

1. Robert Boylestad and Louis Nashelsky, "Electron Devices and Circuit Theory" Pearson Prentice Hall, 10th edition, July 2008.
2. R.S.Sedha, " A Text Book of Applied Electronics" S.Chand Publications, 2006.

22EC202 ELECTRICAL TECHNOLOGY

L	T	P	C
3	0	0	3

Syllabus Version V 0.1

Course Objectives:

Course Content:

UNIT I MAGNETIC CIRCUITS AND CORE LOSSES **9**

Different laws for calculating magnetic field - Biot-Savart law- Ampere's circuital law-Application of Ampere's circuital law in magnetic circuit-Reluctance permanence & B-H Characteristics Different zones of B-H characteristic - Analysis of Series magnetic circuit-Analysis of Series-parallel magnetic circuit.

UNIT II TRANSFORMER **9**

Single phase transformer-Operation of practical transformer under no-load and on-load with phasor diagrams-Open circuit and Short circuit tests-calculation of equivalent circuit parameters and predetermination of efficiency-commercial and all-day efficiency-Voltage regulation and its significance-Three-phase Transformers-Constructional features of three-phase transformers.

UNIT III DC MACHINES **9**

Construction-working of DC Generator-EMF Equation-types and characteristics of DC generator-

Principle of DC motor-Torque Equation of Motor-types of DC Motors-Torque speed characteristic and speed control of DC motor.

UNIT IV THREE PHASE INDUCTION MOTOR 9

construction details of cage and wound rotor machines-production of a rotating magnetic field - principle of operation - rotor Emf and rotor frequency - rotor reactance -rotor current and pf at standstill and during operation-Rotor power input-rotor copper loss and mechanical power developed and their inter relation-torque equation-deduction from torque equation - expressions for maximum torque and starting torque - torque slip characteristic.

UNIT V MEASURING INSTRUMENTS 9

Electronic voltmeter- precision rectifiers-true r.m.s voltmeter-basics of digital measurements- A/D and D/A converters, programmable gain amplifier- auto-ranging; comparators and function generators-elements of digital multimeter- clamp-on meter; solid state energy meter, frequency, phase angle and time period measurement. Cathode Ray Oscilloscope, Digital Storage Oscilloscope. Sample and Hold circuits, Data Acquisition System. Time and Frequency measurement- Oscilloscopes.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1.

Text Book(s):

1. Electric Machines , D. P. Kothari, I. J. Nagrath, McGraw Hill 5th edition, 2017.
2. J. B. Gupta , Rajeev Manglik, Rohit Manglik(2015), Theory & Performance of Electrical Machines, 14th edition, S. K. Kataria& Sons, New Delhi.

Reference Books:

1. Electrical Machines, V.K Mehta , Rohit Mehta 2014,S.Chand Publishers.
2. Electrical And Electronic Measurements, Banerjee, Gopal Krishna 2016,PHI Learning Pvt. Ltd.

22ES201	ENGINEERING PRACTICES LABORATORY	L	T	P	C
		0	0	2	1

Pre-requisite **Syllabus Version** V 0.1

List of Experiments:

GROUP A (CIVIL &MECHANICAL)

1 Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.
2 Preparingplumbinglinesketches.
3 Laying pipe connection to the suction side of a pump
4 Laying pipe connection to the delivery side of a pump.
5 Connecting pipes of different materials: Metal, plastic and flexible pipes used in house hold appliances

WOODWORK:

1 Sawing
2 Planing
3 Making joints likeT-Joint,Mortise joint and Tenon joint and Dovetail joint.
4 Studying joints in door panels and wood enfurniture
5 Studying common industrial trusses using models.

WELDINGWORK:

1 WeldingofButtJoints,LapJoints,andTeeJointsusingarcwelding.
2 Practicinggaswelding.

BASIC MACHINING WORK:

1 (simple)Turning.
2 (simple)Drilling.
3 (simple)Tapping.

ASSEMBLY WORK:

1 Assembling a centrifugal pump.
2 Assembling a house hold mixer.
3 Assembling an air conditioner.

SHEETMETALWORK:

1 Making of a square tray

FOUNDRY WORK:

1 Demonstrating basic foundry operations.

ELECTRICAL ENGINEERING PRACTICES

1. Introduction to switches, fuses, indicators and lamps - Basic switch board wiring with lamp, fan and three pin socket **3**
2. Staircase wiring & Fluorescent Lamp wiring with introduction to CFL and LED types **3**
3. Energy meter wiring and related calculations/ calibration **3**
4. Study of Iron Box wiring and assembly **3**

5.	Study of Fan Regulator (Resistor type and Electronic type using Diac/Triac/quadrac)	**3**
6.	Study of emergency lamp wiring/Water heater	**3**
	ELECTRONIC ENGINEERING PRACTICES	**3**
7.	Soldering simple electronic circuits and checking continuity.	
8.	Assembling and testing electronic components on a small PCB.	**3**
	ELECTRONIC EQUIPMENT STUDY:	**3**
9.	Study elements of smart phone.	
10.	Assembly and dismantle of LED TV.	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Wire various electrical joints in common household electrical wire work
2. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

List of Equipments: (for batch of 30 students)

1.	Single phase house wiring setup	2 No
2.	Three phase house wiring setup	2 No
3.	Staircase wiring setup	2 No
4.	Fluorescent lamp wiring setup	2 No
5.	Emergency lamp wiring setup	2 No
6.	Iron box wiring setup	2 No
7.	Emergency lamp wiring setup	2 No
8.	Soldering Iron, Lead	15 No
9.	Multi meter	15 No
10.	Continuity tester	15 no
11.	Used Laptop, Used desktop computer, Used LED TV	2 no

22EC301 **DIGITAL LOGIC CIRCUIT DESIGN** **L T P C**
3 0 2 4

Syllabus Version V 0.1

Course Objectives:

1. To present the fundamentals of digital circuits and simplification methods.
2. To practice the design of various combinational digital circuits using logic gates.
3. To bring out the analysis and design procedures for synchronous and asynchronous Sequential circuits.
4. To learn integrated circuit families.
5. To introduce semiconductor memories and related technology.

Course Content:

UNIT I BASIC CONCEPTS OF DIGITAL SYSTEMS 9

Review of Number systems, Number Representation, Binary Arithmetic and Logic gates, Boolean algebra, Boolean postulates and laws - De-Morgan's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Realization of combinational logic using gates , Design of combinational circuits : Adder , Subtractor, Parallel adder / Subtractor, Carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, Demultiplexer - Function realization using Multiplexer, Decoder - Code converters.

UNIT III SYNCHRONOUS SEQUENTIAL CIRCUITS 9

Latches, Flip flops – SR, JK, T, D, Master/Slave FF, Triggering of FF, Analysis and design of clocked sequential circuits – Design Moore/Mealy models, state minimization, state assignment, lock - out condition circuit implementation - Counters, Ripple Counters, Ring Counters, Shift registers, Universal Shift Register. Model Development: Designing of rolling display/real time clock

UNIT IV ASYNCHRONOUS SEQUENTIAL CIRCUITS 9

Stable and Unstable states, output specifications, cycles and races, state reduction, race free assignments, Hazards, Essential Hazards, Fundamental and Pulse mode sequential circuits, Design of Hazard free circuits.

UNIT V LOGIC FAMILIES AND PROGRAMMABLE DEVICES 9

Introduction to Logic families – ECL, TTL &CMOS - Programmable Logic Devices – Programmable Logic Array (PLA) - Programmable Array Logic (PAL) – Implementation of combinational logic circuits using PLA, PAL.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply Boolean algebra, Karnaugh map and Tabulation method to design combinational logic circuits.
2. Design various combinational digital circuits using logic gates.

3. Analyse and design synchronous sequential circuits
4. Analyse and design asynchronous sequential circuits.
5. Build logic gates and use programmable devices

Text Book(s):

1. M. Morris Mano, "Digital Logic and Computer Design", Pearson Education, 4th Edition, 2016.

Reference Books:

1. Charles H. Roth, Jr, 'Fundamentals of Logic Design', Jaico Books, 4th Edition, 2002.
2. Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education, NewDelhi, 2009.
3. Leach D, Malvino A P & Saha, "Digital Principles and Applications" 8th Edition, Tata McGrawHill Publishing Company, 2014.

List of Experiments:

1.	Study of Logic Gates.	**3**
2.	Design of adders and subtractors using logic gates.	**3**
3.	Design of Multiplexers & Demultiplexers using logic gates.	**3**
4.	Design of Encoders and Decoders using logic gates.	**3**
5.	Design of Magnitude Comparators using logic gates.	**3**
6.	Design of Code Converters using logic gates.	**3**
7.	Parity Generator and Parity Checker.	**3**
8.	Design and implementation of 3-bit synchronous up/down counter	**3**
9.	Construction and verification of 4 bit ripple counter and Mod-10 / Mod-12 Ripple counters	**3**
10.	Design and implementation of shift registers.	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipments: (for batch of 30 students)		
1.	Dual power supply/ single mode power supply	15 nos
2.	IC Trainer Kit	15 nos
3.	Bread Boards	15 nos
4.	Multimeter	15 nos
5.	IC : 7400/ 7402 / 7404 / 7486 / 7408 / 7432 / 7483 / 74150 / 74151 / 74147 / 7445 / 7476/7491/ 555 / 7494 / 7447 / 74180 / 7485 / 7473 / 74138 / 7411 / 7474	30 Each

22EC302	ELECTRONIC CIRCUITS	L	T	P	C
		3	0	2	4

Syllabus Version V 0.1

Course Objectives:

1. To learn about biasing of BJT and JFET circuits.
2. To study the behavior of small signal amplifiers using BJT Course.
3. To provide an insight on the large signal amplifiers and linear wave shaping circuits.
4. To impart knowledge on feedback amplifiers.
5. To discuss the operating principles of Oscillators and multivibrators.

Course Content:

UNIT I BIASING OF BJT AND FET **9**

Need for biasing-Stability factor-Load line and quiescent point-Variation of quiescent point - BJT biasing circuits-Bias compensation for BJT-FET and MOSFET Biasing circuits

UNIT II SMALL SIGNAL AMPLIFIERS **9**

H-parameter small-signal equivalent circuit - Mid band analysis of single stage CE amplifiers - Low frequency response of CE amplifiers - High frequency a model -High frequency response of CE amplifiers, Multistage amplifiers-Darlington Amplifier.

UNIT III LARGE SIGNAL AMPLIFIERS AND LINEAR WAVE SHAPING CIRCUITS **9**

Classification of large signal amplifiers-Class A, Class B amplifier-Cross over Distortion - Push-Pull amplifier- complementary symmetry push-pull amplifier, Tuned amplifiers -Class C tuned amplifier -Integrator- Differentiator-Clippers- Clampers- Diode comparator

UNIT IV FEEDBACK AMPLIFIERS **9**

Block diagram, Loop gain, Gain with feedback, Effects of negative feedback. Sensitivity and desensitivity of gain, Cut-off frequencies, distortion, noise, input impedance and output impedance with feedback Four types of negative feedback connections-voltage series feedback, voltage shunt feedback, current series feedback and current shunt feedback.

UNIT V OSCILLATORS AND MULTIVIBRATORS **9**

Classification of oscillator, Barkhausen Criterion Mechanism for start of oscillation and stabilization of amplitude. General form of an Oscillator, Analysis of Hartley, Colpitt's, RC phase shift and Wien bridge Oscillator- A stable multivibrator-Monostable multivibrator and Bistable multivibrator

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand various biasing circuit for BJT and JFET amplifiers and apply in solving the problems.
2. Understand the low frequency and high frequency response of BJT amplifiers using small signal equivalent circuit.
3. Understand the operation of various types of large signal amplifiers and lincar wave

shaping circuits.
4. Understand the different types of feedback amplifiers with examples.
5. Understand various types of oscillators and multivibrators and their applications

Text Book(s):

1. S Salivahanan, N.Suresh Kumar and A. Valluvaraj, "Electronic Devices and Circuits", 3rd Edition 2012, McGraw Hill.

2. Donald A. Neamen, "Electronic Circuit Analysis and Design" 3 rd edition, Tata McGraw Hill, 2010.

Reference Books:

1. Robert L. Boylestad, Louis Nasheisky. "Electronic Devices and Circuit Theory", 9th Edition, 2007.
2. Jacob Millman, Christos C.Halkins, "Electronic Devices and Circuits" McGraw Hill, Edition 1991.
3. D.Schilling and C Belove, "Electronic Circuits", 3rd Edition, McGraw Hill, 1989.
4. David A. Bell, "Electronic Devices and Circuits", fifth edition, Oxford Higher education.

List of Experiments:

1.	Frequency Response of CE, CB, CC amplifiers	**3**
2.	Darlington Amplifier	**3**
3.	Differential Amplifiers - Transfer characteristics, CMRR Measurement	**3**
4.	Determination of bandwidth of single stage and multistage amplifiers	**3**
5.	RC Integrator and Differentiator circuits	**3**
6.	Series and Shunt feedback amplifiers-Frequency response, Input and output impedance	**3**
7.	Clippers and Clampers	**3**
8.	Astable and Monostable multivibrators	**3**
9.	Hartley Oscillator and Colpitts Oscillator	**3**
10.	RC Phase shift oscillator and Wien Bridge Oscillator	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipments: (for batch of 30 students)

1.	CRO (30MHz) , Signal Generator /Function Generators (3 MHz)	15 nos
2.	Dual Regulated Power Supplies (0 – 30V), Bread Boards, Transformers.	15 nos
3.	Standalone desktop PCs with SPICE software (SPICE Circuit Simulation Software: (any public domain or commercial software)	15 nos
4.	Transistor/FET (BJT-NPN-PNP and NMOS/PMOS)	50 Each
5.	Components and Accessories: Resistors, Capacitors, Inductors, diodes, Zener Diodes.	30 Each

22CS301	DATA STRUCTURES	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the concepts of ADTs.
2. To Learn linear data structures – lists, stacks, and queues.
3. To understand non-linear data structures – trees and graphs.
4. To understand sorting, searching and hashing algorithms.
5. To apply Tree and Graph structures

Course Content:

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- Infixto 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 LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Define linear and non-linear data structures.
2. Implement linear and non–linear data structure operations.
3. Use appropriate linear/non–linear data structure operations for solving a given

problem.

4. Apply appropriate graph algorithms for graph applications.
5. Analyze the various searching and sorting algorithms

Text Book(s):

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

Reference Books:

1. Langsam, Augenstein and Tanenbaum, Data Structures Using C and C++, 2nd Edition, PearsonEducation, 2015.
2. Thomas H. Cormen, Charles E. Leiserson, Ronald L.Rivest, Clifford Stein, Introduction toAlgorithms", 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

List of Experiments:

1.	Array implementation of Stack, Queue and Circular Queue ADTs	**3**
2.	Implementation of Singly Linked List	**3**
3.	Linked list implementation of Stack and Linear Queue ADTs	**3**
4.	Implementation of Polynomial Manipulation using Linked list	**3**
5.	Implementation of Evaluating Postfix Expressions, Infix to Postfix conversion	**3**
6.	Implementation of Binary Search Trees	**3**
7.	Implementation of AVL Trees	**3**
8.	Implementation of Heaps using Priority Queues	**3**
9.	Implementation of Dijkstra's Algorithm	**3**
10.	Implementation of Open Addressing (Linear Probing and Quadratic Probing)	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipment: (for batch of 30 students)

1.	Systems with Linux Operating System with gnu compiler	30 nos

22MA301	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	L	T	P	C
		3	1	0	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the basic concepts of PDE for solving standard partial differential equations.
2. To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
3. To acquaint the student with Fourier series techniques in solving heat flow problems used invarious situations.
4. To acquaint the student with Fourier transform techniques used in wide variety of situations.
5. To introduce the effective mathematical tools for the solutions of partial differential equationsthat model several physical processes and to develop Z transform techniques for discrete time systems.

Course Content:

UNIT I PARTIAL DIFFERENTIAL EQUATIONS 9+3

Formation of partial differential equations— Solutions of standard types of first order partial differential equations – Lagrange's linear equation — Linear partial differential equations of second and higher order with constant coefficients of homogeneous type.

UNIT II FOURIER SERIES 9+3

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series – Half range cosine series– Parseval's identity – Harmonic analysis.

UNIT III APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS 9+3

Classification of PDE – Method of separation of variables – Solutions of one-dimensional wave equation – One dimensional equation of heat conduction.

UNIT IV FOURIER TRANSFORMS 9+3

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

UNIT V Z - TRANSFORMS AND DIFFERENCE EQUATIONS 9+3

Z-transforms – Elementary properties - Initial and final value theorems - Inverse Z – transform (using partial fraction and residues) – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.

TOTAL LECTURE PERIODS 60 Periods

Expected Course Outcome:

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

1. Understand how to solve the given standard partial differential equations.
2. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications.
3. Appreciate the physical significance of Fourier series techniques in solving one heat flow problems and one-dimensional wave equations.
4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
5. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

Text Book(s):

1. Veerarajan. T., "Transforms and Partial Differential Equations", Tata McGraw Hill Education Pvt. Ltd., New Delhi, Second reprint, 2012.
2. Grewal. B.S., "Higher Engineering Mathematics", 42nd Edition, Khanna Publishers, Delhi, 2012.
3. Narayanan.S., ManicavachagomPillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students" Vol. II & III, S.Viswanathan Publishers Pvt. Ltd.1998.

Reference Books:

1. Bali.N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 7th Edition, Laxmi Publications Pvt Ltd,
2007.
2. Ramana.B.V., "Higher Engineering Mathematics", Tata Mc Graw Hill Publishing Company Limited, NewDelhi, 2008.
3. Glyn James, "Advanced Modern Engineering Mathematics", 3rd Edition, Pearson Education, 2007.
4. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.
5. Ray Wylie. C and Barrett.L.C, "Advanced Engineering Mathematics" Tata Mc Graw Hill Education Pvt Ltd, Sixth
Edition, New Delhi, 2012.
6. Datta.K.B., "Mathematical Methods of Science and Engineering", Cengage Learning India Pvt Ltd, Delhi, 2013.

22EC303	ELECTROMAGNETIC ENGINEERING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To learn the field and potentials due to static charges.
2. To learn the basics of static magnetic field.
3. To understand how materials affect electric and magnetic fields.
4. To be familiar with the relations between the fields under time varying situations.
5. To provide knowledge on basic characteristics of guided waves.

Course Content:

UNIT I STATIC ELECTRIC FIELD 9

Review of vector algebra, Co-ordinate Systems – Gradient, Divergence, Curl – Divergence theorem, Stokes theorem - Coulomb's Law– Electric Field Intensity – Electric Field due to discrete charges, charges distributed uniformly on an infinite line, finite line and infinite sheet. Electric Scalar Potential – Electric Flux Density – Gauss Law and its applications.

UNIT II STATIC MAGNETIC FIELD 9

Biot-Savart's Law– Magnetic Field intensity due to infinite and finite wire carrying current I – Ampere's circuital law. Magnetic flux density –Lorentz force equation – Force on a wire carrying a current placed in a magnetic field – Torque on a loop carrying a current – Magnetic moment – Magnetic Vector Potential

UNIT III ELECTRIC AND MAGNETIC FIELDS IN MATERIALS 9

Poisson's and Laplace's equation – Electric Polarization - Capacitance – Capacitance of parallel plate capacitor and coaxial cable – Capacitance of parallel plate capacitor with two dielectrics – Electrostatic energy - Energy density – Boundary conditions for electric fields – Electric current – Current density – Point form of ohm's law – Continuity equation for current. Inductance – Inductance of loops and solenoids – Mutual inductance –Energy density in magnetic fields – Magnetization and Permeability - Magnetic boundary conditions.

UNIT IV TIME VARYING ELECTRIC AND MAGNETIC FIELDS 9

Faraday's law – Transformer and Motional electromotive forces - Displacement current – Maxwell's equations in integral form and differential form –Maxwell's equation in Phasor form - Poynting Vector and the flow of power – Poynting theorem.

UNIT V ELECTROMAGNETIC WAVES 9

Wave equations for conducting and non-conducting media - Wave equations in Phasor form – Uniform plane waves in perfect dielectrics, conductors and free space - Skin effect- Introduction to EM Shielding.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Describe the fundamental concepts of static electric field.
2. Explain the fundamental concepts of static magnetic field.
3. Analyze the effect of static electric and magnetic fields in materials.
4. Understand the significance of Maxwell's equations for time varying field.
5. Apply Maxwell's equations to analyze wave propagation in various mediums.

Text Book(s):

1. M.N.O.Sadiku and S.V. Kulkarni, Principles of electromagnetics, 6th ed., Oxford(Asian Edition), 2015.
2. William H.Hayt, J A Buck, "Engineering Electromagnetics" Tata McGraw Hill Education Private Limited, Seventh Edition, 2012.

Reference Books:

1. Clayton.R.Paul, Keith W.Whites, Syed.A.Nasar "Introduction to Electro Magnetic Fields", WCB/McGraw-Hill, Third Edition, 2007.
2. David K.Cheng "Field and Wave Electromagnetics" Second Edition, Pearson Education Limited, 2014.
3. S.Ramo, J.R.Whinnery and T.VanDuzer: "Fields and Waves in Communications Electronics" John Wiley & Sons, Third edition, 2003.

22EC304	**CONTROL SYSTEMS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Syllabus Version V 0.1

Course Objectives:

1. To know the concept of modeling of control systems.
2. To gain adequate knowledge in the time response analysis of first and second order systems.
3. To examine the various frequency response plots.
4. To enumerate the concept of different stability analysis techniques.
5. To describe the concept of state variable analysis.

Course Content:

UNIT I SYSTEMS COMPONENTS AND THEIR REPRESENTATION 9

Control System: Terminology and Basic Structure-Feed forward and Feedback control theoryElectrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs models-DC and AC servo Systems.

UNIT II TIME RESPONSE ANALYSIS 9

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control.

UNIT III FREQUENCY RESPONSE AND SYSTEM ANALYSIS 9

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot- Nyquist plots-Design of compensators using Bode plots-Cascade lead compensation-Cascade lag compensation-Cascade lag-lead compensation

UNIT IV CONCEPTS OF STABILITY ANALYSIS 9

Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.

UNIT V CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS 9

State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Compute the transfer function of different physical systems.
2. Analyse the time domain specification and calculate the steady state error.
3. Illustrate the frequency response characteristics of open loop and closed loop system response.
4. Analyse the stability using Routh and root locus techniques.
5. Illustrate the state space model of a physical system and discuss the concepts of sampled data control system.

Text Book(s):

1. M.Gopal,"Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.

Reference Books:

1. J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.
2. K.Ogata, "Modern Control Engineering", PHI, 5th Edition, 2012.
3. S.K.Bhattacharya, "Control System Engineering", Pearson, 3rd Edition, 2013.
4. Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition,1995.

22CS403	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To learn the fundamentals of data models and to represent a database system using ERdiagrams.
2. To study SQL and relational database design.
3. To understand the internal storage structures using different file and indexingtechniques which will help in physical DB design.
4. To understand the fundamental concepts of transaction processing-concurrencycontrol techniques and recovery procedures.
5. To have an introductory knowledge about the Storage and Query processing Techniques

Course Content:

UNIT I RELATIONAL DATABASES 9

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 9

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 – Concurrency Control – Need for Concurrency – Locking Protocols – Two Phase Locking – Deadlock – Transaction Recovery - Save Points – Isolation Levels – SQL Facilities for Concurrency and Recovery

UNIT IV IMPLEMENTATION TECHNIQUES 9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing –Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations – Query optimization using Heuristics and Cost Estimation

UNIT V ADVANCED TOPICS 9

Distributed Databases: Architecture, Data Storage, Transaction Processing –MongoDB–DDL,DLL,DML– Object-based Databases: Object Database Concepts, Object-Relational features, ODMG Object Model, ODL, OQL - XML Databases: XML Hierarchical Model, DTD, XML Schema, XQuery – Information Retrieval: IR Concepts, Retrieval Models,

Queries in IR systems.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Classify the modern and futuristic database applications based on size and complexity
2. Map ER model to Relational model to perform database design effectively
3. Write queries using normalization criteria and optimize queries
4. Compare and contrast various indexing strategies in different database systems
5. Appraise how advanced databases differ from traditional databases

Text Book(s):

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", SixthEdition, Tata McGraw Hill, 2011.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Sixth Edition,Pearson Education, 2011.

Reference Books:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition,Pearson Education, 2006.
2. Raghu Ramakrishnan, —Database Management Systems‖, Fourth Edition, McGraw-HillCollege Publications, 2015.
3. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011

List of Experiments:

1.	Data Definition Commands, Data Manipulation Commands for inserting, deleting, updating and retrieving Tables and Transaction Control statements	**3**
2.	Database Querying – Simple queries, Nested queries, Sub queries and Joins.	**3**
3.	Views, Sequences, Synonyms.	**3**
4.	Database Programming: Implicit and Explicit Cursors.	**3**
5.	Procedures and Functions	**3**
6.	Triggers	**3**
7.	Exception Handling	**3**
8.	Database Design using ER modeling, normalization and Implementation for any application.	**3**
9.	Database Connectivity with Front End Tools.	**3**
10.	Case Study using real life database applications.	**3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipment: (for batch of 30 students)

1.	Systems with MySql	30 nos
2.	Visual Studio	30 nos
3.	Server	-

22EC401	LINEAR INTEGRATED CIRCUITS	L	T	P	C
		3	0	2	4

Syllabus Version V 0.1

Course Objectives:

1. To study the basic concepts of OPAMP.
2. To impart knowledge on various applications of OPAMP.
3. To know the working of comparators and waveform generators.
4. To impart the design concepts of ADC and DAC
5. To study the working of PLL and voltage regulators

Course Content:

UNIT I BASICS OF OPERATIONAL AMPLIFIERS 9

Basic information about op-amps, Ideal Operational Amplifier -General operational amplifier stages DC and AC performance characteristics, slew Rate , Open and closed loop configurations.

UNIT II APPLICATIONS OF OPERATIONAL AMPLIFIERS 9

Sign Changer, Scale Changer, Phase Shift Circuits, Voltage Follower, V-to-1 and I-to-V converters, adder, subtractor, Instrumentation amplifier, Integrator, Differentiator, Precision rectifier, clipper and clamper, Low-pass, high-pass and band-pass Butterworth filters.

UNIT III COMPARATORS AND WAVEFORM GENERATORS 9

Comparators, Schmitt trigger, Sine-wave generators, Multivibrators, IC 555, Frequency to Voltage and Voltage to Frequency converters

UNIT IV ANALOG TO DIGITAL AND DIGITAL TO ANALOG CONVERTERS 9

D/A converter-specifications-weighted resistor type, R-2R Ladder type, Voltage Mode and Current-Mode –R-2RLadder types swatches for D/A converters, A/D Converters specifications-Flash type-Successive Approximation type-Single Slope type-Dual Slope Type.

UNIT V PLL and VOLTAGE REGULATORS 9

Operation of the basic PLL, Voltage controlled oscillator, Application of PLL for AM detection, FM detection, IC Voltage regulators-Three terminal fixed and adjustable voltage.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. To understand the characteristics of opamp.
2. To understand the various applications of opamp.
3. To understand the various wave generating and shaping circuits.
4. To apply ADC and DAC for various applications.
5. To understand the concept of PLL. and voltage regulators.

Text Book(s):

1. D.Roy Choudhry, Shail Jain, "Linear Integrated Circuits", Wiley Easter, New Delhi, 2014.
2. Ramakant A. Gayakwad, "OP-AMP and Linear ICs, 4th Edition, Pearson Education 2015.

Reference Books:

1. Salivahanan & V.S. Kanchana Bhaskaran, "Linear Integrated Circuits", 2nd edition McGraw Hill, 2014.
2. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", 3rd Edition, Tat McGraw-Hill, 2007.
3. Robert F.Coughlin, Frederick F.Driscoll, "Operational Amplifiers and Linear Integrated Circuits", Sixth Edition, PHI, 2001.
4. B S Sonde, "System design using Integrated Clots, 2nd Edition, New Age Pub, 2001.

List of Experiments:

1.	Design and test the following experiments Inverting and Non Inverting Amplifiers Using IC 741	**3**
2.	Active Low Pass, High pass filters using IC 741	**3**
3.	Astable Multivibrator and Monostable Multivibrator using IC 741	**3**
4.	Clippers and Clampers using IC741	**3**
5.	Integrator and Differentiator circuits using Op-Amp	**3**
6.	RC Phase shift oscillator and Wien Bridge Oscillator	**3**
7.	Hartley Oscillator and Colpitts Oscillator SIMULATION USING SPICE	**3**
8.	Integrator and Differentiator using SPICE.	**3**
9.	Astable Multivibrator and Monostable Multivibrator with NE555 Timer	**3**
10.	RC Phase shift oscillator and Wien Bridge Oscillator with op-amp using SPICE.	**3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipments: (for batch of 30 students)		
1.	Dual power supply/ single mode power supply	15 nos
2.	CRO (30MHz) , Signal Generator /Function Generators (3 MHz)	15 nos
3.	Bread Boards	15 nos
4.	Multimeter	15 nos
5.	IC741, LM 555, NE555, LM311	25 Each

22MA303	PROBABILITY AND STATISTICS	L	T	P	C
		3	1	0	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. This course aims at providing the required skill to apply the statistical tools in engineering problems.
2. To introduce the basic concepts of probability and random variables.
3. To introduce the basic concepts of two-dimensional random variables.
4. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
5. 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.

Course Content:

UNIT I PROBABILITY AND RANDOM VARIABLES 9+3

Probability – 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.

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 TESTING OF HYPOTHESIS 9+3

Sampling distributions - Estimation of parameters - Statistical hypothesis - Large sample tests based on Normal distribution for single mean and difference of means -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT IV DESIGN OF EXPERIMENTS 9+3

One way and Two-way classifications - Completely randomized design – Randomized block design – Latin square design.

UNIT V STATISTICAL QUALITY CONTROL 9+3

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

TOTAL LECTURE PERIODS 60 Periods

Expected Course Outcome:

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

1. Understand the fundamental knowledge of the concepts of probability and have knowledge of standard distributions which can describe real life phenomenon.
2. Understand the basic concepts of one- and two-dimensional random variables and apply in engineering applications.
3. Apply the concept of testing of hypothesis for small and large samples in real life problems.
4. Apply the basic concepts of classifications of design of experiments in the field of agriculture and statistical quality control.
5. Have the notion of sampling distributions and statistical techniques used in engineering and management problems.

Text Book(s):

1. Johnson, R.A., Miller, I and Freund J., "Miller and Freund‘s Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.
2. Milton. J. S. and Arnold. J.C., "Introduction to Probability and Statistics", Tata McGraw Hill, 4th Edition, 2007.

Reference Books:

1. Devore. J.L., "Probability and Statistics for Engineering and the Sciences‖, Cengage Learning, New Delhi, 8th Edition, 2014.
2. Papoulis, A. and Unnikrishnapillai, S., "Probability, Random Variables and Stochastic Processes", McGraw Hill Education India, 4th Edition, New Delhi, 2010.
3. Ross, S.M., "Introduction to Probability and Statistics for Engineers and Scientists", 3rd Edition, Elsevier, 2004.
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, 2004.
5. Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", Pearson Education, Asia, 8th Edition, 2007.

22EC402	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

Syllabus Version V 0.1

Course Objectives:

1. To understand the basic signals and their properties.
2. To learn the mathematical tool of Fourier series and transforms.
3. To understand the concept of system analysis using Laplace transforms.
4. To understand the discrete signal analysis using transforms.
5. To know discrete system analysis using Z transform.

Course Content:

UNIT I SIGNALS AND SYSTEM REPRESENTATION & CLASSIFICATION **12**

Standard signal representation-continuous and discrete domain. Properties of impulse signal. Mathematical operation on signals, classification of signals and system -analog and discrete.

UNIT II ANALYSIS OF CONTINUOUS TIME (CT) SIGNALS **12**

Fourier series analysis-Trigonometric form, spectrum of continuous time (CT) signals-Fourier and Laplace transform of standard signals-Region of Convergence (ROC). Inverse Fourier and Laplace transform-partial fraction method, Properties

UNIT III LINEAR TIME INVARIANT-CONTINUOUS TIME (CT) SYSTEMS **12**

Block diagram representation of system- Direct form I & II. Applying Fourier and Laplace transform: Transfer function impulse response and Frequency response of CT system, Convolution integrals-Integral & Graphical method.

UNIT IV ANALYSIS OF DISCRETE TIME SIGNALS **12**

DTFT and Inverse DTFT-properties of DTFT- z transform and Inverse z-transform -Region of Convergence, properties of z transform. Convolution sum-Graphical and Matrix method.

UNIT V LINEAR TIME INVARIANT-DISCRETE TIME SYSTEMS **12**

Block diagram representation of system- Direct form I & II structure. DTFT and Z transform analysis of systems: Transfer function, impulse response, system response and Frequency response, Convolution and de-convolution

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the signal and system classification and properties.
2. Understand signal spectrum and apply Fourier series to continuous signal spectrum.
3. Apply Fourier and Laplace transform in LTI system analysis.

4. Apply DTFT to understand the properties of discrete time signals.
5. Apply Z-transform for discrete system analysis.

Text Book(s):

1. Allan V.Oppenheim, S.Wilsky and S.H.Nawab, "Signals and Systems", Pearson, 2007.
2. P Ramakrishna Rao, "Signals and System", Tata McGraw-Hill Education, 2010.

Reference Books:

1. M.J.Roberts, "Signals & Systems Analysis using Transform Methods & MATLAB", McGraw Hill, 2017.
2. B. P. Lathi, "Principles of Linear Systems and Signals". Second Edition, Oxford, 2009.
3. Ramesh Babu.P and Ananda natarajan, "Signals and Systems" Fifth edition, Scitech publications,2017.
4. A.NagoorKani, "Signals and Systems, Simplified", McGraw Hill Publication, 2018.

22MC401	**INDIAN CONSTITUTION**	**L**	**T**	**P**	**C**
		1	**0**	**0**	**0**

Syllabus Version V 0.1

Course Objectives:

1. To enable the student to get knowledge on Constitution of India.
2. To enhance the student knowledge in the area of parliamentary system and Federal system.
3. To enhance the student knowledge in the area of the Judiciary system and Foreign Policy.

Course Content:

UNIT I INDIAN CONSTITUTION **9**

Salient Features – Preamble-Pillars of constitution - Fundamental Rights – Directive Principles of State Policy - Fundamental Duties.

UNIT II PARLIAMENTARY SYSTEM **9**

Powers and Functions of President and Prime Minister - Council of Ministers – The Legislature Structure and Functions of Lok Sabha and Rajya Sabha – Speaker.

UNIT III FEDERAL SYSTEM **9**

Features of Federal System - Administrative Relationship between Union and States - Powers and Functions of Governor and Chief Minister – Council of Ministers – State Legislature.

UNIT IV THE JUDICIARY **9**

Organization and Composition of Judiciary - Powers and Functions of the Supreme Court - Judicial Review – High Courts.

UNIT V INTERNATIONAL POLITICS **9**

Foreign Policy of India – VISA Application Process- International Institutions like UNO, WTO, SAARC and Environmentalism.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1: Describe the salient features of the Indian Constitution.
2: Discuss the structure and functions of parliament.
3: Elaborate the structure and functions of state legislature.
4: Explain the fundamentals of organization and working of the Judiciary.
5: Discuss the foreign policy of India.

Text Book(s):

1. Basu D.D," Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

Reference Books:

1. Pylee M.V, "Introduction to the Constitution of India", Vikas Publishing House, New Delhi, 2011.
2. Kashyap S, "Our Constitution", National Book Trust, New Delhi, 2010.
3. Shukla V N, "Constitution of India", Eastern Book Company Ltd., New Delhi, 2011.

22EC403	ARDUINO PROGRAMMING LAB	L	T	P	C
		0	0	2	1

Syllabus Version V 0.1

Course Objectives:

1. To enable the student to get the basic knowledge of microcontroller and its peripherals.
2. To enable the student to get knowledge on interfacing controller with LED and LCD.
3. To enhance the student knowledge in the area of interfacing with Sensor like temperature, soil moisture, ultasonic sensor.

List of Experiments:

1. Blinking LED
2. LED Control by Push Button
3. Interfacing with Potentiometer
4. Interfacing with LCD Display
5. Distance Measurement using Ultrasonic sensor
6. Interfacing with Soil Moisture sensor
7. Interfacing with Temperature Sensor.
8. Interfacing with servo Motor
9. Smart Door Lock using Arduino
10. Automatic Street Light control using Arduino

TOTAL PERIODS **30 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1: Understand the microcontroller and its pin description.
2: Apply the knowledge on interfacing with the sensor and drives.
3: Apply the knowledge on applications.

List of Equipments:

Arduino Board - 15 No
Temperature Sensor - 15 No
Soil Moisture sensor - 15 No

Servo Motor - 15 NO
LCD Display - 10 No
Push button - 20 No
Potentiometer - 15 No
LDR - 15

22CS302	PROBLEM SOLVING TECHNIQUE-III	L	T	P	C
		3	0	2	4

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

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

Course Content:

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

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply the concepts of classes and objects to solve simple problems
2. Develop programs using inheritance, packages and interfaces
3. Make use of exception handling mechanisms and multithreaded model to solve real world problems
4. Build Java applications with I/O packages, string classes, Collections and generics concepts Integrate the concepts of event handling and JavaFX components and controls for developing GUIbased applications

Text Book(s):

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, NewDelhi, 2015

Reference Books:

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

List of Experiments:

1. Solve problems by using sequential search, binary search, and quadratic sorting algorithms (selection, insertion). **3**
2. Develop stack and queue data structures using classes and objects. **3**
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 grossand net salary. **3**
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. **3**
5. Solve the above problem using an interface **3**
6. Implement exception handling and creation of user defined exceptions **3**
7. Write a java program that implements a multi-threaded application that has three threads. Firstthread 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 **3**

value is odd, the third thread will print thevalue of the cube of the number.

8. Write a program to perform file operations. **3**
9. Develop applications using JavaFX controls, layouts and menus **3**
10. Develop a mini project for any application using Java concepts. **3**

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipments: (for batch of 30 students)

1. Operating Systems: Linux / Windows 30 nos
2. Front End Tools: Eclipse IDE / Netbeans IDE -

22EC501	COMMUNICATION SYSTEMS	L	T	P	C
		3	0	2	4

Syllabus Version V 0.1

Course Objectives:

1. To introduce Analog Modulation Schemes.
2. To impart knowledge in random process.
3. To study various Digital techniques.
4. To introduce the importance of sampling & quantization.
5. To impart knowledge in demodulation techniques.
6. To enhance the class room teaching using smart connectivity instruments.

Course Content:

UNIT I AMPLITUDE MODULATION 9

Review of signals and systems, Time and Frequency domain representation of signals, Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations. Angle Modulation, Representation of FM and PM signals, Spectral characteristics of angle modulated signals. SSB Generation – Filter and Phase Shift Methods, VSB Generation – Filter Method, Hilbert Transform, Pre-envelope & complex envelope AM techniques, Superheterodyne Receiver.

UNIT II RANDOM PROCESS & SAMPLING 9

Review of probability and random process. Gaussian and white noise characteristics, Noise in amplitude modulation systems, Noise in Frequency modulation systems. Pre-emphasis and Deemphasis, Threshold effect in angle modulation. Low pass sampling – Aliasing- Signal Reconstruction-Quantization - Uniform & non-uniform quantization - quantization noise - Nyquist criterion- Logarithmic Companding –PAM, PPM, PWM, PCM – TDM, FDM.

UNIT III DIGITAL TECHNIQUES 9

Pulse modulation Differential pulse code modulation. Delta modulation, Noise considerations in PCM,, Digital Multiplexers, Channel coding theorem - Linear Block codes - Hamming codes - Cyclic codes - Convolutional codes - Viterbi Decoder

UNIT IV DIGITAL MODULATION SCHEME 9

Geometric Representation of signals - Generation, detection, IQ representation, PSD & BER of Coherent BPSK, BFSK, & QPSK - QAM - Carrier Synchronization - Structure of Non-coherent Receivers Synchronization and Carrier Recovery for Digital modulation, Spectrum Analysis – Occupied bandwidth – Adjacent channel power, EVM, Principle of DPSK.

UNIT V DEMODULATION TECHNIQUES 9

Elements of Detection Theory, Optimum detection of signals in noise, Coherent communication with waveforms- Probability of Error evaluations. Baseband Pulse Transmission- Inter symbol Interference, Optimum demodulation of digital signals over band-limited channels.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Gain knowledge in amplitude modulation techniques.
2. Understand the concepts of Random Process to the design of communication systems.
3. Gain knowledge in digital techniques.
4. Gain knowledge in sampling and quantization.
5. Understand the importance of demodulation techniques

Text Book(s):

1. B.P.Lathi, "Modern Digital and Analog Communication Systems", 4th Edition, Oxford University Press, 2011.
2. Simon Haykins," Communication Systems", Wiley, 5th Edition, 2009.

Reference Books:

1. Wayner Tomasi, Electronic Communication System, 5th Edition, Pearson Education,2008.
2. A.Papoulis, "Probability, Random variables and Stochastic Processes", McGraw Hill, 3rd edition, 1991.
3. H P Hsu, Schaum Outline Series - "Analog and Digital Communications" TMH 2006

List of Experiments:

1.	AM- Modulator and Demodulator	3
2.	FM - Modulator and Demodulator	3
3.	Pre-Emphasis and De-Emphasis.	3
4.	Signal sampling and TDM.	3
5.	Pulse Code Modulation and Demodulation	3
6.	Pulse Amplitude Modulation and Demodulation.	3
7.	Pulse Position Modulation and Demodulation	3
8.	Pulse Width Modulation and Demodulation.	3
9.	Digital Modulation – ASK, PSK, FSK	3
10.	Delta Modulation and Demodulation.	3
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipments: (for batch of 30 students)		
1.	Kits for Signal Sampling, TDM, AM, FM, PCM, DM and Line Coding Schemes, Error control code	14 nos
2.	CROs, Probes(CRO)	15 nos
3.	MATLAB/SCILAB or equivalent software package for simulation experiments	15 nos
4.	DSO	2 nos
5.	Patch cords	100

22MC501	ESSENCE OF INDIAN KNOWLEDGE TRADITION	L	T	P	C
		1	0	0	0

Syllabus Version V 0.1

Course Objectives:

The course will introduce the students to

1. get a knowledge about Indian Culture Know Indian Languages and Literature religion and philosophy and the fine arts in India
2. Explore the Science and Scientists of Ancient, Medieval and Modern India
3. Understand education systems in India

Course Content:

UNIT I INTRODUCTION TO CULTURE 9

Culture, civilization, culture and heritage, general characteristics of culture, importance of culture in human literature, Indian Culture, Ancient India, Medieval India, Modern India.

UNIT II INDIAN LANGUAGES AND LITERATURE 9

Indian Languages and Literature – I: Languages and Literature of South India, – Indian Languages and Literature – II: Northern Indian Languages & Literature

UNIT III RELIGION AND PHILOSOPHY 9

Major religions practiced in India and Understanding their Philosophy – religious movements in Modern India (Selected movements only)

UNIT IV FINE ARTS IN INDIA (ART, TECHNOLOGY& ENGINEERING) 9

Indian Painting, Indian handicrafts, Music, divisions of Indian classic music, modern Indian music, Dance and Drama, Indian Architecture (ancient, medieval and modern), Science and Technology in India, development of science in ancient, medieval and modern India

UNIT V EDUCATION SYSTEM IN INDIA 9

Education in ancient, medieval and modern India, aims of education, subjects, languages, Science and Scientists of Ancient India, Science and Scientists of Medieval India, Scientists of Modern India

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand philosophy of Indian culture.
2. Distinguish the Indian languages and literature.
3. Learn the philosophy of ancient, medieval and modern India
4. Acquire the information about the fine arts in India.
5. Know the contribution of scientists of different eras.
6. Understand education systems in India

Text Book(s):

1. Basu D.D," Introduction to Indian Constitution", Prentice Hall of India, New Delhi, 2015.
2. Gupta D.C, "Indian Government and Politics", Vikas Publishing House, New Delhi, 2010.

Reference Books:

1. Kapil Kapoor, "Text and Interpretation: The India Tradition",ISBN: 81246033375, 2005
2. "Science in Samskrit", Samskrita Bharti Publisher, ISBN 13: 978-8187276333, 2007

3. NCERT, “Position paper on Arts, Music, Dance and Theatre”, ISBN 81-7450 494-X, 200
4. Narain, “Examinations in ancient India”, Arya Book Depot, 1993
5. Satya Prakash, “Founders of Sciences in Ancient India”, Vijay Kumar Publisher, 1989
6. M. Hiriyanna, “Essentials of Indian Philosophy”, Motilal Banarsidass Publishers, ISBN 13: 978-8120810990, 2014

22EC601	DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	2	4

Syllabus Version V 0.1

Course Objectives:

1. To learn discrete fourier transform, properties of DFT and its application to linear filtering
2. To understand the characteristics of digital filters, design digital IIR and FIR filters and apply these filters to filter undesirable signals in various frequency bands.
3. To understand the effects of finite precision representation on digital filters.
4. To understand the fundamental concepts of multi rate signal processing and its applications.
5. To introduce the concepts of adaptive filters and its application to communication engineering.

Course Content:

UNIT I DISCRETE FOURIER TRANSFORM 9

Sampling Theorem, concept of frequency in discrete-time signals, summary of analysis & synthesis equations for FT & DTFT, DFT and its properties, Relation between DTFT and DFT, Radix-2 FFT algorithms –DFT computation using Decimation in time and Decimation in frequency algorithms, Overlap-add and save Methods.

UNIT II INFINITE IMPULSE RESPONSE DIGITAL FILTERS 12

Design of analog Butterworth and Chebyshev Filters – Frequency transformation in analog domain – Design of IIR digital filters - Impulse invariance techniques, Bilinear transform – Prewarping – Realization of IIR filters - Direct, cascade and parallel forms, Lattice structure.

UNIT III FINITE IMPULSE RESPONSE DIGITAL FILTERS 12

Linear phase FIR filters – Design using Rectangular, Hamming, Hanning and Blackmann Windows – Frequency sampling method – Realization of FIR filters – Direct form and Lattice structure.

UNIT IV FINITE WORD LENGTH EFFECTS 6

Representation of numbers, Quantization of filter coefficients in IIR and FIR filters, Round off effects in digital filters –Limit cycle Oscillations, Scaling, Quantization effect in fixed point realization of digital filters.

UNIT V DSP ARCHITECTURE 6

Comparison of Von-Neumann and Harvard architecture - Architecture of TMS320C67XX Processors Addressing modes- Memory organization - Program Control – Pipelining- On-Chip Peripherals- Interrupts

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply DFT algorithm for signal analysis.
2. Design, implement and analyze IIR filter for the given specification.
3. Design, implement and analyze FIR filter for the given specification.

4. Analyze the effect of finite word length.
5. Compare DSP Processor Architectures.

Text Book(s):

1. John G. Proakis and Dimitris G.Manolakis, Digital Signal Processing – Principles, Algorithms and Applications, Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. A. V. Oppenheim, R.W. Schafer and J.R. Buck, ―Discrete-Time Signal Processing", 8th Indian Reprint, Pearson, 2004.

Reference Books:

1. Emmanuel C. Ifeachor& Barrie. W. Jervis, "Digital Signal Processing", Second Edition, Pearson Education / Prentice Hall, 2002.
2. Sanjit K. Mitra, "Digital Signal Processing – A Computer Based Approach", Tata Mc Graw Hill, 2007.
3. Andreas Antoniou, "Digital Signal Processing", Tata Mc Graw Hill, 2006.

List of Experiments:

MATLAB / EQUIVALENT SOFTWARE PACKAGE/ DSP PROCESSOR BASED IMPLEMENTATION

1.	Generation of elementary Discrete-Time sequences.	3
2.	Linear and Circular convolutions.	3
3.	Auto correlation and Cross Correlation.	3
4.	Frequency Analysis using DFT.	3
5.	Design of FIR filters (LPF/HPF/BPF/BSF) and demonstrates the filtering operation	3
6.	Design of Butterworth and Chebyshev IIR filters (LPF/HPF/BPF/BSF) and demonstrate the filtering operations	3
7.	Study of architecture of Digital Signal Processor.	3
8.	Design and demonstration of FIR Filter for Low pass, High pass, Band pass and Band stop filtering	3
9.	Design and demonstration of Butter worth and Chebyshev IIR Filters for Low pass, High pass, Band pass and Band stop filtering	3
10.	Implement an Up-sampling and Down-sampling operation in DSP Processor.	3
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipments: (for batch of 30 students)		
1.	PCs with Fixed / Floating point DSP Processors (Kit / Add-on Cards)	15 nos
2.	MATLAB with Simulink and Signal Processing Tool Box or Equivalent Software in desktop systems	15 nos
3.	Signal Generators (1MHz) & CRO	15 nos

22EC602	VLSI DESIGN	L	T	P	C
		3	0	2	4

Syllabus Version V 0.1

Course Objectives:

1. Understand the fundamentals of IC technology components and their characteristics.
2. Understand combinational logic circuits and design principles.
3. Understand sequential logic circuits and clocking strategies.
4. Understand ASIC Design functioning and design.
5. To learn Hardware Descriptive Language

Course Content:

UNIT I MOS TRANSISTOR PRINCIPLES 9

MOS logic families (NMOS and CMOS), Ideal and Non Ideal IV Characteristics, CMOS devices. MOS(FET) Transistor Characteristic under Static and Dynamic Conditions, Technology Scaling, power consumption.

UNIT II COMBINATIONAL LOGIC CIRCUITS 9

Propagation Delays, stick diagram, Layout diagrams, Examples of combinational logic design, Elmore's constant, Static Logic Gates, Dynamic Logic Gates, Pass Transistor Logic, Power Dissipation, Low Power Design principles.

UNIT III SEQUENTIAL LOGIC CIRCUITS AND CLOCKING STRATEGIES 9

Static Latches and Registers, Dynamic Latches and Registers, Pipelines, Nonbistable Sequential Circuits. Timing classification of Digital Systems, Synchronous Design, Self-Timed Circuit Design.

UNIT IV INTERCONNECT , MEMORY ARCHITECTURE AND ARITHMETIC CIRCUITS 9

Interconnect Parameters – Capacitance, Resistance, and Inductance, Electrical Wire Models, Sequential digital circuits: adders, multipliers, comparators, shift registers. Logic Implementation using Programmable Devices (ROM, PLA, FPGA), Memory Architecture and Building Blocks, Memory Core and Memory Peripherals Circuitry.

UNIT V VERILOG HDL 9

VLSI Circuit Design Flow-Hierarchical modeling concepts – Basic concepts: Lexical conventions – Datatypes – Modules and ports. Gate level modeling – Dataflow modeling – Behavioral modeling – Design examples of Combinational and Sequential circuits – Switch level modeling – Tasks and Functions – UDP concepts.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. In depth knowledge of MOS technology
2. Understand Combinational Logic Circuits and Design Principles.
3. Understand Sequential Logic Circuits and Clocking Strategies.
4. Understand Memory architecture and building blocks.

5. Implement and verify combinational and sequential circuits using Verilog HDL.

Text Book(s):

1. Jan D Rabaey, Anantha Chandrakasan, " Digital Integrated Circuits: A Design Perspective", PHI, 2016.
2. Neil H E Weste, Kamran Eshranghian, " Principles of CMOS VLSI Design: A System Perspective," Addison Wesley, 2009.
3. Samir Palnitkar," Verilog HDL:A guide to Digital Design and Synthesis", Second Edition, Pearson Education,2003.

Reference Books:

1. P. Rashinkar, Paterson and L. Singh, "System-on-a-Chip Verification-Methodology and Techniques", Kluwer Academic Publishers,2001.
2. SamihaMourad and YervantZorian, "Principles of Testing Electronic Systems", Wiley 2000.
3. M. Bushnell and V. D. Agarwal, "Essentials of Electronic Testing for Digital, Memory and Mixed-Signal VLSI Circuits", Kluwer Academic Publishers,2000.

List of Experiments:

1.	Design of basic combinational and sequential (Flip-flops) circuits using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA	3
2.	Design an Adder ; Multiplier (Min 8 Bit) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA	3
3.	Design and implement Universal Shift Register using HDL. Simulate it using Xilinx/Altera Software	3
4.	Design Memories using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA.	3
5.	Design Finite State Machine (Moore/Mealy) using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA	3
6.	Design 3-bit synchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA	3
7.	Design 4-bit Asynchronous up/down counter using HDL. Simulate it using Xilinx/Altera Software and implement by Xilinx/Altera FPGA	3
8.	Design and simulate a CMOS Basic Gates & Flip-Flops. Generate Manual/Automatic Layout.	3
9.	Design and simulate a 4-bit synchronous counter using a Flip-Flops. Generate Manual/Automatic Layout.	3
10.	Design and Simulate a CMOS Inverting Amplifier.	3
	TOTAL PRACTICAL PERIODS	**30 Periods**

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipments: (for batch of 30 students)		
1.	Xilinx ISE/Altera Quartus/ equivalent EDA Tools	10 nos
2.	Xilinx/Altera/equivalent FPGA Boards	10 nos
3.	Cadence/Synopsis/ Mentor Graphics/Tanner/equivalent EDA Tools	10 nos
4.	Personal Computer	30 nos

22EC701	IoT Design	L	T	P	C
		3	0	2	4

Syllabus Version V 0.1

Course Objectives:

1. To provide a good understanding of Internet of Things (IoT) and its envisioned deployment domains.
2. To provide an overview about the various protocol standards deployed in the Internet of Things (IoT) domain and to make informed choices.
3. To impart knowledge in the design and development of IoT systems with enablement ensuring security and assimilated privacy.
4. To provide a good understanding of AI & Wireless sensor network implementation.

Course Content:

UNIT I INTRODUCTION TO IOT AND CYBER-PHYSICAL SYSTEMS **9**

Introduction to IoT and Cyber-Physical Systems; Typical IOT system and how it works? Different Types of IOT System, IOT Protocols, System – Smart System – IOT System, IOT Opportunities & Challenges, IOT Applications, Different Levels of IoT Systems; IoT Design Methodology.

UNIT II EMBEDDED SYSTEM FOR IOT **9**

Components of IoT System, Introduction to Electronic system, Embedded system basics, Overview of Non OS and OS based Hardware, Connected Sensors and Actuators, Communication interface: RS232 / RS485 / I2C / SPI / Wi-Fi. Communication Network for IoT: Network Requirements, Network Hierarchy, Networking Requirements, TCP/ IP Stack, Wired & Wireless Networks. Communication Models: Request Response, Publisher-Subscriber, Push-Pull, Exclusive Pair.

UNIT III SOFTWARE & PROGRAMMING **9**

Implementation of Sensor Node (Things) using Embedded system (Embedded C & Python): Handling Digital & Analog Signals, Digital IN, Digital OUT, Analog IN, Analog OUT, Communication Interface Wired & Wireless. Implementation of IoT systems with HTTP and MQTT protocols, working with cloud servers for exchanging data and creating dash board visualization.

UNIT IV IOT ENABLING TECHNOLOGIES: ARTIFICIAL INTELLIGENCE & WSN **9**

Overview of Artificial Intelligence, Programming Approach Traditional Vs ML, AI work Flow AI Implementation method, Types of Machine learning, Deep Learning, when do you want to use DL. Introduction to Wireless Sensor Network, Infrastructure less (Ad hoc) Networks & IoT, Characteristics of WSN. Demo of AI, WSN+IOT

UNIT V APPLICATION SPECIFIC SYSTEM DESIGN **9**

System Design: System Build consideration, Architectural understanding with peripherals, Sensors and Actuators - choice, understanding and connectivity for system, communication protocols for working with peripheral modules. Power and Memory budget for the system.

Embedded Processing Module – Choice, understanding the application requirements, mapping peripheral requirements and selection of appropriate hardware for the system. Case Study1: Building a simple Home Automation using Web server as User interface

Case Study2: Building an Industry automation using the appropriate sensors & actuators.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the design architecture of IoT
2. Make choice of protocols and deployment in solutions
3. Comprehend the design perspective of IoT based products /services
4. Understand the basic concepts of AI & WSN.

Text Book(s):

1. Arshdeep Bahga & Vijay Madisetti (2015). Internet of Things - A hands-on approach, (1st ed.), Hyderabad : Universities Press Ltd. Print.
2. Raj Kamal (2017). Internet of Things – Architecture and Design Principles (1st ed.), Mc Graw Hill Education Pvt. Ltd. Print

Reference Books:

1. Joe Biron & Jonathan Follett, Foundational Elements of an IoT Solution – The Edge, The Cloud and Application Development, Oreilly,1st Edition, 2016.
2. The Internet of Things (A Look at Real World Use Cases and Concerns), Kindle Edition, Lucas Darnell, 2016.

List of Experiments:

1.	Interfacing and programming GPIO ports in using (blinking LEDs, push buttons)	3
2.	Interfacing 3x3 Key pad matrix	3
3.	Interrupt programming examples through GPIOs	3
4.	Interfacing Temperature / LDR using ADC	3
5.	Adjusting LED brightness using PWM / DAC	3
6.	Communication interface: Serial (UART), Wireless connectivity – obtain IP address	3
7.	Interfacing DHT sensor using one wire digital interface	3
8.	Interfacing Stepper motor / Relay module through ULN2003	3
9.	Implementing IOT Solution using HTTP protocol and visualizing data at cloud	3
10.	Implementing IOT Solution using MQTT protocol and visualizing data at cloud	3

TOTAL PRACTICAL PERIODS 30 Periods

TOTAL LECTURE CUM PRACTICAL PERIODS 75 Periods

List of Equipments: (for batch of 30 students)		
1.	ESP32	15 nos
2.	Temperature Sensor	15 nos

3.	Push Button	15 nos
4.	Relay Module	15 Nos
5.	LDR	15 Nos

22EC702 OPTICAL COMMUNICATION

L	T	P	C
3	0	2	4

Syllabus Version V 0.1

Course Objectives:

1. To study about the various optical fiber modes, configuration and transmission characteristics of optical fibers.
2. To learn about the various optical sources, detectors and transmission techniques.
3. To explore various idea about optical fiber measurements and various coupling techniques.
4. To enrich the knowledge about optical communication systems and networks.

Course Content:

UNIT I INTRODUCTION TO OPTICAL FIBERS 9

Introduction-general optical fiber communication system- basic optical laws and definitions optical modes and configurations -mode analysis for optical propagation through fibers modes in planar wave guide-modes in cylindrical optical fiber-transverse electric and transverse magnetic modes- fiber materials-fiber fabrication techniques-fiber optic cables classification of optical fiber-single mode fiber-graded index fiber.

UNIT II TRANSMISSION CHARACTERISTIC OF OPTICAL FIBER 9

Attenuation-absorption --scattering losses-bending losses-core and cladding losses-signal dispersion –inter symbol interference and bandwidth-intra model dispersion-material dispersion- waveguide dispersion-polarization mode dispersion-intermodal dispersion dispersion optimization of single mode fiber-characteristics of single mode fiber-R-I Profile cutoff wave length-dispersion calculation-mode field diameter.

UNIT III OPTICAL SOURCES AND DETECTORS 9

Sources: Intrinsic and extrinsic material-direct and indirect band gaps-LED-LED structuressurface emitting LED-Edge emitting LED-quantum efficiency and LED power-light source materials-modulation of LED-LASER diodes-modes and threshold conditions-Rate equations-external quantum efficiency-resonant frequencies-structures and radiation patterns-single mode laser-external modulation-temperature effort.

Detectors: PIN photo detector-Avalanche photo diodes-Photo detector noise-noise sources-SNR-detector response time-Avalanche multiplication noise-temperature effects comparisons of photo detectors.

UNIT IV OPTICAL RECEIVER, MEASUREMENTS AND COUPLING 9

Fundamental receiver operation-preamplifiers-digital signal transmission-error sources-Front

end amplifiers-digital receiver performance-probability of error-receiver sensitivity-quantum limit.

Optical power measurement-attenuation measurement-dispersion measurement- Fiber Numerical Aperture Measurements- Fiber cut- off Wave length Measurements- Fiber diameter measurements-Source to Fiber Power Launching-Lensing Schemes for Coupling Management-Fiber to Fiber Joints-LED Coupling to Single Mode Fibers-Fiber SplicingOptical Fiber connectors.

UNIT V OPTICAL COMMUNICATION SYSTEMS AND NETWORKS **9**

System design consideration Point – to –Point link design –Link power budget –rise time budget, WDM –Passive DWDM Components-Elements of optical networks-SONET/SDH Optical Interfaces-SONET/SDH Rings and Networks-High speed light wave Links-OADM configuration-Optical ETHERNET-Soliton.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Realize basic elements in optical fibers, different modes and configurations.
2. Analyze the transmission characteristics associated with dispersion and polarization techniques.
3. Design optical sources and detectors with their use in optical communication system.
4. Construct fiber optic receiver systems, measurements and coupling techniques.
5. Design optical communication systems and its networks.

Text Book(s):

1. P Chakrabarti, "Optical Fiber Communication", McGraw Hill Education (India)Private Limited, 2016.
2. Gred Keiser," Optical Fiber Communication", McGraw Hill Education (India) Private Limited. Fifth Edition, Reprint 2013.

Reference Books:

1. John M.Senior, "Optical fiber communication", Pearson Education, second edition.2007.
2. Rajiv Ramaswami, "Optical Networks " , Second Edition, Elsevier , 2004.
3. J.Gower, "Optical Communication System", Prentice Hall of India, 2001.
4. Govind P. Agrawal, "Fiber-optic communication systems", third edition, John Wiley & sons, 2004.

List of Experiments:

LIST OF OPTICAL EXPERIMENTS

1.	Measurement of connector, bending and fiber attenuation losses.	3
2.	Numerical Aperture and Mode Characteristics of Fibers.	3
3.	DC Characteristics of LED and PIN Photo diode.	3
4.	Fiber optic Analog and Digital Link Characterization - frequency response(analog), eye diagram and BER (digital)	3
5.	**LIST OF WIRELESS COMMUNICATION EXPERIMENTS** Wireless Channel Simulation including fading and Doppler effects	3
6.	Simulation of Channel Estimation, Synchronization & Equalization	3

techniques

7.	Simulation of Channel Estimation, Synchronization & Equalization techniques	3
8.	**LIST OF MICROWAVE EXPERIMENTS** VSWR and Impedance Measurement and Impedance Matching	3
9.	Characterization of Directional Couplers, Isolators, Circulators	3
10.	Gunn Diode Characteristics	3
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**75 Periods**

List of Equipments: (for batch of 30 students)		
1.	Trainer kit for carrying out LED and PIN diode characteristics, Digital multi meter, optical power meter	2 Nos
2.	Trainer kit for determining the mode characteristics, losses in optical fiber	2 Nos
3.	Trainer kit for analyzing Analog and Digital link performance, 2 Mbps PRBS Data source, 10 MHz signal generator, 20 MHz Digital storage Oscilloscope	2 Nos
4.	Kit for measuring Numerical aperture and Attenuation of fiber	2 Nos
5.	Advanced Optical fiber trainer kit for PC to PC communication, BER Measurement, Pulse broadening.	2 Set
6.	MM/SM Glass and plastic fiber patch chords with ST/SC/E2000 connectors	2 Set
7.	LEDs with ST / SC / E2000 receptacles – 650 / 850 nm	2 Set
8.	PIN PDs with ST / SC / E2000 receptacles – 650 / 850 nm	2 Set
9.	Digital Communications Teaching Bundle (LabVIEW/MATLAB/Equivalent software tools)	10 Users
10.	Software Define Radio Transceiver Platform with antennas and accessories	1 No

22EC703	ANTENNAS AND MICROWAVE ENGINEERING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To enable the student to understand the basic principles in antenna and microwave system design.
2. To enhance the student knowledge in the area of various antenna designs.
3. To enhance the student knowledge in the area of microwave components and antenna for practical applications.

Course Content:

UNIT I INTRODUCTION TO MICROWAVE SYSTEMS AND ANTENNAS **9**

Microwave frequency bands, Physical concept of radiation, Near- and far-field regions, Fields and Power Radiated by an Antenna, Antenna Pattern Characteristics, Antenna Gain and Efficiency, Aperture Efficiency and Effective Area, Antenna Noise Temperature and G/T, Impedance matching, Friis transmission equation, Link budget and link margin, Noise Characterization of a microwave receiver.

UNIT II RADIATION MECHANISMS AND DESIGN ASPECTS **9**

Radiation Mechanisms of Linear Wire and Loop antennas, Aperture antennas, Reflector antennas, Microstrip antennas and Frequency independent antennas, Design considerations and applications.

UNIT III ANTENNA ARRAYS AND APPLICATIONS **9**

Two-element array, Array factor, Pattern multiplication, Uniformly spaced arrays with uniform and non-uniform excitation amplitudes, Smart antennas.

UNIT IV PASSIVE AND ACTIVE MICROWAVE DEVICES **9**

Microwave Passive components: Directional Coupler, Power Divider, Magic Tee, attenuator, resonator, Principles of Microwave Semiconductor Devices: Gunn Diodes, IMPATT diodes, Schottky Barrier diodes, PIN diodes, Microwave tubes: Klystron, TWT, Magnetron.

UNIT V MICROWAVE DESIGN PRINCIPLES **9**

Impedance transformation, Impedance Matching, Microwave Filter Design, RF and Microwave Amplifier Design, Microwave Power amplifier Design, Low Noise Amplifier Design, Microwave Mixer Design, Microwave Oscillator Design

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply the basic principles and evaluate antenna parameters and link power budgets.
2. Design and assess the performance of various antennas.
3. Design a microwave system given the application specifications.

Text Book(s):

1. John D Krauss, Ronald J Marhefka and Ahmad S. Khan, "Antennas and Wave Propagation: Fourth Edition, Tata McGraw-Hill, 2006.
2. David M. Pozar, "Microwave Engineering", Fourth Edition, Wiley India, 2012.

Reference Books:

1. Constantine A.Balanis, “Antenna Theory Analysis and Design”, Third edition, John Wiley India Pvt Ltd., 2005.
2. R.E.Collin, "Foundations for Microwave Engineering", Second edition, IEEE Press, 2001

22HS601	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
		3	0	0	3

Pre-requisite	Nil	Syllabus Version	V 0.1

Course Objectives:

1. To gain the knowledge about environment, ecological balance and biodiversity.
2. To finding and implementing scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth's interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management.

Course Content:

UNIT I ENVIRONMENT, ECOSYSTEMS & BIODIVERSITY 10

Definition, scope and importance of environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers-energy flow in the ecosystem – food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (pond, lake and river). Biodiversity – definition, types, value of biodiversity (consumptive use, productive use, social, ethical, aesthetic and option values) – India as a mega-diversity nation– hot spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts –conservation of biodiversity: In-situ and ex-situ conservation of biodiversity.

UNIT II ENVIRONMENTAL POLLUTION 9

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards. Solid waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution- disaster management: floods, earthquake, cyclone and landslides.

UNIT III NATURAL RESOURCES 10

Forest resources: Use and over-exploitation, deforestation – Water resources: Use and over-utilization of surface and ground water, dams-benefits and problems – Mineral resources: environmental effects of extracting and using mineral resources – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture,

fertilizer-pesticide problems, water logging, salinity – Energy resources: renewable – solar, wind, biomass and non-renewable energy sources-coal and nuclear energy-Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

Sustainable development – urban problems related to energy, consumerism and waste products – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns – role of non-governmental organization - environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion - wasteland reclamation - 12 principles of green chemistry- environment production act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Wildlife protection act – Forest conservation act.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 7

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA) – role of information technology in environment and human health.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome:

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

1. Interfer the importance of environment and explain the concept, structure, functions of ecosystem and summarize different values, threats and the need for conservation of biodiversity.
2. Explain the types of natural resourses and its importance of conservation.
3. Classify the types of pollution and propose suitable methods to prevent pollution.
4. Outline the various social issuses and possible solutions to protect environment for sustainable Development.
5. Describe the effect of population explosion, trend of population in various countries ana understand the role of IT in environment and human health.

Text Book(s):

1. Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi,2006.
2. Gilbert M.Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education,2004.

Reference Books:

1. Dharmendra S. Sengar, ‘Environmental law’, Prentice Hall of India PVT LTD, New Delhi,2007.
2. Erach Bharucha, “Textbook of Environmental Studies”, Universities Press(I) PVT, LTD, Hyderabad,
2015.
3. Rajagopalan, R, ‘Environmental Studies-From Crisis to Cure’, Oxford University Press,2005.

22MG701 PRINCIPLES OF MANAGEMENT L T P C
3 0 0 3

OBJECTIVE:

- To enable the students to study the evolution of Management, to study the functions and principles of management and to learn the application of the principles in an organization .

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

OUTCOME:

- Upon completion of the course, students will be able to have clear understanding
- Managerial functions like planning, organizing, staffing, leading & controlling and have same basic knowledge on international aspect of management

TEXTBOOKS:

1. Stephen P. Robbins & Mary Coulter, “Management”, Prentice Hall (India) Pvt. Ltd., 10th Edition, 2009.
2. JAF Stoner, Freeman R.E and Daniel R Gilbert “Management”, Pearson Education, 6th Edition, 2004.

REFERENCES:

1. Stephen A. Robbins & David A. Decenzo & Mary Coulter, “Fundamentals of Management” Pearson Education, 7th Edition, 2011.
2. Robert Kreitner & Mamata Mohapatra, “ Management”, Biztantra, 2008.
3. Harold Koontz & Heinz Weihrich “Essentials of management” Tata McGraw Hill,1998.
4. Tripathy PC & Reddy PN, “Principles of Management”, Tata McGraw Hill, 1999

22PEC01	TRANSMISSION LINES AND RF SYSTEMS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To introduce the various types of transmission lines and its characteristics
2. To understand high frequency line, power and impedance measurements
3. To impart technical knowledge in impedance matching using Smith Chart.
4. To introduce passive filters and basic knowledge of active RF components
5. To learn the concepts of a RF system transceiver design.

Course Content:

UNIT I TRANSMISSION LINE THEORY 9

General theory of Transmission lines - the transmission line - general solution - The infinite line - Wavelength, velocity of propagation - Waveform distortion - the distortion less line - Loading and different methods of loading - Line not terminated in Z 0 - Reflection coefficient - calculation of current, voltage, power delivered and efficiency of transmission - Input and transfer impedance - Open and short circuited lines - reflection factor and reflection loss.

UNIT II HIGH FREQUENCY TRANSMISSION LINES 9

Transmission line equations at radio frequencies - Line of Zero dissipation - Voltage and current on the dissipation less line, Standing Waves, Nodes, Standing Wave Ratio - Input impedance of the dissipation less line - Open and short circuited lines - Power and impedance measurement on lines - Reflection losses - Measurement of VSWR and wavelength.

UNIT III IMPEDANCE MATCHING IN HIGH FREQUENCY LINE 9

Impedance matching: Quarter wave transformer ,One Eighth wave line, Half wave line- Impedance matching by stubs- Single stub and double stub matching - Smith chart – Application of Smith chart, Solutions of problems using Smith chart - Single and double stub matching using Smith chart.

UNIT IV WAVEGUIDES 9

Waves between parallel planes of perfect conductors- Transverse Electric waves and Transverse Magnetic waves, Characteristics of TE and TM waves, Transverse Electromagnetic waves, TM and TE waves in Rectangular waveguides, TM and TE waves in Circular waveguides.

UNIT V RF SYSTEM DESIGN CONCEPTS 8

Active RF components: Semiconductor basics in RF, bipolar junction transistors, RF field effect transistors, High electron mobility transistors, Fundamentals of MMIC, Basic concepts of RF design: Filters, couplers, power dividers, Amplifier power relations, Low noise

amplifiers, Power amplifiers.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to
CO1: Explain the characteristics of transmission lines and its losses.
CO2: Calculate the standing wave ratio and input impedance in high frequency transmission lines.
CO3: Analyze impedance matching by stubs using Smith Charts.
CO4: Comprehend the characteristics of TE and TM waves.
CO5: Design a RF transceiver system for wireless communication

Text Book(s):

1. John D Ryder, “Networks lines and fields”,Prentice Hall of India,New Delhi,2005.

2. Mathew M. Radmanesh, “Radio Frequency &Microwave Electronics”, Pearson Education Asia, Second Edition, 2002

3. Annapurna Das, Sisir K. Das, “Microwave Engineering”, McGraw Hill Education (India) private limited, Third edition,2000.

Reference Books:

1. Reinhold Ludwig and Powel Bretchko, “RF Circuit Design” – Theory and Applications”, Pearson Education Asia, First Edition, 2001.

2. D. K. Misra, “Radio Frequency and Microwave Communication Circuits”- Analysis and Design, John Wiley & Sons, 2004.

3. Richard Chi-Hsi Li - , “RF Circuit Design” – A John Wiley & Sons, Inc, Publications

4. W.Alan Davis, Krishna Agarwal, “Radio Frequency Circuit Design”, John willy & Sons,2001

22PEC02	RF TRANSCEIVERS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.To understand the fundamentals of RF system design

2. To acquaint with the various components of RF system for wireless communications

3. To know the basic techniques needed for analysis of RF systems

4. To enable the students to verify the basic principles and design aspects involved in RF systems components

5.To conduct experiments to analyze and interpret data to produce meaningful conclusion and match with theoretical concepts

Course Content:

UNIT I CMOS PHYSICS, TRANSCEIVER SPECIFICATIONS AND ARCHITECTURES **9**

CMOS: Introduction to MOSFET Physics - Noise: Thermal, shot, flicker, popcorn noise - Transceiver Specifications: Two port Noise theory, Noise Figure, THD, IP2, IP3, Sensitivity, SFDR - Phase noise - Transceiver Architectures: Receiver: Homodyne, Heterodyne, Image reject, Low-IF Architectures - Transmitter: Direct-up conversion, Two-step up conversion schemes

UNIT II IMPEDANCE MATCHING NETWORKS AND AMPLIFIERS **9**

Review of S-parameters and Smith chart - Passive IC components - Impedance matching networks - Amplifiers: Common Gate, Common Source Amplifiers - OC Time constants in bandwidth estimation and enhancement - High frequency amplifier design - Low Noise Amplifiers: Power match and Noise match, single-ended and differential LNAs

UNIT III FEEDBACK SYSTEMS AND POWER AMPLIFIERS **9**

Feedback Systems: Stability of feedback systems, Gain and phase margin, Root-locus techniques, Time and Frequency domain considerations, Compensation - Power Amplifiers: General model - Class A, AB, B, C, D, E and F amplifiers - Linearization Techniques - Efficiency boosting techniques - ACPR metric.

UNIT IV FILTERS, OSCILLATORS AND MIXERS **9**

Overview - basic resonator and filter configuration, special filter realizations, filter implementation - Basic oscillator model, high-frequency oscillator configuration, Colpitt's oscillator - basic characteristics of mixers, single and double-balanced mixers

UNIT V PLL AND FREQUENCY SYNTHESIZERS **9**

PLL: Linearized Model, Noise properties, Phase detectors, Loop filters and Charge pumps- Frequency Synthesizers: Integer-N frequency synthesizers - Direct Digital Frequency Synthesizers

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to
CO1: Interpret the nonlinear effects in RF circuits
CO2: Design RF circuits
CO3: Analyze the performance of RF circuits
CO4: Apply knowledge to identify a suitable architecture and systematically design an RF System
CO5: Comprehensively record and report the measured data, and would be capable analyzing, interpreting the experimentally measured data and produce the conclusions

Text Book(s):

1. Lee T, Design of CMOS RF Integrated Circuits, Cambridge, Second Edition, 2004.
2. Razavi B, RF Microelectronics, Pearson Education, Second Edition, 2012.

Reference Books:

1. Ludwig R, and Bretchko P, RF Circuit Design Theory and Applications, Prentice Hall, 2000
2. Razavi B, Design of Analog CMOS Integrated Circuits, McGraw Hill, Second Edition, 2017
3. Kyung-WhanYeom, Microwave Circuit Design - A Practical Approach using ADS, Pearson Education, 2015.

22PEC03	SIGNAL INTEGRITY	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Understand characteristic impedance of transmission line and impedance matching techniques.
2. Understand plain signal reflection and cross talk noise in the transmission line, and also explain the mathematical analysis method.
3. Understand Eye diagram and related measurement to test quality of Signal
4. Learn Jitter analysis and jitter decomposition
5. Work with high frequency differential signal and its applications

Course Content:

UNIT I SIGNAL REFLECTION AND IMPEDANCE MATCHING TECHNIQUE **9**

Phenomenon of signal reflection. Signal reflection at transmitting end. Signal reflection at branch point. Multiple reflection in transmission line. Prevention of signal reflection by using impedance matching technique.

UNIT II CROSSTALK NOISE **9**

Crosstalk definition and classification. Crosstalk mechanism. Analysis of crosstalk noise in transmission line. Main factor of causing crosstalk noise.

UNIT III DIFFERENTIAL SIGNAL TRANSMISSION CIRCUIT **9**

Pros and cons of using differential signaling compared with that of single-ended signaling. High-speed differential interfaces. Theory of differential signaling. Differential signal termination techniques.

UNIT IV FREQUENCY RESPONSE OF A CIRCUIT **9**

Frequency response of transmission line and circuit. Inter-symbol interference (ISI) and eye-pattern. Deterioration of a signal waveform due to ISI. Circuit techniques to prevent the deterioration. Linear time-invariant systems. Frequency response of pulse.

UNIT V EYE DIAGRAM AND JITTER **9**

Jitter Definition and Types of Jitter; Jitter decomposition; Eye diagram analysis and related measurement.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Familiarity with High speed design and related issues

CO2: Understanding on critical design aspect

CO3: Know about Jitter and related measurements which is critical for design

CO4: Practical application of high speed differential signals
CO5: Measurement expertise up to industry expectations

Text Book(s):

1. Signal and Power integrity Simplified -Eric Bogatin, Pearson, 3rd Edition
2. High Speed Digital Design by Howard Johnson and Martin Graham, Prentice Hall,1st Edition

Reference Books:

1. High Speed Signal Propagation and Howard Johnson,Prentice Hall,1st Edition

22PEC04	ANTENNA DESIGN	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To introduce the basic concepts of antenna arrays for smart antenna design
2. To discuss the random variables and processes for angle of arrival (AOA) estimation
3. To describe different algorithms used for AOA estimation
4. To introduce the concepts of fixed weight beamforming
5. To introduce the concept of adaptive beamforming

Course Content:

UNIT I ANTENNA ARRAY FUNDAMENTALS 9

Linear arrays: Two element and Uniform N element array – Array weighting: Beam steered and weighted arrays – Circular arrays – Rectangular planar arrays – Fixed beam arrays – Butler Matrices – Fixed sidelobe cancelling – Retrodirective arrays: Passive and active retrodirective arrays.

UNIT II PRINCIPLES OF RANDOM VARIABLES AND PROCESSES 9

Definition of Random Variables - Probability Density Functions - Expectation and Moment - Common Probability Density Functions - Stationarity and Ergodicity - Autocorrelation and Power Spectral Density - Correlation Matrix

UNIT III ANGLE OF ARRIVAL ESTIMATION 9

Fundamentals of Matrix Algebra: Vector basics - Matrix basics - Array Correlation Matrix -

AOA Estimation Methods: Bartlett AOA estimate, Capon AOA estimate, Linear prediction AOA estimate, Maximum entropy AOA estimate, Pisarenko harmonic decomposition AOA estimate, Min-norm AOA estimate, MUSIC AOA estimate, Root-MUSIC AOA estimate, ESPRIT AOA estimate

UNIT IV SMART ANTENNAS: FIXED WEIGHT BEAMFORMING **9**

Introduction - Historical Development of Smart Antennas - Fixed Weight Beamforming Basics: Maximum signal-to-interference ratio, Minimum mean-square error, Maximum likelihood, Minimum variance

UNIT V SMART ANTENNAS: ADAPTIVE BEAMFORMING **9**

Adaptive Beamforming: Least mean squares, Sample matrix inversion, Recursive least squares, Constant modulus, Least squares constant modulus, Conjugate gradient method, Spreading sequence array weights, Description of the new SDMA receiver.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Describe the basics of phased array antennas

CO2: Understand random process and its application in Smart antennas

CO3: Estimate the weights of the antenna array based on the angle of arrival

CO4: Analyze the fixed weight beamforming in smart antennas

CO5: Analyze adaptive beamforming in smart antennas

Text Book(s):

1. Frank Gross, Smart antennas for wireless communications, McGra-Hill, 2006.

2. S. Chandran, Adaptive antenna arrays, trends and applications, Springer, 2009.

Reference Books:

1. T. S. Rappaport, Smart antennas: Adaptive arrays, algorithms and wireless position location, IEEE Press, 1998.

2. Robert A.Monzingo, Randy L. Haupt and Thomas W.Miller, Introduction to Adaptive arrays, 2nd Edition, IET, 2011.

3. Thomas Kaiser, Smart Antennas: State of the Art, Hindawi, 2005

22PEC05	MICS AND RF SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To study the characteristics of Active components and applications.
2. To design the RF filter and analyze the circuits operated at millimeter wavelength
3. To understand the basics of Microwave integrated circuits
4. To learn the concepts of non reciprocal components for MICs
5. To design the antenna and analyze its performance using measurement techniques

Course Content:

UNIT I ACTIVE RF COMPONENTS AND APPLICATIONS 9

RF diodes, BJT, RF FET'S, High electron mobility transistors, matching and biasing networks- impedance matching using discrete components, microstripline matching networks, amplifier classes of operation and biasing networks.

UNIT II RF FILTER DESIGN 9

Overview, Basic resonator and filter configuration, special filter realizations, smith chart based filter design, coupled filter.

UNIT III INTRODUCTION TO MICROWAVE INTEGRATED CIRCUITS 9

Overview of ABCD and S parameters - Overview of Planar transmission lines (Stripline, Microstripline, Slotline, CPW, Finline)-Design Parameters for Strip Line And Microstripline-Active Device Technologies- Design ApproachesMultichip Module Technology- Substrates

UNIT IV NON RECIPROCAL COMPONENTS FOR MICs 9

Microstrip on Ferrimagnetic substrates, Microstrip circulators. Isolators and phase shifters, Design of microstrip circuits – high power and low power circuits.

UNIT V INTEGRATED ANTENNA DESIGN AND MEASUREMENTS 9

Integrated Antenna Design- Photonic Band Gap Antennas - Micro Machined Antenna - Micro Electro Mechanical System Antennas - Test Fixture Measurements - Probe Station Measurements -Thermal and Cryogenic Measurements- Experimental Field Probing Techniques

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to
CO1: Apply knowledge of S parameter theory to any RF active component design circuit for obtaining performance measure.
CO2: Analyze microwave circuits for filters design.
CO3: Evaluate the performance of any practical Microwave integrated circuits
CO4: Create communication circuits and subsystems with practical design parameters fornon-reciprocal components in MICs.
CO5: Design microwave integrated antenna design circuit for the required Performance using professional software tools.

Text Book(s):

1. Reinhold Ludwig and Powel Bretchko, RF Circuit Design – Theory and Applications, Pearson Education Asia, First Edition, 2001.

2. Bharathi Bhat, Shiban K. Koul, "Stripline-like Transmission Lines for Microwave Integrated Circuits", New Age International Pvt Ltd Publishers, 2007.

3. Gupta KC and Amarjit Singh, "Microwave Integrated circuits", Wiley Eastern, 1974.

Reference Books:

1. MathewM. Radmanesh, Radio Frequency & Microwave Electronics, Pearson Education Asia, Second Edition, 2002.

2. Ulrich L. Rohde and David P. NewKirk, RF / Microwave Circuit Design, John Wiley & Sons USA 2000.

3. RolandE. Best, Phase – Locked Loops: Design, simulation and applications, McGraw Hill Publishers 5TH edition 2003

4. David Pozar ,Microwave Engineering, Addison Wesley 3rd Edition

5. Ravender Goyal, "Monolithic MIC; Technology & Design", Artech House, First Edition 1989.

22PEC06	EMI / EMC PRE COMPLIANCE TESTING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To introduce the basic concepts of Electromagnetic Interference
2. To teach the importance of measurement device for EMI.
3. To explain the EMI coupling & control principles
4. To understand receivers & Analyzer functionalities
5. To impart knowledge on design issues in EMI/EMC

Course Content:

UNIT I NATURE AND ORIGINS OF ELECTROMAGNETIC COMPATIBILITY **9**

Introduction-Visualisiong the EMI problem-Source of EMI,EMI coupling to victim equipment,
Intersystem and Intrasystem EMI, EMC standards and specifications

UNIT II TYPES of EMI COUPLING **9**

Conducted, radiated and transient coupling; Common ground impedance coupling; Common mode and ground loop coupling; Differential mode coupling, Near field cable to cable coupling; Field to cable coupling, Power mains and Power supply coupling; Transient EMI

UNIT III MEASUREMENT DEVICES FOR EMI **9**

Introduction – Measurement by direct connection, Inductively coupled devices, EMC antennas – Basic antenna parameters, Antennas for radiated emission testing, Wideband antennas - Magnetic field antennas, Type of antennas used in susceptibility testing

UNIT IV RECEIVERS, ANALYSERS AND MEASUREMENT EQUIPMENT **9**

EMI receiver, Spectrum Analyzers, RF power meter Frequency meters. Standards requiring immunity tests, Automatic EMC tests, Electromagnetic transient testing, Transient types, Continuous and transient signal, ESD-electrostatic discharge

UNIT V PRE-COMPLIANCE TESTING TO AVOID EMC PROBLEMS **9**

Need for Pre-Compliance Testing; Intersystem and Intrasystem EMC - Developing an approach to EMC design - Process flow chart, - EMC strategy – Self certification; Solutions to avoid EMC: ESD Shielding, EMI Filters; Grounding; Bonding, Isolation transformer, Transient suppressors; EMI Suppression Cables.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to
CO1: Perceive the various types and mechanisms of Electromagnetic Interference
CO2: Propose a suitable EMI mitigation technique.
CO3: Evaluate EMI coupling & control principles
CO4: Explain the importance receivers & Analyzer functionalities
CO5: Inspect the design issues in EMI/EMC

Text Book(s):

1. David Morgan , "A Handbook for EMC Testing and Measurement", IET Electrical Measurement, 2012
2. Tim Williams , "EMC for Product Designers", 5th Edition, Newnes Elsevier, 2017

Reference Books:

1. V.P.Kodali, “Engineering EMC Principles, Measurements and Technologies”, IEEE Press, Newyork, 1996
2. Paul, C.R., “Introduction to Electromagnetic Compatibility”, 2nd ed., Wiley (2010)
3. David K. Cheng, “Field and Wave Electromagnetics”, 2nd ed. Pearson Education, 2009

22PEC07	RFID SYSTEM DESIGN AND TESTING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.To discuss the fundamentals of near field and far field RFID communications

2.To articulate the standards and protocols used in RFID systems

3.To describe the operating principles of RFID tag and reader

4.To introduce the security aspects and system architecture of RFID systems

5.To illustrate the industrial and scientific applications of RFID systems

Course Content:

UNIT I INTRODUCTION 9

RFID Principles: Near-field based RFID – Properties of Magnetic field – Far-field based RFID – Properties of Backscatter RF Systems – Modulation techniques – Frequency based property comparison of RFID Systems

UNIT II RFID STANDARDS AND PROTOCOLS 9

RFID Industry standards: EPC global – ISO15693 Vicinity cards and RFID – ISO14443 Proximity cards and RFID – The NFC forum – Reading collocated RFID tags: Query Tree protocol – Query Slot protocol

UNIT III OPERATING PRINCIPLES 9

RFID Tag components: RFID tag types – the 1-Bit Transponder and Chipless Tags – RFID readers and middleware component – Communication fundamentals: Coupling, Data encoding, multi-path effect – Tag, Reader and sensor communication.

UNIT IV DATA INTEGRITY AND SECURITY 9

The checksum procedure – Multiaccess procedures – Attacks on RFID Systems – Protection by Cryptographic measures

UNIT V RFID ENABLED SENSORS AND APPLICATIONS 9

RFID enabled Sensors: Antenna design challenges – IC design – Integration of sensors and RFID – Power consumption and Link budget.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Classify RFID systems based on frequency, architecture and performance

CO2: Define standards for RFID technology

CO3: Illustrate the operation of various components of RFID systems

CO4: Describe the privacy and security issues in RFID Systems

CO5: Discuss the construction and applications of RFID enabled sensor

Text Book(s):

1. Roy Want, RFID Explained, Springer 2022.

2. Amin Rida, Li Yang, Manos M. Tentzeris, RFID Enabled Sensor Design and Applications, Artech House, 2010

Reference Books:

1. Klaus Finkenzeller, RFID Handbook, 3rd Edition, Wiley, 2010

2. Syed Ahson, Mohammad Ilyas, RFID Handbook, CRC Press, 2008

3. Paris Kitsos, Security in RFID and Sensor Networks, CRC Press, 2016.

22PEC08	MICROPROCESSORS AND MICROCONTROLLERS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To understand the Architecture of 8086 microprocessor.
2. To learn the design aspects of I/O and Memory Interfacing circuits.
3. To interface microprocessors with supporting chips.
4. To study the Architecture of 8051 microcontroller.
5. To design a microcontroller based system

Course Content:

UNIT I THE 8086 MICROPROCESSOR 9

Introduction to 8086 – Microprocessor architecture – Addressing modes - Instruction set and assembler directives – Assembly language programming – Modular Programming - Linking and Relocation - Stacks - Procedures – Macros – Interrupts and interrupt service routines – Byte and String Manipulation.

UNIT II 8086 SYSTEM BUS STRUCTURE 9

8086 signals – Basic configurations – System bus timing –System design using 8086 – I/O programming – Introduction to Multiprogramming – System Bus Structure – Multiprocessor configurations – Coprocessor, Closely coupled and loosely Coupled configurations – Introduction to advanced processors.

UNIT III I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface – Serial communication interface – D/A and A/D Interface - Timer – Keyboard /display controller – Interrupt controller – DMA controller – Programming and applications Case studies: Traffic Light control, LED display , LCD display, Keyboard display interface and Alarm Controller.

UNIT IV MICROCONTROLLER 9

Architecture of 8051 – Special Function Registers(SFRs) - I/O Pins Ports and Circuits – Instruction set - Addressing modes - Assembly language programming.

UNIT V INTERFACING MICROCONTROLLER 9

Programming 8051 Timers - Serial Port Programming - Interrupts Programming – LCD & Keyboard Interfacing - ADC, DAC & Sensor Interfacing - External Memory Interface- Stepper

Motor and Waveform generation - Comparison of Microprocessor, Microcontroller, PIC and ARM processors

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand and execute programs based on 8086 microprocessor.
2. Design Memory Interfacing circuits.
3. Design and interface I/O circuits.
4. Design and implement 8051 microcontroller based systems.

Text Book(s):

1. Yu-Cheng Liu, Glenn A.Gibson, “Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design”, Second Edition, Prentice Hall of India, 2007.
2. Mohamed Ali Mazidi, Janice Gillispie Mazidi, Rolin McKinlay, “The 8051 Microcontroller and Embedded Systems: Using Assembly and C”, Second Edition, Pearson education, 2011.

Reference Books:

1. Doughlas V.Hall, “Microprocessors and Interfacing, Programming and Hardware”,TMH,2012
2. A.K.Ray,K.M.Bhurchandi, "Advanced Microprocessors and Peripherals" 3rd edition, Tata McGrawHill, 2012

22PEC09	MICROCONTROLLER BASED SYSTEM DESIGN	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To Teach the architecture of PIC Microcontroller and RISC processor.
2. To compare the architecture and programming of 8,16,32 bit RISC processor.
3. To teach the implementation of DSP in ARM processor.
4. To discuss on memory management, application development in RISC processor.
5. To involve Discussions/ Practice/Exercise onto revising & familiarizing the concepts

Course Content:

UNIT I PIC MICROCONTROLLER 9

Architecture – memory organization – addressing modes – instruction set – PIC programming in Assembly & C –I/O port, Data Conversion, RAM & ROM Allocation, Timer programming, practice in MP-LAB.

UNIT II ARM ARCHITECTURE 9

Architecture – memory organization – addressing modes –The ARM Programmer's model – Registers – Pipeline - Interrupts – Coprocessors – Interrupt Structure

UNIT III PERIPHERALS OF PIC AND ARM MICROCONTROLLER 9

PIC: ADC, DAC and Sensor Interfacing –Flash and EEPROM memories. ARM: I/O Memory –EEPROM – I/O Ports – SRAM –Timer –UART - Serial Communication with PC – ADC/DAC
Interfacing.

UNIT IV ARM MICROCONTROLLER PROGRAMMING 9

ARM general Instruction set – Thumb instruction set –Introduction to DSP on ARM – Implementation example of Filters

UNIT V DESIGN WITH PIC AND ARM MICROCONTROLLERS 9

PIC implementation - Generation of Gate signals for converters and Inverters - Motor Control – Controlling DC/ AC appliances – Measurement of frequency - Stand alone Data Acquisition System –ARM Implementation- Simple ASM/C programs- Loops –Look up table- Block copy- subroutines-Hamming Code.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Understand the basics and requirement of processor functional blocks.
CO2: Observe the specialty of RISC processor Architecture.

CO3: Incorporate I/O hardware interface of a processor based automation for consumer application with peripherals.
CO4: Incorporate I/O software interface of a processor with peripherals.
CO5: Improved Employability and entrepreneurship capacity due to knowledge up gradation on recent trends in commercial embedded processors

Text Book(s):

1. Steve Furber, 'ARM system on chip architecture', Addision Wesley,2010.
2. Andrew N. Sloss, Dominic Symes, Chris Wright, John Rayfield 'ARM System Developer's
Guide Designing and Optimizing System Software', Elsevier 2007.

Reference Books:

1.Muhammad Ali Mazidi, Rolin D. Mckinlay, Danny Causey ' PIC Microcontroller and Embedded Systems using Assembly and C for PIC18', Pearson Education 2008.
2. John Iovine, 'PIC Microcontroller Project Book ', McGraw Hill 2000
3. William Hohl, ' ARMAssebly Language' Fundamentals and Techniques,2009.
4. Rajkamal,"Microcontrollers Architecture, Programming, Interfacing,& System Design,Pearson,2012
5. ARM Architecture Reference Manual, LPC213x User Manual
6. www.Nuvoton .com/websites on Advanced ARM Cortex Processors

22PEC10	NANO TECHNOLOGY AND APPLICATIONS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Understand basic nano particles, materials and catalysisPLC terminologies digital principles, PLC architecture and operation.
2. Develop synthesis of Nanomaterials..
3. Understand the importance of nano composites.
4. Exposures about different nano structures and characterization.

Course Content:

UNIT I INTRODUCTION 9

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 9

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 9

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 9

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 LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1 - Understand the basic properties such as structural, physical, chemical properties of Nano materials 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 Nano materials

CO5 - Develop a deeper knowledge in the application of Nano materials in different fields.

Text Book(s):

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.

Reference Books:

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

22PEC11	EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Understand the concepts of embedded system design and analysis.
2. Learn the architecture and programming of ARM processor.
3. Be exposed to the basic concepts of embedded programming.
4. Learn the real time operating systems.

Course Content:

UNIT I INTRODUCTION TO EMBEDDEDSYSTEM DESIGN **9**

Complex systems and micro processors– Embedded system design process –Design example: Model train controller- Design methodologies- Design flows - Requirement Analysis – Specifications-System analysis and architecture design – Quality Assurance techniques - Designing with computing platforms – consumer electronics architecture – platform-level performance analysis.

UNIT II ARM PROCESSOR AND PERIPHERALS **9**

ARM Architecture Versions – ARM Architecture – Instruction Set – Stacks and Subroutines – Features of the LPC 214X Family – Peripherals – The Timer Unit – Pulse Width Modulation Unit – UART – Block Diagram of ARM9 and ARM Cortex M3 MCU.

UNIT III EMBEDDED PROGRAMMING **9**

Components for embedded programs- Models of programs- Assembly, linking and loading – compilation techniques- Program level performance analysis – Software performance optimization – Program level energy and power analysis and optimization – Analysis and optimization of program size- Program validation and testing.

UNIT IV REAL TIME SYSTEMS **9**

Structure of a Real Time System — Estimating program run times – Task Assignment and Scheduling – Fault Tolerance Techniques – Reliability, Evaluation – Clock Synchronisation.

UNIT V PROCESSES AND OPERATING SYSTEMS **9**

Introduction – Multiple tasks and multiple processes – Multirate systems- Preemptive realtime operating systems- Priority based scheduling- Interprocess communication mechanisms – Evaluating operating system performance- power optimization strategies for processes – Example Real time operating systems-POSIX-Windows CE. - Distributed embedded systems – MPSoCs and shared memory multiprocessors. – Design Example - Audio player, Engine control unit – Video accelerator.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Describe the architecture and programming of ARM processor.
2. Outline the concepts of embedded systems.
3. Explain the basic concepts of real time operating system design.
4. Model real-time applications using embedded-system concepts.

Text Book(s):

1. Marilyn Wolf, "Computers as Components - Principles of Embedded Computing System Design", Third Edition "Morgan Kaufmann Publisher (An imprint from Elsevier), 2012.
2. Jane W.S.Liu," Real Time Systems", Pearson Education, Third Indian Reprint, 2003.

Reference Books:

1. Lyla B.Das, "Embedded Systems : An Integrated Approach" Pearson Education, 2013.
2. Jonathan W.Valvano, "Embedded Microcomputer Systems Real Time Interfacing", Third Edition Cengage Learning, 2012.
3. David. E. Simon, "An Embedded Software Primer", 1st Edition, Fifth Impression, AddisonWesley Professional, 2007.
4. K.V.K.K.Prasad, "Embedded Real-Time Systems: Concepts, Design & Programming", Dream Tech Press, 2005.

22PEC12	SENSORS AND ACTUATORS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

The objective of this course is to make the students to list common types of sensor and actuators used in automotive vehicles.

Course Content:

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 LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

CO1: List common types of sensor and actuators used in vehicles.

CO2:Design measuring equipment's for the measurement of pressure force, temperature and flow.
CO3:Generate new ideas in designing the sensors and actuators for automotive application
CO4:Understand the operation of thesensors, actuators and electronic control.
CO5:Design temperature control actuators for vehicles.

Text Book(s):

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.

Reference Books:

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.

22PEC13	ANALOG IC DESIGN	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To study the basics of MOS Circuits.
2. To analyse the noise characteristics of amplifiers.
3. To study the performance parameters of amplifiers.
4. To comprehend the compensation techniques
5. To understand the detection and testing of faults.

Course Content:

UNIT I SINGLE STAGE AMPLIFIERS 9

Basic MOS physics and equivalent circuits and models, CS, CG and Source Follower, differential amplifier with active load, Cascode and Folded Cascode configurations with active load, design of Differential and Cascode Amplifiers – to meet specified SR, noise, gain, BW, ICMR and power dissipation, voltage swing, high gain amplifier structures.

UNIT II HIGH FREQUENCY AND NOISE CHARACTERISTICS OF AMPLIFIERS 9

Miller effect, association of poles with nodes, frequency response of CS, CG and Source Follower, Cascode and Differential Amplifier stages, statistical characteristics of noise, noise in Single Stage amplifiers, noise in Differential Amplifiers.

UNIT III FEEDBACK AND SINGLE STAGE OPERATIONAL AMPLIFIERS 9

Properties and types of negative feedback circuits, effect of loading in feedback networks, operational amplifier performance parameters, single stage Op Amps, two-stage Op Amps, input range limitations, gain boosting, slew rate, power supply rejection, noise in Op Amps.

UNIT IV STABILITY , FREQUENCY COMPENSATION 9

Multipole Systems, Phase Margin, Frequency Compensation, Compensation Of Two Stage Op Amps, Slewing In Two Stage Op Amps, Other Compensation Techniques.

UNIT V LOGIC CIRCUIT TESTING 9

Faults in Logic Circuits- Basic Concepts of Fault Detection- Design for Testability- Ad Hoc Techniques, Level-Sensitive Scan Design, Partial Scan, Built-in Self-Test.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Design amplifiers to meet user specifications.
CO2: Analyse the frequency and noise performance of amplifiers.
CO3: Design and analyse feedback amplifiers and one stage op amps.
CO4: Analyse stability of op amp.

CO5: Testing experience of logic circuits.

Text Book(s):

1. Behzad Razavi, “Design Of Analog Cmos Integrated Circuits”, Tata Mcgraw Hill, 2001.

2. Parag K.Lala, “An Introduction to Logic Circuit Testing”,Morgan & Claypool Publishers,2009.

Reference Books:

1. Willey M.C. Sansen, “Analog Design Essentials”, Springer, 2006.

2. Grebene, “Bipolar And Mos Analog Integrated Circuit Design”, John Wiley & Sons,Inc.,2003. Phillip E.Allen, Douglas R .Holberg, “Cmos Analog Circuit Design”, Oxford University Press, 2nd Edition, 2002.

3. Recorded Lecture Available at http://www.ee.iitm.ac.in/vlsi/courses/ee5320_2021/start

4. Jacob Baker “CMOS: Circuit Design, Layout, And Simulation, Wiley IEEE Press, 3rd Edition, 2010.

22PEC14	WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.To study and understand the concepts and design of a Cellular System.

2.To Study And Understand Mobile Radio Propagation And Various Digital Modulation Techniques.

3.To Understand The Concepts Of Multiple Access Techniques And Wireless Networks

Course Content:

UNIT I THE CELLULAR CONCEPT-SYSTEM DESIGN FUNDAMENTALS **9**

Introduction-Frequency Reuse-Channel Assignment Strategies-**Handoff Strategies:** Prioritizing Handoffs, Practical Handoff Considerations. **Interference And System Capacity**: Co-Channel Interference And System Capacity-Channel Planning For Wireless Systems, Adjacent Channel Interference, Power Control For Reducing Interference, Trunking And Grade Of Service. **Improving Coverage And Capacity In Cellular Systems:** Cell Splitting, Sectoring.

UNIT II MOBILE RADIO PROPAGATION **9**

Large Scale Path Loss: Introduction To Radio Wave Propagation - Free Space Propagation Model – **Three Basic Propagation Mechanism:** Reflection – Brewster Angle- Diffraction-Scattering.**Small Scale Fading And Multipath:** Small Scale Multipath Propagation, Factors Influencing Small-Scale Fading, Doppler Shift, Coherence Bandwidth, Doppler Spread And Coherence Time. **Types Of Small- Scale Fading:** Fading Effects Due To Multipath Time Delay Spread, Fading Effects Due To Doppler Spread.

UNIT III MODULATION TECHNIQUES AND EQUALIZATION AND DIVERSITY **9**

Digital Modulation – **An Overview**: Factors That Influence The Choice Of Digital Modulation, **Linear Modulation Techniques:** Minimum Shift Keying (MSK), Gaussian Minimum Shift Keying(GMSK), **Spread Spectrum Modulation Techniques:** Pseudo- Noise (PN) Sequences, Direct Sequence Spread Spectrum (DS-SS)- Modulation Performance In Fading And Multipath Channels- **Equalization, Diversity And Channel Coding:** Introduction-Fundamentals Of Equalization- **Diversity Techniques:** Practical Space Diversity Considerations, Polarization Diversity, Frequency Diversity, Time Diversity.

UNIT IV MULTIPLE ACCESS TECHNIQUES **9**

Introduction: Introduction To Multiple Access- Frequency Division Multiple Access (FDMA)- Time Division Multiple Access(TDMA)- Spread Spectrum Multiple Access-Code Division Multiple Access(CDMA)- Space Division Multiple Access(SDMA)- **Capacity Of**

Cellular Systems: Capacity Of Cellular CDMA, Capacity Of CDMA With Multiple Cells.

UNIT V WIRELESS NETWORKING 9

Introduction: Difference Between Wireless And Fixed Telephone Networks, The Public Switched Telephone Network(PSTN), **Development Of Wireless Networks:** First Generation Wireless Networks, Second Generation Wireless Networks, Third Generation Wireless Networks, Fixed Network Transmission Hierarchy, **Traffic Routing In Wireless Networks**: Circuit Switching, Packet Switching- **Personal Communication Services/ Networks(PCS/PCNs):**Packet Vs Circuit Switching For PCN, Cellular Packet- Switched Architecture- Packet Reservation Multiple Access(PRMA)- **Network Databases:** Distributed Database For Mobility Management- Universal Mobile Telecommunication Systems(UMTS).

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1:Understand The Concept And Design Of A Cellular System.

CO2:Understand Mobile Radio Propagation And Various Digital Modulation Techniques.

CO3:Understand The Concepts Of Multiple Access Techniques And Wireless Networks

CO4:Characterize a wireless channel and evolve the system design specifications

CO5:Design a cellular system based on resource availability and traffic demands.

Text Book(s):

1. Rappaport,T.S.,-Wireless communications", Pearson Education, Second Edition, 2010.

Reference Books:

1. Wireless Communication –Andrea Goldsmith, Cambridge University Press, 2011

2. Van Nee, R. and Ramji Prasad, ―OFDM for wireless multimedia communications, Artech House, 2000

3. David Tse and Pramod Viswanath, ―Fundamentals of Wireless Communication, Cambridge University Press, 2005.

4. Upena Dalal, ―Wireless Communication", Oxford University Press, 2009.

5. Andreas.F. Molisch, ―Wireless Communications", John Wiley – India, 2006.

6. Wireless Communication and Networks –William Stallings ,Pearson Education, Second Edition 2002.

22PEC15	AD HOC AND WIRELESS SENSOR NETWORKS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Learn Ad hoc network and Sensor Network fundamentals.
2. Understand the different routing protocols.
3. Have an in-depth knowledge on sensor network architecture and design issues.
4. Understand the transport layer and security issues possible in Ad hoc and Sensor networks.
5. Have an exposure to mote programming platforms and tools.

Course Content:

UNIT I AD HOC NETWORKS – INTRODUCTION AND ROUTING PROTOCOLS **9**

Elements of Ad hoc Wireless Networks, Issues in Ad hoc wireless networks, Example commercial applications of Ad hoc networking, Ad hoc wireless Internet, Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks, Classifications of Routing Protocols, Table Driven Routing Protocols - Destination Sequenced Distance Vector (DSDV), On–Demand Routing protocols –Ad hoc On–Demand Distance Vector Routing (AODV).

UNIT II SENSOR NETWORKS – INTRODUCTION & ARCHITECTURES **9**

Challenges for Wireless Sensor Networks, Enabling Technologies for Wireless Sensor Networks, WSN application examples, Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes, Network Architecture - Sensor Network Scenarios, Transceiver Design Considerations, Optimization Goals and Figures of Merit.

UNIT III WSN NETWORKING CONCEPTS AND PROTOCOLS **9**

MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Contention based protocols - PAMAS, Schedule based protocols – LEACH, IEEE 802.15.4 MAC protocol, Routing Protocols Energy Efficient Routing, Challenges and Issues in Transport layer protocol.

UNIT IV SENSOR NETWORK SECURITY **9**

Network Security Requirements, Issues and Challenges in Security Provisioning, Network Security Attacks, Layer wise attacks in wireless sensor networks, possible solutions for jamming, tampering, black hole attack, flooding attack. Key Distribution and Management, Secure Routing – SPINS, reliability requirements in sensor networks.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS **9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software

platforms – TinyOS, nesC, CONTIKIOS, Node-level Simulators – NS2 and its extension to sensor networks, COOJA, TOSSIM, Programming beyond individual nodes – State centric programming.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Know the basics of Ad hoc networks and Wireless Sensor Networks.
2. Apply this knowledge to identify the suitable routing algorithm based on the network and user requirement.
3. Apply the knowledge to identify appropriate physical and MAC layer protocols.
4. Understand the transport layer and security issues possible in Ad hoc and sensor networks.
5. Be familiar with the OS used in Wireless Sensor Networks and build basic modules.

Text Book(s):

1. Holger Karl , Andreas willig, "Protocol and Architecture for Wireless Sensor Networks", John wiley publication, Jan 2006.
2. C. Siva Ram Murthy and B. S. Manoj, "Ad Hoc Wireless Networks Architectures and Protocols", Prentice Hall, PTR, 2004.

Reference Books:

1. Charles E. Perkins, "Ad Hoc Networking", Addison Wesley, 2000.
2. Feng Zhao, Leonidas Guibas, "Wireless Sensor Networks: an information processing approach", Elsevier publication, 2004.

22PEC16	4G / 5G COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To learn the evolution of wireless networks.
2. To get acquainted with the fundamentals of 5G networks.
3. To study the processes associated with 5G architecture.
4. To study spectrum sharing and spectrum trading.
5. To learn the security features in 5G networks.

Course Content:

UNIT I EVOLUTION OF WIRELESS NETWORKS 9

Networks evolution: 2G,3G,4G, evolution of radio access networks, need for 5G. 4G versus 5G, Next Generation core(NG-core), visualized Evolved Packet core(vEPC).

UNIT II 5G CONCEPTS AND CHALLENGES 9

Fundamentals of 5G technologies, overview of 5G core network architecture,5G new radio and cloud technologies, Radio Access Technologies (RATs), EPC for 5G.

UNIT III NETWORK ARCHITECTURE AND THE PROCESSES 9

5G architecture and core, network slicing, multi access edge computing(MEC)visualization of 5G components, end-to-end system architecture, service continuity, relation to EPC, and edge computing. 5G protocols: 5G NAS,NGAP, GTP-U, IPSec and GRE.

UNIT IV DYNAMIC SPECTRUM MANAGEMENT AND MM-WAVES 9

Mobility management, Command and control, spectrum sharing and spectrum trading, cognitive radio based on 5G, millimeter waves.

UNIT V SECURITY IN 5G NETWORKS 9

Security features in 5G networks, network domain security, user domain security, flow based QoS framework, mitigating the threats in 5G.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1:To understand the evolution of wireless networks.
CO2:To learn the concepts of 5G networks.
CO3:To comprehend the 5G architecture and protocols.
CO4:To understand the dynamic spectrum management.
CO5:To learn the security aspects in 5G networks.

Text Book(s):

1. 5G Core networks: Powering Digitalization , Stephen Rommer, Academic Press,2019
2. An Introduction to 5G Wireless Networks : Technology, Concepts and Use cases, Saro Velrajan,First Edition, 2020.

Reference Books:

1. 5G Simplified: ABCs of Advanced Mobile Communications Jyrki T.J.Penttinen, Copyrighted Material.
2. 5G system Design: An end to end Perspective , Wan Lee Anthony, Springer Publications,2019.

22PEC17	MASSIVE MIMO NETWORKS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To gain knowledge about massive MIMO networks.
2. To understand the massive MIMO propagation channels.
3. To learn about channel estimation in single cell and multicell massive MIMO systems.
4. To comprehend the concepts of massive MIMO deployment in the context of single cell and multicell deployment.

Course Content:

UNIT I MASSIVE MIMO NETWORKS 9

Definition of Massive MIMO, Correlated Rayleigh Fading, System Model for Uplink and Downlink, Basic Impact of Spatial Channel Correlation, Channel Hardening and Favourable Propagation, Local Scattering Spatial Correlation Model

UNIT II THE MASSIVE MIMO PROPAGATION CHANNEL 9

Favorable Propagation and Deterministic Channels-Capacity Upper Bound-Distance from Favorable Propagation-Favorable Propagation and Linear Processing-Singular Values and Favorable Propagation, Favorable Propagation and Random Channels-Independent Rayleigh Fading-Uniformly Random Line-of-Sight (UR-LoS)-Independent Rayleigh Fading versus UR-LoS - Finite-Dimensional Channels

UNIT III SINGLE-CELL SYSTEMS 9

Uplink Pilots and Channel Estimation - Orthogonal Pilots- De-Spreading of the Received Pilot Signal-MMSE Channel Estimation, Uplink Data Transmission - Zero-Forcing - Maximum-Ratio, Downlink Data Transmission-Linear Precoding-Zero-Forcing-Maximum-Ratio, Discussion-Interpretation of the Effective SINR Expressions-Implications for Power Control-Scaling Laws and Upper Bounds on the SINR - Near-Optimality of Linear Processing when M >> K - Net Spectral Efficiency - Limiting Factors: Number of Antennas and Mobility

UNIT IV MULTI-CELL SYSTEMS 9

Uplink Pilots and Channel Estimation, Uplink Data Transmission - Zero-Forcing -Maximum-Ratio, Downlink Data Transmission -Zero-Forcing - Maximum-Ratio, Discussion - Asymptotic Limits with Infinite Numbers of Base Station Antennas - The Effects of Pilot Contamination - Non-Synchronous Pilot Interference

UNIT V CASE STUDIES 9

Single-Cell Deployment Example: Fixed Broadband Access in Rural Area, Multi-Cell Deployment: Preliminaries and Algorithms, Multi-Cell Deployment Examples: Mobile

Access - Dense Urban Scenario - Suburban Scenario - Minimum Per-Terminal Throughput Performance -Additional Observations - Comparison of Power Control Policies

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Understand and explain massive MIMO networks.

CO2: Analyze massive MIMO propagation channels and their capacity bounds

CO3: Examine channel estimation techniques for single cell system.

CO4: Analyze channel estimation techniques for multi cell system.

CO5: Explain the concepts underlining the deployment of single and multicell massive MIMO systems.

Text Book(s):

1.Thomas L. Marzetta, Erik G. Larsson, Hong Yang, Hien Quoc Ngo, "Fundamentals of Massive MIMO", Cambridge University Press 2016.

2.Emil Björnson, Jakob Hoydis and Luca Sanguinetti (2017), "Massive MIMO Networks: Spectral, Energy, and Hardware Efficiency", Foundations and Trends, Now, 2017.

Reference Books:

1.Long Zhao, Hui Zhao, Kan Zheng, "Wei Xiang Massive MIMO in 5G Networks: Selected Applications", Springer 2018.

2.Leibo Liu, Guiqiang Peng, Shaojun Wei, "Massive MIMO Detection Algorithm and VLSI Architecture", Springer 2019.

3. Shahid Mumtaz, Jonathan Rodriguez, Linglong Dai, "mmWave Massive MIMO A Paradigm for 5G", Elsevier, 2017

22PEC18	WIRELESS BROAD BAND NETWORKS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.To study the various network layer and transport layer protocols for wireless networks
2.To study the architecture and interference mitigation techniques in 3G standards
3. To learn about 4G technologies and LTE-A in mobile cellular network.
4. To learn about the layer level functionalities in interconnecting networks.
5. To study the emerging techniques in 5G network.

Course Content:

UNIT I WIRELESS PROTOCOLS 9

Mobile network layer- Fundamentals of Mobile IP, data forwarding procedures in mobile IP, IPv4, IPv6, IP mobility management, IP addressing - DHCP, Mobile transport layer- Traditional TCP, congestion control, slow start, fast recovery/fast retransmission, classical TCP improvements- Indirect TCP, snooping TCP, Mobile TCP.

UNIT II 3G EVOLUTION 9

IMT-2000 - W-CDMA, CDMA 2000 - radio & network components, network structure, packet-data transport process flow, Channel Allocation, core network, interference-mitigation techniques, UMTS-services, air interface, network architecture of 3GPP, UTRAN – architecture, High Speed Packet Data-HSDPA, HSUPA.

UNIT III 4G EVOLUTION 9

Introduction to LTE-A – Requirements and Challenges, network architectures – EPC, E-UTRAN architecture - mobility management, resource management, services, channel - logical and transport channel mapping, downlink/uplink data transfer, MAC control element, PDU packet formats, scheduling services, random access procedure.

UNIT IV LAYER-LEVEL FUNCTIONS 9

Characteristics of wireless channels - downlink physical layer, uplink physical layer, MAC scheme -frame structure, resource structure, mapping, synchronization, reference signals and channel estimation, SC-FDMA, interference cancellation – CoMP, Carrier aggregation, Services - multimedia broadcast/multicast, location-based services.

UNIT V 5G EVOLUTION 9

5G Roadmap - Pillars of 5G - 5G Architecture, The 5G internet - IoT and context awareness - Networking reconfiguration and virtualization support - Mobility QoS control - emerging approach for resource over provisioning, Small cells for 5G mobile networks- capacity limits and achievable gains with densification - Mobile data demand, Demand Vs Capacity, Small cell challenges, conclusion and future directions.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Design and implement the various protocols in wireless networks.
CO2: Analyze the architecture of 3G network standards.
CO3: Analyze the difference of LTE-A network design from 4G standard.
CO4: Design the interconnecting network functionalities by layer level functions.
CO5: Explore the current generation (5G) network architecture.

Text Book(s):

1.Kaveh Pahlavan, “Principles of wireless networks”, Prentice-Hall of India, 2008

Reference Books:

1. Vijay K.Garg, “Wireless Network Evolution - 2G & 3G”. Prentice Hall, 2008.

2. Clint Smith,P.E, Dannel Collins, “3G Wireless Networks” Tata McGraw- Hill, 2nd Edition, 2011.

3. Sassan Ahmadi, “LTE-Advanced – A practical systems approach to understanding the 3GPP LTE Releases 10 and 11 radio access technologies”, Elsevier, 2014.

4. Jonathan Rodriguez, "Fundamentals of 5G Mobile networks", John Wiley, 2015.

22PEC19	MODERN DIGITAL COMMUNICATION TECHNIQUES	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.To understand the coherent and non coherent receivers and their performance under AWGN channel conditions

2.To understand the effect of signalling through bandlimited channels and Equalization techniques used to overcome ISI

3. To understand different channel models, channel capacity and different block coding techniques

4. To understand the principle of convolutional coding and different decoding techniques

5. To understand the basics of OFDM as a multicarrier communication and CDMA as a multiuser communication technique.

Course Content:

UNIT I COHERENT AND NON-COHERENT COMMUNICATION **9**

Coherent receivers – Optimum receivers in WGN – IQ modulation & demodulation – QAM modulation and demodulation Noncoherent receivers in random phase channels; MFSK receivers – Rayleigh and Rician channels – Partially coherent receivers – DPSK; M-PSK; M-DPSK-BER Performance Analysis. Carrier SynchronizationBit synchronization.

UNIT II EQUALIZATION TECHNIQUES **9**

Band Limited Channels- ISI – Nyquist Criterion- Controlled ISI-Partial Response signals-Equalization algorithms– Linear equalizer – Decision feedback equalization – Adaptive Equalization algorithms.

UNIT III BLOCK CODED DIGITAL COMMUNICATION **9**

Architecture and performance – Binary block codes; – Shannon's channel coding theorem; Channel capacity; Matched filter; Concepts of Spread spectrum communication – Coded BPSK and DPSK demodulators– Linear block codes; Hamming; Golay; Cyclic; BCH ; Reed – Solomon codes. Space time block codes.

UNIT IV CONVOLUTIONAL CODED DIGITAL COMMUNICATION **9**

Representation of codes using Polynomial, State diagram, Tree diagram, and Trellis diagram – Decoding techniques using Maximum likelihood, Viterbi algorithm, Sequential and Threshold methods – Error probability performance for BPSK and Viterbi algorithm, Turbo Coding.

UNIT V MULTICARRIER AND MULTIUSER COMMUNICATIONS **9**

Single Vs multicarrier modulation, orthogonal frequency division multiplexing (OFDM), Modulation and demodulation in an OFDM system, An FFT algorithmic implementation of

an OFDM system, Bit and power allocation in multicarrier modulation, Peak-to-average ratio in multicarrier modulation. Introduction to CDMA systems, multiuser detection in CDMA systems – optimum multiuser receiver, suboptimum detectors, successive interference cancellation.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Differentiate coherent and non coherent receivers and analyse their performance under AWGN channel conditions

CO2: Illustrate the effect of signalling through bandlimited channels and Equalization techniques used to overcome ISI

CO3: Determine the channel capacity and design various block coding techniques to combat channel errors

CO4: Construct convolutional coders and analyze the performance of different decoding techniques.

CO5: Describe the basics of OFDM as a multicarrier communication and CDMA as a multiuser communication technique.

Text Book(s):

1.John G. Proakis and Masoud Salehi “Digital Communication”, Fifth Edition, Mc Graw Hill Publication, 2014.

2. Simon Haykin, “Digital communication Systems”, John Wiley and sons, 2014.

Reference Books:

1. Bernard Sklar and Pabitra Kumar Ray, “Digital Communications Fundamentals & Applications”, second edition, Pearson Education, 2009.

2. Lathi B P and Zhi Ding, “Modern Digital and Analog communication Systems", Oxford University Press, 2011.

3. Richard Van Nee & Ramjee Prasad, “OFDM for Multimedia Communications” Artech House Publication, 2001.

4. Theodore S.Rappaport, ‘Wireless Communications”, 2nd edition, Pearson Education, 2002.

22PEC20	MACHINE LEARNING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To understand the basic concepts of machine learning.
2. To understand and build supervised learning models.
3. To understand and build unsupervised learning models.
4. To evaluate the algorithms based on corresponding metrics identified

Course Content:

UNIT I INTRODUCTION TO MACHINE LEARNING 9

Review of Linear Algebra for machine learning; Introduction and motivation for machine learning; Examples of machine learning applications, Vapnik-Chervonenkis (VC) dimension, Probably Approximately Correct (PAC) learning, Hypothesis spaces, Inductive bias, Generalization, Bias variance trade-off.

UNIT II SUPERVISED LEARNING 9

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

UNIT III 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 IV NEURAL NETWORKS 9

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.

UNIT V DESIGN AND ANALYSIS OF MACHINE LEARNING EXPERIMENTS 9

Guidelines for machine learning experiments, Cross Validation (CV) and resampling – K-fold CV, bootstrapping, measuring classifier performance, assessing a single classification algorithm and comparing two classification algorithms – *t* test, McNemar's test, K-fold CV paired *t* test

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to
CO1: Explain the basic concepts of machine learning.
CO2 : Construct supervised learning models.
CO3 : Construct unsupervised learning algorithms.
CO4: Evaluate and compare different models

Text Book(s):

1.Ethem Alpaydin, "Introduction to Machine Learning", MIT Press, Fourth Edition, 2020.

2. Stephen Marsland, "Machine Learning: An Algorithmic Perspective, "Second Edition", CRC Press, 2014.

Reference Books:

1. Christopher M. Bishop, "Pattern Recognition and Machine Learning", Springer, 2006.

2. Tom Mitchell, "Machine Learning", McGraw Hill, 3rd Edition, 1997.

3. Mehryar Mohri, Afshin Rostamizadeh, Ameet Talwalkar, "Foundations of Machine Learning", Second Edition, MIT Press, 2012, 2018.

4. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016

5. Sebastain Raschka, Vahid Mirjalili , "Python Machine Learning", Packt publishing, 3rd Edition, 2019.

22PEC21	SOFT COMPUTING TECHNIQUES	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To classify various soft computing frame works.
2. To be familiar with the design of neural networks, fuzzy logic, and fuzzy systems.
3. To learn mathematical background for optimized genetic programming.
4. Be exposed to neuro-fuzzy hybrid systems and its applications.
5. To understand the various evolutionary optimization techniques.

Course Content:

UNIT I FUZZY LOGIC 9

Introduction to Fuzzy logic - Fuzzy sets and membership functions- Operations on Fuzzy setsFuzzy relations, rules, propositions, implications, and inferences- Defuzzification techniques- Fuzzy logic controller design- Some applications of Fuzzy logic.

UNIT II ARTIFICIAL NEURAL NETWORKS 9

Supervised Learning: Introduction and how brain works, Neuron as a simple computing element, The perceptron, Backpropagation networks: architecture, multilayer perceptron, backpropagation learning-input layer, accelerated learning in multilayer perceptron, The Hopfield network, Bidirectional associative memories (BAM), RBF Neural Network. Unsupervised Learning: Hebbian Learning, Generalized Hebbian learning algorithm, Competitive learning, Self- Organizing Computational Maps: Kohonen Network.

UNIT III GENETIC ALGORITHM 9

Genetic algorithm- Introduction - biological background - traditional optimization and search techniques - Genetic basic concepts - operators – Encoding scheme – Fitness evaluation – crossover - mutation - Travelling Salesman Problem, Particle swam optimization, Ant colony optimization.

UNIT IV NEURO-FUZZY MODELING 9

Adaptive Neuro-Fuzzy Inference Systems (ANFIS) – architecture - Coactive Neuro-Fuzzy Modeling, framework, neuron functions for adaptive networks – Data Clustering Algorithms – Rule base Structure Identification –Neuro-Fuzzy Control – the inverted pendulum system.

UNIT V CONVENTIONAL OPTIMIZATION TECHNIQUES 9

Introduction to optimization techniques, Statement of an optimization problem, classification, Unconstrained optimization-gradient search method-Gradient of a function, steepest gradientconjugate gradient, Newton’s Method, Marquardt Method, Constrained optimization –sequential linear programming, Interior penalty function method, external penalty function method.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Develop application on different soft computing techniques like Fuzzy, GA and Neural network.
2. Implement Neuro-Fuzzy and Neuro-Fuzz-GA expert system.
3. Implement machine learning through Neural networks.
4. Model Neuro Fuzzy system for clustering and classification.
5. Able to use the optimization techniques to solve the real world problems.

Text Book(s):

1. J.S.R.Jang, C.T. Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI / Pearson Education 2004.
2. George J. Klir and Bo Yuan, Fuzzy Sets and Fuzzy Logic-Theory and Applications,Prentice Hall, 1995.

Reference Books:

1. David E. Goldberg, Genetic Algorithms in Search, Optimization and Machine Learning, Addison wesley, 2009.
2. James A. Freeman and David M. Skapura, Neural Networks Algorithms, Applications, and Programming Techniques, Pearson Edn., 2003.
3. Jyh-Shing Roger Jang, Chuen-Tsai Sun, Eiji Mizutani, Neuro-Fuzzy and Soft Computing, Prentice-Hall of India, 2003.
4. Simon Haykins, Neural Networks: A Comprehensive Foundation, Prentice Hall International Inc, 1999.

22PEC22	ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.Learn the basic AI approaches

2. Develop problem solving agents

3. Perform logical and probabilistic reasoning

Course Content:

UNIT I INTELLIGENT AGENTS 9

Introduction to AI – Agents and Environments – concept of rationality – nature of environments – structure of agents. Problem solving agents – search algorithms – uninformed search strategies.

UNIT II PROBLEM SOLVING 9

Heuristic search strategies – heuristic functions. Local search and optimization problems – local search in continuous space – search with non-deterministic actions – search in partially observable environments – online search agents and unknown environments

UNIT III GAME PLAYING AND CSP 9

Game theory – optimal decisions in games – alpha-beta search – monte-carlo tree search – stochastic games – partially observable games. Constraint satisfaction problems – constraint propagation – backtracking search for CSP – local search for CSP – structure of CSP.

UNIT IV LOGICAL REASONING 9

Knowledge-based agents – propositional logic – propositional theorem proving – propositional model checking – agents based on propositional logic. First-order logic – syntax and semantics – knowledge representation and engineering – inferences in first-order logic – forward chaining – backward chaining – resolution.

UNIT V 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.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Explain intelligent agent frameworks
CO2: Apply problem solving techniques
CO3: Apply game playing and CSP techniques
CO4: Perform logical reasoning
CO5: Perform probabilistic reasoning under uncertainty

Text Book(s):

1. Stuart Russell and Peter Norvig, “Artificial Intelligence – A Modern Approach”, Fourth Edition, Pearson Education, 2021.

Reference Books:

1. Dan W. Patterson, “Introduction to AI and ES”, 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.
5. http://nptel.ac.in/

Couse Code	BLOCKCHAIN TECHNOLOGIES	L	T	P	C
22PCS20		2	0	2	3

Pre-requisite Computer networks **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics of Blockchain
2. To learn Different protocols and consensus algorithms in Blockchain
3. To learn the Blockchain implementation frameworks
4. To understand the Blockchain Applications
5. To experiment the Hyperledger Fabric, Ethereum networks.

Course Content:

UNIT I INTRODUCTION TO BLOCKCHAIN 6

Blockchain- Public Ledgers, Blockchain as Public Ledgers - Block in a Blockchain, Transactions- The Chain and the Longest Chain - Permissioned Model of Blockchain, Cryptographic -Hash Function, Properties of a hash function-Hash pointer and Merkle tree.

UNIT II BITCOIN AND CRYPTOCURRENCY 6

A basic crypto currency, Creation of coins, Payments and double spending, FORTH – the precursorfor Bitcoin scripting, Bitcoin Scripts , Bitcoin P2P Network, Transaction in Bitcoin Network, Block Mining, Block propagation and block relay

UNIT III BITCOIN CONSENSUS 6

Bitcoin Consensus, Proof of Work (PoW)- Hashcash PoW , Bitcoin PoW, Attacks on PoW ,monopoly problem- Proof of Stake- Proof of Burn - Proof of Elapsed Time - Bitcoin Miner, Mining Difficulty, Mining Pool-Permissioned model and use cases

UNIT IV HYPERLEDGER FABRIC & ETHEREUM 6

Architecture of Hyperledger fabric v1.1- chain code- Ethereum: Ethereum network, EVM, Transaction fee, Mist Browser, Ether, Gas, Solidity

UNIT V BLOCKCHAIN APPLICATIONS 6

Smart contracts, Truffle Design and issue- DApps- NFT. Blockchain Applications in Supply Chain Management, Logistics, Smart Cities, Finance and Banking, Insurance,etc- Case Study

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand emerging abstract models for Blockchain Technology
2. Identify major research challenges and technical gaps existing between theory and practicein the crypto currency domain.
3. It provides conceptual understanding of the function of Blockchain as a method of securingdistributed ledgers, how consensus on their contents is achieved, and the new applications that they enable.
4. Apply hyperledger Fabric and Ethereum platform to implement the Block chain Application

Text Book(s):

1. Bashir and Imran, Mastering Blockchain: Deeper insights into decentralization, cryptography, Bitcoin, and popular Blockchain frameworks, 2017.
2. Andreas Antonopoulos, “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly, 2014

Reference Books:

1. Daniel Drescher, “Blockchain Basics”, First Edition, Apress, 2017.
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller, and Steven Goldfeder.Bitcoin and cryptocurrency technologies: a comprehensive introduction. Princeton UniversityPress, 2016.
3. Melanie Swan, “Blockchain: Blueprint for a New Economy”, O’Reilly, 2015
4. Ritesh Modi, “Solidity Programming Essentials: A Beginner’s Guide to Build Smart Contractsfor Ethereum and Blockchain”, Packt Publishing
5. Handbook of Research on Blockchain Technology, published by Elsevier Inc. ISBN: 9780128198162, 2020

List of Experiments:

1.	Install and understand Docker container, Node.js, Java and Hyperledger Fabric, Ethereum and perform necessary software installation on local machine/create instance on cloud to run.	4
2.	Create and deploy a blockchain network using Hyperledger Fabric SDK for Java Set up and initialize the channel, install and instantiate chain code, and perform invoke and query on your blockchain network.	5
3.	Interact with a blockchain network. Execute transactions and requests against a blockchain network by creating an app to test the network and its rules.	5
4.	Deploy an asset-transfer app using blockchain. Learn app development within a HyperledgerFabric network.	5
5.	Use blockchain to track fitness club rewards. Build a web app that uses Hyperledger Fabricto track and trace member rewards	5
6.	Car auction network: A Hello World example with Hyperledger Fabric Node SDK and IBM Blockchain Starter Plan. Use Hyperledger Fabric to invoke chain code while storing results and data in the starter plan	6
	TOTAL PRACTICAL PERIODS	**15 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**45 Periods**

List of Equipments: (for batch of 30 students)

1.	Systems with either Netbeans or Eclipse	30 nos

Course Code	NEURAL NETWORKS AND DEEP LEARNING	L	T	P	C
22PCS12		2	0	2	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To understand the basics in deep neural networks
2. To understand the basics of associative memory and unsupervised learning networks
3. To apply CNN architectures of deep neural networks
4. To analyze the key computations underlying deep learning, then use them to build and traindeep neural networks for various tasks.
5. To apply autoencoders and generative models for suitable applications.

Course Content:

UNIT I INTRODUCTION 6

Neural Networks-Application Scope of Neural Networks-Artificial Neural Network: An Introduction- Evolution of Neural Networks-Basic Models of Artificial Neural Network-Important Terminologies of ANNs-Supervised Learning Network.

UNIT II ASSOCIATIVE MEMORY AND UNSUPERVISED LEARNING NETWORKS 6

Training Algorithms for Pattern Association-Autoassociative Memory Network-Hetero-associative Memory Network-Bidirectional Associative Memory (BAM)-Hopfield Networks-Iterative Auto-associative Memory Networks-Temporal Associative Memory Network-Fixed Weight Competitive Nets-Kohonen Self-Organizing Feature Maps-Learning Vector Quantization-Counter propagation Networks-Adaptive Resonance Theory Network

UNIT III THIRD-GENERATION NEURAL NETWORKS 6

Spiking Neural Networks-Convolutional Neural Networks-Deep Learning Neural Networks-Extreme Learning Machine Model-Convolutional Neural Networks: The Convolution Operation – Motivation –Pooling – Variants of the basic Convolution Function – Structured Outputs – Data Types – Efficient Convolution Algorithms – Neuroscientific Basis – Applications: Computer Vision, Image Generation,Image Compression

UNIT IV DEEP FEEDFORWARD NETWORKS 6

History of Deep Learning- A Probabilistic Theory of Deep Learning- Gradient Learning – Chain Rule and Backpropagation - Regularization: Dataset Augmentation – Noise Robustness -Early Stopping, Bagging and Dropout - batch normalization- VC Dimension and Neural Nets

UNIT V RECURRENT NEURAL NETWORKS 6

Recurrent Neural Networks: Introduction – Recursive Neural Networks – Bidirectional RNNs – Deep Recurrent Networks – Applications: Image Generation, Image Compression, Natural Language Processing. Complete Auto encoder, Regularized Autoencoder, Stochastic Encoders and Decoders,Contractive Encoders

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Apply Convolution Neural Network for image processing.
2. Understand the basics of associative memory and unsupervised learning networks.
3. Apply CNN and its variants for suitable applications.
4. Analyze the key computations underlying deep learning and use them to build and train deepneural networks for various tasks.
5. Apply autoencoders and generative models for suitable applications

Text Book(s):

1. Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.
2. Francois Chollet, "Deep Learning with Python", Second Edition, Manning Publications,2021

Reference Books:

1. Aurélien Géron, "Hands-On Machine Learning with Scikit-Learn and TensorFlow", Oreilly,2018.
2. Josh Patterson, Adam Gibson, "Deep Learning: A Practitioner's Approach", O'Reilly Media,2017
3. Charu C. Aggarwal, "Neural Networks and Deep Learning: A Textbook", SpringerInternational Publishing, 1st Edition, 2018.

List of Experiments:

1.	Implement simple vector addition in TensorFlow	**3**
2.	Implement a regression model in Keras.	**3**
3.	Implement a perceptron in TensorFlow/Keras Environment.	**3**
4.	Implement a Feed-Forward Network in TensorFlow/Keras.	**3**
5.	Implement an Image Classifier using CNN in TensorFlow/Keras.	**3**
6.	Improve the Deep learning model by fine tuning hyper parameters.	**3**
7.	Implement a Transfer Learning concept in Image Classification.	**3**
8.	Using a pre trained model on Keras for Transfer Learning	**3**
9.	Perform Sentiment Analysis using RNN	**3**
10.	Implement an LSTM based Autoencoder in TensorFlow/Keras	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	PC with Linux/Windows/Solaris/Mac OSX operating system	30 nos
2.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos

Course Code	DATA ANALYTICS AND VISUALIZATION	L	T	P	C
22PCS09		2	0	2	3

Pre-requisite Python programming, Data Science **Syllabus Version** V 0.1

Course Objectives:

The objective of this course is to equip students with the necessary skills to effectively analyze and visualize data using Python. By the end of this course, students will be able to manipulate and explore data, conduct statistical analysis, build and evaluate machine learning models, and create advanced visualizations.

Course Content:

UNIT I INTRODUCTION TO DATA ANALYTICS AND VISUALIZATION 6

Introduction to data analytics and visualization - Understanding the data analytics process - Tools and techniques for data analysis and visualization

UNIT II DATA MANIPULATION AND EXPLORATION 6

Data types and data structures in Python - Data manipulation using Pandas - Data exploration using Matplotlib and Seaborn.

UNIT III STATISTICAL ANALYSIS 6

Statistical inference and hypothesis testing - Descriptive statistics - Correlation and regression analysis.

UNIT IV MACHINE LEARNING FOR DATA ANALYTICS 6

Introduction to machine learning - Supervised and unsupervised learning - Building and evaluating machine learning models.

UNIT V ADVANCED DATA VISUALIZATION TECHNIQUES 6

Interactive data visualization using Plotly - Geospatial data visualization - Network visualization

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Students will be able to use Python for data manipulation, exploration, and analysis.
2. Students will be able to apply statistical concepts and techniques to real-world datasets.
3. Students will be able to build and evaluate machine learning models for classification and regression tasks.
4. Students will be able to create advanced visualizations using Plotly, geospatial data, and network data.
5. Students will be able to effectively communicate insights derived from data through visualizations and presentations.

Text Book(s):

1. Python for Data Analysis: Data Wrangling with Pandas, NumPy, and

IPython, Author: Wes McKinney, Publisher: O'Reilly Media, Edition: 2nd edition (2017), ISBN-13: 978-1491957660

Reference Books:

1. Data Science from Scratch: First Principles with Python, Author: Joel Grus, Publisher: O'Reilly Media, Edition: 2nd edition (2019), ISBN-13: 978-1492041139

List of Experiments:

1	Data Manipulation with Pandas	**3**
2	Data Exploration with Matplotlib and Seaborn	**3**
3	Statistical Analysis using Scipy	**3**
4	Machine Learning using Scikit-Learn	**3**
5	Interactive Data Visualization using Plotly	**3**
6	Geospatial Data Visualization using Folium	**3**
7	Network Visualization using NetworkX	**3**
8	Data Cleaning and Preprocessing	**3**
9	Model Evaluation and Selection	**3**
10	Final Project - Applying Data Analytics and Visualization techniques to a real-world dataset.	**3**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipment: (for batch of 30 students)

1.	Systems with MySql	30 nos
2.	Visual Studio and Server	30 nos
3.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos

22PBM25	COMPUTATIONAL NEUROSCIENCE	L	T	P	C
		3	0	0	3

Course Objectives:

1. To know the general organization of brain and physiological and cognitive processes.
2. To apply the molecular, cellular, and cognitive bases of learning and memory.

Course Content:

UNIT I NEUROANATOMY **9**

What are central and peripheral nervous systems; Structure and function of neurons; types of neurons; Synapses; Glial cells; myelination; Blood Brain barrier; Neuronal differentiation; Characterization of neuronal cells; Meninges and Cerebrospinal fluid; Spinal Cord.

UNIT II NEUROPHYSIOLOGY **9**

Using current clamp techniques, the electroresponsive behavior of cells are studied by generating a frequency(f)-vs-current(I) plot. This experiment deals with the f-I curve.

UNIT III SINGLE NEURON MODELING **9**

Ion flux in membranes, Nernst Planck Equation, Ion-Channels, Excitable membranes, Spiking, Hodgkin Huxley models, Integrate and Fire Neurons

UNIT IV NEURAL ENCODING AND DECODING **9**

Spike train statistics, Receptive fields, Linear and Nonlinear models of Receptive fields, Applications of Information Theory in neural coding and decoding

UNIT V PLASTICITY: ADAPTATION AND LEARNING **9**

Synapses: structure and function, plasticity, Spike Timing Dependent Plasticity (STDP), Learning rules, Supervised and Unsupervised Learning, Classical conditioning, Reinforcement Learning

TOTAL LECTURE PERIODS **45 Periods**

Text Books:

3. Mathews G.G. Neurobiology, 2nd edition, Blackwell Science, UK, 2000.
4. Gordon M. Shepherd G.M, and Shepherd Neurobiology, 3rd Edition Oxford University Press, USA, 1994
5. Theoretical Neuroscience - Computational and Mathematical Modeling of Neural Systems by Peter Dayan and L.F. Abbott
6. C.R.Hill, Jeff C.Bamber, Gail Haa, Physical Principles of medical Ultrasonics; John Wiley & Sons Ltd; 2nd Edition, 2004.

Online Reference:

1. https://courses.cit.cornell.edu/bionb330/Class%20Notes%20PartIV.pdf (Unit III)
2. https://courses.cit.cornell.edu/bionb330/Class_notes_PARTIII.pdf(Unit III)

Reference Books:

1. Mason P., Medical Neurobiology, Oxford University Press, 2011.

22PEC23	RADAR TECHNOLOGIES	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Understand the basics of Radar and Radar equation
2. Understand the types of Radar
3. Understand tracking Radar
4. Understand the various signal processing in Radar
5. Understand the Subsystems in Radar

Course Content:

UNIT I INTRODUCTION TO RADAR EQUATION 9

. The Origins of Radar ,Radar principles, Basic Block Diagram, Radar classifications based on Frequencies, Wave form and application,Radar Fundamentals: Detection, Range, velocity, The simple form of the Radar Equation, Pulsed Radar equation, Detection of Signals in Noise- Receiver Noise, Signal-to-Noise Ratio, Probabilities of Detection and False Alarm, Integration of Radar Pulses, Radar Cross Section of Targets,Transmitter Power,Pulse Repetition Frequency,Antenna Parameters, System losses.

UNIT II CW, MTI AND PULSE DOPPLER RADAR 9

CW and Frequency Modulated Radar, Doppler and MTI Radar- Delay Line Cancellers, Staggered Pulse Repetition Frequencies, Doppler Filter Banks, Digital MTI Processing, Moving Target Detector, Limitations to MTI Performance, MTI from a Moving Platform (AMIT), Pulse Doppler Radar.

UNIT III TRACKING RADAR 9

Tracking with Radar, Monopulse Tracking, Conical Scan, Sequential Lobing, Limitations to Tracking Accuracy, Low-Angle Tracking - Comparison of Trackers, Track while Scan (TWS) Radar- Target prediction , state estimation, Measurement models, alpha – beta tracker, Kalman Filtering, Extended Kalman filtering.

UNIT IV RADAR SIGNAL PROCESSING 9

Radar Signal Processing Fundamentals, Detection strategies, Optimal detection, Threshold detection, Constant False alarm rate detectors, Adaptive CFAR, pulse compression waveforms, compression gain, LFM waveforms matched filtering, radar ambiguity functions, radar resolution, Detection of radar signals in Noise and clutter, detection of non fluctuating target in noise, Doppler spectrum of fluctuating targets, Range Doppler spectrum of stationary and moving radar.

UNIT V RADAR TRANSMITTERS AND RECEIVERS 9

Radar Transmitter, Linear Beam Power Tubes, Solid State RF Power Sources, Magnetron, Crossed Field Amplifiers, Other RF Power Sources. The Radar Receiver ,Receiver noise

power, Super heterodyne Receiver, Duplexers and Receiver Protectors- Radar Displays. Radar Antenna - Reflector Antennas - Electronically Steered Phased Array Antennas – Phase Shifters

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1:Identify the Radar parameters

CO2:Differentiate various radar types

CO3:Evaluate different tracking and filtering schemes

CO4:Apply signal processing in target detection

CO5:Design Radar transmitter and receiver blocks

Text Book(s):

1.Habibur Rahman, Fundamental Principles of Radar, CRC press, Taylor and Francis, 2019.

2.M. R. Richards, J. A. Scheer, W. A. Holm, Editors "Principles of Modern Radar, Basic Principles", SciTech Publishing, 2012

Reference Books:

1.Nathansan, "Radar design principles-Signal processing and environment", PHI, 2nd Edition,2007.

2. M.I.Skolnik , "Introduction to Radar Systems", Tata McGraw Hill 2006.

3. Mark A. Richards, "Fundamentals of Radar Signal Processing", McGraw-Hill, 2005.

22PEC24	AVIONICS SYSTEMS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To impart knowledge on the needs for avionics for both Civil and military aircraft.
2. To impart knowledge on avionics architecture and Avionics data bus.
3. To impart knowledge understand the various cockpit displays and human interfaces.
4. To impart knowledge on the concepts of flight control systems, FMS and their importance
5. To impart knowledge on different navigation aids and need for certification

Course Content:

UNIT I INTRODUCTION TO AVIONICS 9

Basics of Avionics-Basics of Cockpits – Need for Avionics in civil and military aircraft and space systems – Integrated Avionics Architecture –Military and Civil system – Typical avionics System and Sub systems – Design and Technologies – Requirements and Importance of illities of Avionic Systems.

UNIT II DIGITAL AVIONICS BUS ARCHITECTURE 9

Evolution of Avionics architecture– Avionics Data buses MIL-STD-1553, MIL-STD-1773, ARINC-429, ARINC-629, AFDX/ARINC-664, ARINC-818 – Aircraft system Interface

UNIT III COCKPIT DISPLAYS AND MAN-MACHINE INTERACTION 9

Trends in display technology- CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) –-Civil cockpit and military cockpit: MFD, MFK, HUD, HDD, HMD, HOTAS – Glass cockpit.

UNIT IV FLIGHT CONTROL SYSTEMS 9

Introduction to Flight control systems and FMS– Longitudinal control – Lateral Control – Autopilot – Flight planning – Radar Electronic Warfare - Certification-Military and civil aircrafts.

UNIT V NAVIGATION SYSTEMS 9

Overview of navigation systems - Communication Systems – Radio navigation – Types & Principles – Fundamentals of Inertial Sensors – INS – GNSS -- GPS – Approach and Landing Aids – ILS & MLS – Hybrid Navigation

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1:Explain the different of Avionics Systems and its need for civil and military aircrafts considering the reliability and safety aspects

CO2:Select a suitable architecture and data bus based on the requirements

CO3:Compare the different display technologies used in cockpit

CO4:Explain the principles of flight control systems and the importance of FMS

CO5:Explain the communication and navigation techniques used in aircrafts

Text Book(s):

1. R.P.G. Collinson, “Introduction to Avionics”, Springer Publications, Third Edition, 2011.

Reference Books:

1. Cary R .Spitzer, “The Avionics Handbook”, CRC Press, 2000.
2. Middleton, D.H. “Avionics Systems”, Longman Scientific and Technical, Longman Group UK Ltd., England, 1989.

22PEC25	SATELLITE COMMUNICATION	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Understand the basics of satellite orbits
2. Understand the satellite segment and earth segment
3. Understand Link Power budget calculation
4. Understand the various satellite access and coding technology
5. Understand the applications of satellite

Course Content:

UNIT I SATELLITE ORBITS 9

Kepler's Laws, Newton's law, orbital parameters, orbital perturbations, station keeping, geo stationary and non Geo-stationary orbits – Look Angle Determination- Limits of visibility – eclipse-Sub satellite point –Sun transit outage-Launching Procedures - launch vehicles and propulsion.

UNIT II SPACE SEGMENT 9

Spacecraft Technology- Structure, Primary power, Attitude and Orbit control, Thermal control and Propulsion, communication Payload and supporting subsystems, Telemetry, Tracking and command-Transponders Antenna Subsystem.

UNIT III SATELLITE LINK DESIGN 9

Basic link analysis, Uplink and Downlink Design equation, Free space loss-Atmospheric effects, Ionospheric scintillation, Rain induced attenuation and interference, system noise temperature, Link Design with and without frequency reuse.

UNIT IV SATELLITE ACCESS AND CODINGTechniques 9

Modulation and Multiplexing: Voice, Data, Video, Analog – digital transmission system, Digital video Broadcast, multiple access: FDMA, TDMA, CDMA, PAMA and DAMA Assignment Methods, compression – encryption, Coding Schemes.

UNIT V SATELLITE APPLICATIONS 9

INTELSAT Series, INSAT, VSAT, Mobile satellite services: GSM, GPS, LEO, MEO, Satellite Navigational System. GPS-Position Location Principles, Differential GPS, Direct Broadcast satellites (DBS/DTH).

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1:Identify the satellite orbits

CO2:Analyze the satellite subsystems

CO3:Evaluate the satellite link power budget

CO4:Identify access technology for satellite
CO5:Design various satellite applications

Text Book(s):

1.Dennis Roddy, “Satellite Communication”, 4th Edition, Mc Graw Hill International, 2017.
2.Timothy Pratt, Charles, W.Bostain,Jeremy E.Allnutt,"SatelliteCommunication”,3rd Edition, Wiley Publications,2021.

Reference Books:

1. Tri T. Ha, “Digital Satellite Communications”, 2nd edition, Mc Graw Hill education, 2017.
2. Wilbur L.Pritchard, Hendri G. Suyderhoud, Robert A. Nelson, “Satellite Communications Systems Engineering”, 2nd edition , Prentice Hall/Pearson , 2013.
3. M.Richharia, “Satellite Communication Systems-Design Principles”, Macmillan, 1999.
4. Brian Ackroyd, “World Satellite Communication and earth station Design”, BSP professional Books, 1990.
5. Bruce R. Elbert, “The Satellite Communication Applications”, Hand Book, Artech House Bostan London, 2003.

22PEC26	POSITIONING AND NAVIGATION SYSTEMS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To explain the fundamentals of navigation systems.
2. To understand the inertial navigation systems
3. To acquire knowledge on radio navigation.
4. To have an overview of global positioning systems
5. To learn the hybrid navigation systems.

Course Content:

UNIT I NAVIGATION CONCEPTS 9

Fundamentals of navigation systems and Position Fixing – Categories of navigation - Geometric concepts of Navigation – The Earth in inertial space - Different Coordinate Systems – Coordinate Transformation - Euler angle formulations - Direction cosine matrices formulation - Quaternion formulation.

UNIT II INERTIAL NAVIGATION SYSTEMS 9

Inertial sensors - Gyroscopes -Types - Mechanical - Electromechanical-Optical Gyro -Ring Laser gyro- Fiber optic gyro- Accelerometers – Pendulous type – Force Balance type – MEMs - Basic Principles of Inertial Navigation – Types - Platform and Strap down - Mechanization INS system - Rate Corrections - Acceleration errors – Schuler Tuning.

UNIT III RADIO NAVIGATION & AIR TRAFFIC MANAGEMENT 9

Different types of radio navigation- ADF, VOR, DME, TACAN,VORTAC - Doppler – Hyperbolic Navigations – Air Traffic Management – RADAR Surveillance - Airborne Collision Avoidance Systems

UNIT IV GLOBAL POSITIONING SYSTEM 9

Overview of GPS: Basic concept, system architecture, , GPS Signals Signal structure, anti-spoofing (AS), selective availability, GPS for position and velocity determination, GPS aided Geo-augmented navigation (GAGAN) architecture -GPS error sources-clock error, ionospheric error, tropospheric error, multipath, ionospheric error estimation using dual frequency GPS receiver

UNIT V HYBRID NAVIGATION & RELATIVE NAVIGATION SYSTEMS 9

Hybrid Navigation - Introduction to Kalman filtering – Case Studies -Integration of GPS and INS using Kalman Filter - Relative Navigation – fundamentals – Equations of Relative Motion for circular orbits (Clohessy_Wiltshire Equations) - Sensors for Rendezvous Navigation - Relative positioning - Point positioning and differential positioning - Differential GPS (DGPS) and Space based Augmentation system (SBAS)- Concepts - Relative GPS - Formation Flying - Figure of Merit (FOM)

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1 : Understand the advanced concepts of Positioning and Navigation systems and exposure on various Navigation systems

CO2 : Know about Gyroscopes and accelerometers and Inertial Navigation systems and its types and Mechanisation

CO3 : Explain the different Radio Navigation aids and its usage for civil and military aircrafts and satellites

CO4 : Explain the Satellite Navigation – GPS and its usage in aircraft and spacecraft applications

CO5: Deploy these skills effectively in the analysis and understanding of hybrid navigation systems and Relative navigation in a spacecraft.

Text Book(s):

1. Myron Kyton, Walfred Fried, 'Avionics Navigation Systems', John Wiley & Sons,2 edition,1997.

2. Nagaraja, N.S. "Elements of Electronic Navigation", Tata McGraw-Hill Pub. Co., New Delhi, 2nd edition, 1975.

Reference Books:

1. George M Siouris, 'Aerospace Avionics System; A Modern Synthesis', Academic Press Inc., 1993.

2. Albert Helfrick, 'Practical Aircraft Electronic Systems', Prentice Hall Education, Career & Technology, 1995.

3. Albert D. Helfrick, 'Modern Aviation Electronics', Second Edition, Prentice Hall Career & Technology, 1994.

4. Paul. D. Groves. 'Principles of GNSS, Inertial, and Multisensor Integrated Navigation Systems', Artech House, 2013.

5. Maxwell Noton, "Spacecraft navigation and guidance", Springer (London, New York), 1998

22PEC27	REMOTE SENSING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

Course Content:

UNIT I REMOTE SENSING AND ELECTROMAGNETIC RADIATION **9**

Definition – components of RS – History of Remote Sensing – Merits and demerits of Data Collation between conventional and remote sensing methods - Electromagnetic Spectrum – Radiation principles - Wave theory, Planck‘s law, Wien’s Displacement Law, Stefan’s Boltzmann law, Kirchoff‘s law – Radiation sources: active & passive – Radiation Quantities.

UNIT II EMR INTERACTION WITH ATMOSPHERE AND EARTH MATERIAL **9**

Standard atmospheric profile – main atmospheric regions and its characteristics – interaction of radiation with atmosphere – Scattering, absorption and refraction – Atmospheric windows – Energy balance equation – Specular and diffuse reflectors – Spectral reflectance & emittance– Spectroradiometer – Spectral Signature concepts – Typical spectral reflectance curves for vegetation, soil and water – solid surface scattering in microwave region.

UNIT III ORBITS AND PLATFORMS **9**

Motions of planets and satellites – Newton ‘s law of gravitation – Gravitational field and potential - Escape velocity - Kepler ‘s law of planetary motion - Orbit elements and types – Orbital perturbations and maneuvers – Types of remote sensing platforms - Ground based, Air borne platforms and Space borne platforms – Classification of satellites – Sun synchronous and Geosynchronous satellites – Legrange Orbit

UNIT IV SENSING TECHNIQUES **9**

Classification of remote sensors – Resolution concept: spatial, spectral, radiometric and temporal resolutions - Scanners - Along and across track scanners – Optical-infrared sensors – Thermal sensors – microwave sensors – Calibration of sensors – High Resolution Sensors - LIDAR, UAV – Orbital and sensor characteristics of live Indian earth observation satellites.

UNIT V DATA PRODUCTS AND INTERPRETATION **9**

Photographic and digital products – Types, levels and open-source satellite data products – selection and procurement of data – Visual interpretation: basic elements and interpretation keys - Digital interpretation – Concepts of Image rectification, Image enhancement and Image classification.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

CO1: To understand the principles of electromagnetic radiation.
CO2: To learn the atmospheric radiation interactions.
CO3: To study the laws of planetary motion.
CO4: To classify the different types of resolution.
CO5: To know the concepts of digital interpretation.

Text Book(s):

1. Thomas M. Lillesand, Ralph W. Kieferand Jonathan W. Chipman, Remote Sensing and Image interpretation, John Wiley and Sons, Inc., New York, 2015.

2. George Joseph and C Jeganathan, Fundamentals of Remote Sensing, Third Edition Universities Press (India) Private limited, Hyderabad, 2018.

Reference Books:

1. Stanley A Morain; Amelia M Budge; Michael S Renslow. Manual of Remote Sensing. Vol. I, American Society for Photogrammetry and Remote Sensing, Virginia, USA,2019, 4th edition

2. Verbyla, David, Satellite Remote Sensing of Natural Resources. CRC Press,2022 first edition.

3. Paul Curran P. J. Principles of Remote Sensing Longman, RLBS, 1996.

4. Introduction to Physics and Techniques of Remote Sensing, Charles Elachi and Jacob Van Zyl, 2021 Edition3, Wiley Publication.

5. BasudebBhatta, Remote Sensing and GIS, Oxford University Press, 2020 third edition.

22PEC28	ROCKETRY AND SPACE MECHANICS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.This course presents the fundamental aspects of rocket motion along with detailed estimation of rocket trajectories.

2.This course also imparts knowledge on optimization of multistage rockets.

3.This course provides the basics of space mechanics required for an aeronautical student

4.This course helps students to provide with the basics of orbit transfer of satellites.

5.This course will help students to gain knowledge on various control methods of rockets.

Course Content:

UNIT I ORBITAL MECHANICS 9

Description of solar system – Kepler's Laws of planetary motion – Newton's Law of Universal gravitation – Two body and Three-body problems – Jacobi's Integral, Librations points – Estimation of orbital and escape velocities.

UNIT II SATELLITE DYNAMICS 9

Geosynchronous and geostationary satellites- factors determining life time of satellites – satellite perturbations – orbit transfer and examples –Hohmann orbits – calculation of orbit parameters– Determination of satellite rectangular coordinates from orbital elements.

UNIT III ROCKET MOTION 9

Principle of operation of rocket motor – thrust equation – one dimensional and two dimensional rocket motions in free space and homogeneous gravitational fields – Description of vertical, inclined and gravity turn trajectories – determinations of range and altitude – simple approximations to burnout velocity.

UNIT IV ROCKET AERODYNAMICS 9

Description of various loads experienced by a rocket passing through atmosphere – drag estimation – wave drag, skin friction drag, form drag and base pressure drag – Boat-tailing in missiles – performance at various altitudes – rocket stability – rocket dispersion – launching problems.

UNIT V STAGING AND CONTROL OF ROCKET VEHICLES 9

Need for multi staging of rocket vehicles – multistage vehicle optimization – stage separation dynamics and separation techniques- aerodynamic and jet control methods of rocket vehicles – SITVC.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: To knowledge on the fundamental laws of orbital mechanics with particular emphasis

on interplanetary trajectories.
CO2: To calculate orbital parameters and perform conceptual trajectory designs for geocentric or interplanetary missions.
CO3: To familiarize themselves with trajectory calculations for planar motion of rockets.
CO4: To determine forces and moments acting on airframe of a missile.
CO5: To acquire knowledge on the need for staging and stage separation dynamics of rocket vehicles.

Text Book(s):

1. Cornelisse,JW, "Rocket Propulsion and Space Dynamics", J.W. Freeman & Co., Ltd., London, 1982.
2. Parker,ER, "Materials for Missiles and Spacecraft", McGraw-Hill Book Co., Inc., 1982.

Reference Books:

1. Suresh. B N & Sivan. K, "Integrated Design for Space Transportation System", Springer India, 2015.
2. Sutton,GP, "Rocket Propulsion Elements", John Wiley & Sons Inc., New York, 8th Edition, 2010.
3. Van de Kamp, "Elements of Astromechanics", Pitman Publishing Co., Ltd., London, 1980.

22PEC29	MEMS and Applications	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1.To understand the operation of major classes of MEMS devices and systems
2.To understand the fundamentals of standard micro fabrication techniques and processes
3.To understand the unique demands, environments and applications of MEMS devices

Course Content:

UNIT I INTRODUCTION TO MICROSYSTEMS **9**

Overview of MEMS and Microsystems technology - Characteristics of MEMS materials - Laws of scaling - Multi-disciplinary nature of MEMS - Survey of materials central to micro engineering - Applications of MEMS in various industries - RF MEMS, BioMEMS, MOEMS, NEMS.

UNIT II MICRO SENSORS AND ACTUATORS **9**

Working principle of Microsystems - micro actuation techniques - micro sensors - types - micro actuators - types - micropump - micromotors - microvalves - microgrippers - micro accelerometers.

UNIT III FABRICATION PROCESS **9**

Substrates - single crystal silicon wafer formation - Photolithography - Ion implantation - Diffusion - Oxidation - CVD - Physical vapor deposition - Deposition epitaxy - etching process.

UNIT IV MICROMACHINING **9**

Overview of micro manufacturing - Bulk micro manufacturing, Surface micro machining, LIGA - SLIGA- Micro system packaging materials - die level - device level - system level - packaging techniques – die preparation - surface bonding - wire bonding - sealing.

UNIT V MICROSYSTEMS DESIGN AND PACKAGING **9**

Design considerations - Mechanical Design, Process design, Realization of MEMS components – Micro system packaging technologies - Assembly of Microsystems - Reliability in MEMS.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Illustrate the operation of micro devices, micro systems and their applications
2. Design the micro devices, micro systems using the MEMS fabrication process
3. Analyze typical materials used for fabrication of micro systems
4. Apply the principles of standard micro fabrication techniques in manufacturing.

5. Analyze the challenges in the design and fabrication of Micro systems.

Text Book(s):

1.

Reference Books:

1. Chang Liu, Foundations of MEMS, Pearson, 2012.
2. Tai-Ran Hsu, MEMS and Microsystems Design and Manufacture, TMH, 2002.
3. Chang C Y and Sze S. M., VLSI Technology, McGraw-Hill, New York, 2000.
4. Stephen D. Senturia, Microsystem design, Springer (India), 2006.
5. Mark Madou, Fundamentals of Micro fabrication, CRC Press, New York, 1997.
6. Julian W Gardner, Microsensors: Principles and Applications, John Wiley & Sons, 1994.

22PEC30	BIOMEDICAL INSTRUMENTATION	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To understand the origin of various biological signals and electrode configurations specific to bio-potential measurements.
2. To understand the characteristics of Bio signals.
3. To understand the design of bioamplifiers
4. To explain the different techniques used for measurement of non-electrical bioparameters
5. To explain the biochemical measurement techniques as applicable for diagnosis and treatment.

Course Content:

UNIT I ELECTRODE CONFIGURATIONS 9

Bio signals characteristics – Origin of bio potential and its propagation. Frequency and amplitude ranges. Electrode configurations: Electrode-electrolyte interface, electrode–skin interface impedance, polarization effects of electrode – non-polarizable electrodes. Unipolar and bipolar configuration, classification of electrodes.

UNIT II BIOSIGNAL CHARACTERISTICS 9

Bio signals characteristics – ECG-frequency and amplitude ranges – Einthoven's triangle, standard 12 lead system. EEG - EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode. EMG - Electrode configuration -unipolar and bipolar mode.

UNIT III BIOAMPLIFIERS 9

Need for bio-amplifier - Differential bio-amplifier – Single ended amplifier - Band pass filtering, isolation amplifiers – transformer and optical isolation - isolated DC amplifier and AC carrier amplifier. Chopper amplifier. Power line interference

UNIT IV MEASUREMENT OF BIO SIGNALS 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure - indirect methods: auscultatory method, oscillometric method, direct methods: electronic manometer, Pressure amplifiers - systolic, diastolic, mean detector circuit. Blood flow and cardiac output measurement: Indicator dilution, thermal dilution and dye dilution method, Electromagnetic and ultrasound blood flow measurements

UNIT V BIOCHEMICAL MEASUREMENTS 9

Biochemical sensors - pH, pO2 and pCO2, Ion selective Field effect Transistor (ISFET), Immunologically sensitive FET (IMFET), Blood glucose sensors. Blood gas analyzers, colorimeter, flame photometer, spectrophotometer, blood cell counter, auto analyzer.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to
CO1: Illustrate the origin of various biological signals and their characteristics.
CO2: Gain knowledge on characteristics of bio signals.
CO3: Gain knowledge on various amplifiers involved in monitoring and transmission of biosignals.
CO4: Explain the different measurement techniques for non-electrical bio-parameters
CO5: Explain the biochemical measurement techniques as applicable for diagnosis and further treatment.

Text Book(s):

1. Leslie Cromwell, "Biomedical Instrumentation and measurement", 2nd edition, Prentice hall of India, New Delhi, 2015.
2. John G. Webster, "Medical Instrumentation Application and Design", 4th edition, Wiley India Pvt Ltd, New Delhi, 2015.
3. Khandpur R.S, "Handbook of Biomedical Instrumentation", Tata McGraw Hill, New Delhi,2003.

Reference Books:

1.John Enderle, Susan Blanchard, Joseph Bronzino, "Introduction to Biomedical Engineering", second edition, Academic Press,2005.
2. Joseph J. Carr and John M. Brown, "Introduction to Biomedical Equipment Technology", Pearson Education, 2004.

22OCS03	CLOUDCOMPUTING	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. Tounderstandtheconceptofcloudcomputing.
2. Toappreciate theevolutionofcloudfromtheexisting technologies.
3. To haveknowledgeon thevariousissuesincloudcomputing.
4. Tobefamiliarwiththeleadplayersincloud.
5. To appreciate theemergenceofcloudasthe nextgenerationcomputingparadigm.

Course Content:

UNIT I INTRODUCTION **9**

IntroductiontoCloudComputing–DefinitionofCloud–EvolutionofCloudComputing–Underlying Principles of Parallel and Distributed Computing – Cloud Characteristics – Elasticity inCloud– On-demandProvisioning

UNIT II CLOUD ENABLINGTECHNOLOGIES **9**

ServiceOriented Architecture–REST andSystems ofSystems– WebServices –Publish-Subscribe Model – Basics of Virtualization – Types of Virtualization – Implementation Levels ofVirtualization–VirtualizationStructures–ToolsandMechanisms–VirtualizationofCPU– Memory –I/ODevices–VirtualizationSupportandDisasterRecovery.

UNIT III CLOUDARCHITECTURE,SERVICESANDSTORAGE **9**

Layered Cloud Architecture Design – NIST Cloud Computing Reference Architecture – Public,Private and Hybrid Clouds - laaS – PaaS – SaaS – Architectural Design Challenges – CloudStorage–Storage-as-a-Service–AdvantagesofCloudStorage–CloudStorageProviders–S3.

UNIT IV RESOURCEMANAGEMENTANDSECURITYINCLOUD **9**

InterCloudResourceManagement–ResourceProvisioningandResourceProvisioningMethods– Global Exchange of Cloud Resources – Security Overview – Cloud Security Challenges –Software-as-a-ServiceSecurity–SecurityGovernance–VirtualMachineSecurity–IAM–Security Standards

UNIT V CLOUD TECHNOLOGIESANDADVANCEMENTS **9**

Hadoop– MapReduce – Virtual Box -- Google App Engine – Programming Environment forGoogle App Engine –– Open Stack –Federation in the Cloud – Four Levels of Federation – FederatedServicesandApplications –FutureofFederation

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Articulatethemainconcepts,keytechnologies,strengthsandlimitationsofcloudc omputing.
2. Learn thekeyandenablingtechnologiesthathelpinthedevelopmentofcloud.
3. Developtheabilitytounderstandandusethearchitectureofcomputeandstorage cloud,serviceanddeliverymodels.
4. Explain thecoreissuesofcloud computingsuchasresource managementand security.
5. Beable to installand use currentcloudtechnologies.
6. Evaluateandchoosetheappropriatetechnologies,algorithmsandapproachesforimple mentationanduseofcloud

Text Book(s):

1. KaiHwang,GeoffreyC.Fox,JackG.Dongarra,"DistributedandCloudComputing,Fro mParallelProcessingtotheInternetofThings",MorganKaufmannPublishers, 2012.
2. Rittinghouse,JohnW.,andJamesF.Ransome, “CloudComputing:Implementation,ManagementandSecurity”,CRC Press,2017

Reference Books:

1. RajkumarBuyya,ChristianVecchiola,S.ThamaraiSelvi,“MasteringCloudComputin g”,TataMcgrawHill,2013.
2. TobyVelte,AnthonyVelte,RobertElsenpeter,"CloudComputing-APracticalApproach”,TataMcgrawHill,2009.
3. GeorgeReese,"CloudApplicationArchitectures:BuildingApplicationsandInfrastructurei ntheCloud: TransactionalSystemsforEC2andBeyond(Theory inPractice)”,O'Reilly,2009.

22OEC04	DIGITAL MARKETING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. The primary objective of this module is to examine and explore the role and importance of digital marketing in today's rapidly changing business environment.
2. It also focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.

Course Content:

UNIT I INTRODUCTION TO ONLINE MARKET 9

Online Market space- Digital Marketing Strategy- Components - Opportunities for building Brand Website - Planning and Creation - Content Marketing.

UNIT II SEARCH ENGINE OPTIMISATION 9

Search Engine optimisation - Keyword Strategy- SEO Strategy - SEO success factors -On-Page Techniques - Off-Page Techniques. Search Engine Marketing- How Search Engine works- SEM components- PPC advertising -Display Advertisement

UNIT III E- MAIL MARKETING 9

E- Mail Marketing - Types of E- Mail Marketing - Email Automation - Lead Generation - Integrating Email with Social Media and Mobile- Measuring and maximizing email campaign effectiveness. Mobile Marketing- Mobile Inventory/channels- Location based; Context based; Coupons and offers, Mobile Apps, Mobile Commerce, SMS Campaigns-Profiling and targeting

UNIT IV SOCIAL MEDIA MARKETING 9

Social Media Marketing - Social Media Channels- Leveraging Social media for brand conversations and buzz. Successful /benchmark Social media campaigns. Engagement Marketing- Building Customer relationships - Creating Loyalty drivers - Influencer Marketing.

UNIT V DIGITAL TRANSFORMATION 9

Digital Transformation & Channel Attribution- Analytics- Ad-words, Email, Mobile, Social Media, Web Analytics - Changing your strategy based on analysis- Recent trends in Digital marketing.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to
CO1: To examine and explore the role and importance of digital marketing in today's rapidly changing business environment..
CO2: To focuses on how digital marketing can be utilized by organizations and how its effectiveness can be measured.
CO3: To know the key elements of a digital marketing strategy.
CO4: To study how the effectiveness of a digital marketing campaign can be measured
CO5:To demonstrate advanced practical skills in common digital marketing tools such as SEO, SEM, Social media and Blogs.

Text Book(s):

1.Fundamentals of Digital Marketing by Puneet Singh Bhatia;Publisher: Pearson Education;
2. First edition (July 2017);ISBN-10: 933258737X;ISBN-13: 978-9332587373.
3. Digital Marketing by Vandana Ahuja ;Publisher: Oxford University Press (April 2015). ISBN-10: 0199455449

Reference Books:

1. Marketing 4.0: Moving from Traditional to Digital by Philip Kotler;Publisher: Wiley; 1st edition (April 2017); ISBN10: 9788126566938;ISBN 13: 9788126566938;ASIN: 8126566930.
2. Ryan, D. (2014). Understanding Digital Marketing: Marketing Strategies for Engaging the Digital Generation, Kogan Page Limited..
3. Barker, Barker, Bormann and Neher(2017), Social Media Marketing: A Strategic Approach, 2E South-Western ,Cengage Learning.
4. Pulizzi,J Beginner's Guide to Digital Marketing , Mcgraw Hill Education

22OAG04	**Disaster Management**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-requisite Nil **Syllabus Version** V0.1

Course Objectives:

1.To provide students an exposure to disasters, their significance and types.
2.To ensure that students begin to under and the relationship between vulnerability, disasters,disaster prevention and risk reduction
3.To gain a preliminary under standing of approaches of Disaster Risk Reduction(DRR)
4.To enhance awareness of institutional processes in the country.
5.To develop rudimentary ability to respond to their surroundings with potential disaster response in areas where they live,with due sensitivity

CourseContent:

UNITI INTRODUCTIONTO DISASTERS **9**

Definition: Disaster, Hazard, Vulnerability, Resilience, Risks – Disasters: Types of disasters – Earthquake, Landslide, Flood, Drought, Fire etc - Classification, Causes, Impacts including social,economic,political,environmental,health,psychosocial,etc.-Differentialimpacts-intermsof caste, class, gender, age, location, disability - Global trends in disasters: urban disasters,pandemics, complex emergencies, Climate change- Dos and Don''tsduring various types of Disasters

UNIT II APPROACHES TO DISASTER RISK REDUCTION(DRR) **9**

Disaster cycle - Phases, Culture of safety, prevention, mitigation and preparednesscommunity basedDRR,Structural-nonstructuralmeasures,Rolesandresponsibilitiesof-community,Panchayati RajInstitutions/Urban LocalBodies(PRIs/ULBs),States, Centre,andotherstake-holders- Institutional Processes and Framework at State and Central Level- StateDisaster Management Authority(SDMA) – Early Warning System – Advisories from AppropriateAgencies.

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

Factors affecting Vulnerabilities, differential impacts, impact of Development projects such asdams, embankments, changes in Land-use etc.- Climate Change Adaptation- IPCC Scenario andScenarios in the context of India - Relevance of indigenous knowledge, appropriate technologyandlocal resources.

UNITIV DISASTER RISK MANAGEMENT IN INDIA **9**

HazardandVulnerabilityprofileofIndia,ComponentsofDisasterRelief:Water,Food,Sanitation,Shelter, Health, Waste Management, Institutional arrangements (Mitigation, Response andPreparedness, Disaster Management Act and Policy - Other related policies, plans, programsandlegislation– RoleofGISandInformationTechnologyComponentsinPreparedness,Risk Assessment,ResponseandRecovery PhasesofDisaster–DisasterDamageAssessment

UNITV DISASTER MANAGEMENT: APPLICATIONS AND CASESTUDIES AND FIELD WORKS **9**

LandslideHazardZonation:CaseStudies,EarthquakeVulnerabilityAssessmentofBuildingsandInfrastructure: Case Studies, Drought Assessment: Case Studies, Coastal Flooding: Storm SurgeAssessment, Floods: Fluvial and Pluvial Flooding: Case Studies; Forest Fire: Case Studies, ManMadedisasters:CaseStudies,SpaceBasedInputsforDisasterMitigationandManagementandfieldworks relatedtodisastermanagement.

TOTAL LECTURE PERIODS **45Periods**

ExpectedCourseOutcome: Oncompletionofthecourse,thestudentisexpectedto

CO1: Toimpartknowledgeontheconceptsof Disaster,VulnerabilityandDisasterRiskreduction(DRR)

CO2: ToenhanceunderstandingonHazards,VulnerabilityandDisasterRiskAssessment preventionandriskreduction

CO3: Todevelopdisasterresponseskillsbyadoptingrelevanttoolsandtechnology

CO4: Enhanceawarenessof institutionalprocessesforDisasterresponseinthecountryand

CO5: Develop rudimentary ability to respond to their surroundings with potentialDisasterresponse inareaswherethey live,withdue sensitivity

TextBook(s):

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427ISBN-13:978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill IndiaEducationPvt.Ltd.,2012.ISBN-10:1259007367, ISBN-13:978-1259007361]
3. GuptaAnilK,SreejaS.Nair.EnvironmentalKnowledgeforDisasterRiskManagement, NIDM,NewDelhi,2011
4. KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and SagePublishers,NewDelhi,2010.

ReferenceBooks:

1. Govt.ofIndia:DisasterManagement Act,Government ofIndia,NewDelhi,2005
2. GovernmentofIndia,NationalDisasterManagementPolicy,2009.

WebLinks:

1. https://www.iare.ac.in/sites/default/files/lecture_notes/dm%20notes.pdf
2. https://agrimoon.com/wp-content/uploads/Environmental-Studies.pdf
3. http://ecoursesonline.iasri.res.in/course/view.php?id=207

220CS15	DISTRIBUTED COMPUTING	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce the computation and communication models of distributed systems
2. To illustrate the issues of synchronization and collection of information in distributed systems
3. To describe distributed mutual exclusion and distributed deadlock detection techniques
4. To elucidate agreement protocols and fault tolerance mechanisms in distributed systems
5. To explain the cloud computing models and the underlying concepts

Course Content:

UNITI INTRODUCTION **9**

Introduction: Definition-Relation to Computer System Components – Motivation – Message - Passing Systems versus Shared Memory Systems – Primitives for Distributed Communication Synchronous versus Asynchronous Executions – Design Issues and Challenges; A Model of Distributed Computations: A Distributed Program – A Model of Distributed Executions – Models ofCommunication Networks – Global State of a Distributed System

UNIT II LOGICAL TIME AND GLOBAL STATE **9**

Logical Time: Physical Clock Synchronization: NTP – A Framework for a System of Logical Clocks– Scalar Time – Vector Time; Message Ordering and Group Communication: Message Ordering Paradigms – Asynchronous Execution with Synchronous Communication –

Synchronous Program Order on Asynchronous System – Group Communication – Causal Order – Total Order; GlobalState and Snapshot Recording Algorithms: Introduction – System Model and Definitions – Snapshot Algorithms for FIFO Channels

UNIT III DISTRIBUTED MUTEX AND DEADLOCK 9

Distributed Mutual exclusion Algorithms: Introduction – Preliminaries – Lamport's algorithm – Ricart- Agrawala's Algorithm –– Token-Based Algorithms – Suzuki-Kasami's Broadcast Algorithm; Deadlock Detection in Distributed Systems: Introduction – System Model – Preliminaries – Models of Deadlocks – Chandy-Misra-Haas Algorithm for the AND model and OR Model

UNIT IV CONSENSUS AND RECOVERY 9

Consensus and Agreement Algorithms: Problem Definition – Overview of Results – Agreement in a Failure-Free System(Synchronous and Asynchronous) – Agreement in Synchronous Systems with Failures; Checkpointing and Rollback Recovery: Introduction – Background and Definitions – Issues in Failure Recovery – Checkpoint-based Recovery – Coordinated Checkpointing Algorithm -- Algorithm for Asynchronous Checkpointing and Recovery

UNIT V CLOUD COMPUTING 9

Definition of Cloud Computing – Characteristics of Cloud – Cloud Deployment Models – Cloud Service Models – Driving Factors and Challenges of Cloud – Virtualization – Load Balancing –Scalability and Elasticity – Replication – Monitoring – Cloud Services and Platforms: Compute Services – Storage Services – Application Services

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the foundations of distributed systems
2. Solve synchronization and state consistency problems
3. Use resource sharing techniques in distributed systems
4. Apply working model of consensus and reliability of distributed systems
5. Explain the fundamentals of cloud computing

Text Book(s):

1. Kshemkalyani Ajay D, Mukesh Singhal, "Distributed Computing: Principles, Algorithms and Systems", Cambridge Press, 2011. Mukesh Singhal, Niranjan G Shivaratri, "Advanced Concepts in Operating systems", Mc-Graw Hill Publishers, 1994.

Reference Books:

1. George Coulouris, Jean Dollimore, Time Kindberg, "Distributed Systems Concepts and Design", Fifth Edition, Pearson Education, 2012.
2. Pradeep L Sinha, "Distributed Operating Systems: Concepts and Design", Prentice Hall of India, 2007.
3. Tanenbaum A S, Van Steen M, "Distributed Systems: Principles and Paradigms", Pearson Education, 2007.4. Liu M L, "Distributed Computing: Principles and Applications", Pearson Education, 2004.

4. Nancy A Lynch, "Distributed Algorithms", Morgan Kaufman Publishers, 2003.
5. Arshdeep Bagga, Vijay Madisetti, " Cloud Computing: A Hands-On Approach", Universities Press, 2014

22OEC06	**E- VEHICLE**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Syllabus Version V 0.1

Course Objectives:

1. To provide knowledge about electric machines and special machine
2. To understand the basics of power converters
3. To know the concepts of controlling DC and AC drive systems
4. To understand the architecture and power train components.
5. To impart knowledge on vehicle control for standard drive cycles of hybrid electrical vehicles (HEVs)

Course Content:

UNIT I ROTATING POWER CONVERTERS 9

. Magnetic circuits- DC machine and AC machine –Working principle of Generator and Motor- DC and AC - Voltage and torque equations – Characteristics and applications. Working principle of special machines like: Brushless DC motor, Switched reluctance motor and PMSM.

UNIT II STATIC POWER CONVERTERS 9

Working and Characteristics of Power Diodes, MOSFET and IGBT. Working of uncontrolled rectifiers, controlled rectifiers (Single phase and Three phase), DC choppers, single and three phase inverters, Multilevel inverters and Matrix Converters.

UNIT III CONTROL OF DC AND AC MOTOR DRIVES 9

Speed control for constant torque, constant HP operation of all electric motors - DC/DC chopper based four quadrant operation of DC motor drives, inverter based V/f Operation (motoring and braking) of induction motor drives, Transformation theory, vector control operation of Induction motor and PMSM, Brushless DC motor drives, Switched reluctance motor (SRM) drives

UNIT IV HYBRID ELECTRIC VEHICLE ARCHITECTURE AND POWER TRAIN COMPONENTS 9

History of evolution of Electric Vehicles - Comparison of Electric Vehicles with Internal Combustion Engines - Architecture of Electric Vehicles (EV) and Hybrid Electric Vehicles (HEV) – Plug-in Hybrid Electric Vehicles (PHEV)- Power train components and sizing, Gears, Clutches, Transmission and Brakes.

UNIT V MECHANICS OF HYBRID ELECTRIC VEHICLES AND CONTROL OF VEHICLES 9

Fundamentals of vehicle mechanics - tractive force, power and energy requirements for standard drive cycles of HEV's - motor torque and power rating and battery capacity. HEV supervisory control - Selection of modes - power spilt mode - parallel mode - engine brake mode - regeneration mode - series parallel mode

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to
CO1: Able to understand the principles of conventional and special electrical machines.
CO2: Acquired the concepts of power devices and power converters
CO3: Able to understand the control for DC and AC drive systems.
CO4: Learned the electric vehicle architecture and power train components.
CO5: Acquired the knowledge of mechanics of electric vehicles and control of electric vehicles.

Text Book(s):

1. Stephen D. Umans, "Fitzgerald & Kingsley's Electric Machinery", Tata McGraw Hill, 7th Edition, 2020.
2. Paul C. Krause, Oleg Wasynczuk, Scott D. Sudhoff, Steven D. Pekarek "Analysis of Electric Machinery and Drive Systems", 3rd Edition, Wiley-IEEE Press, 2013.

Reference Books:

1. Bogdan M. Wilamowski, J. David Irwin, The Industrial Electronics Handbook, Second Edition, Power Electronics and Motor Drives, CRC Press, 2011.
2. Rashid M.H., "Power Electronics Circuits, Devices and Applications ", Pearson, fourth Edition, 10th Impression 2021.
3. Iqbal Husain, 'Electric and Hybrid Electric Vehicles', CRC Press, 2021.
4. Wei Liu, 'Hybrid Electric Vehicle System Modeling and Control', Second Edition, WILEY, 2017
5. James Larminie and John Lowry, 'Electric Vehicle Technology Explained', Second Edition, Wiley, 2012

22OAG05	**ENERGYCONSERVATION AND MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-requisite Nil **SyllabusVersion** V0.1

CourseObjectives:

1. Understand and analyses the energy data of industries
2. Carry out energy accounting and balancing
3. Conduct energy audit and suggest methodologies for energy savings and utilizethe availableresourcesinoptimalways

CourseContent:

UNITI INTRODUCTION **9**

Energy - Power – Past & Present scenario of World; National Energy consumption Data – Environmental aspects associated with energy utilization – Energy Auditing: Need, Types,MethodologyandBarriers.Roleof EnergyManagers.Instrumentsforenergyauditing.

UNIT II ELECTRICALSYSTEMS **9**

Components of EB billing – HT and LT supply, Transformers, Cable Sizing, Concept ofCapacitors, Power Factor Improvement, Harmonics, Electric Motors - Motor EfficiencyComputation, Energy Efficient Motors, Illumination – Lux, Lumens, Types of lighting,Efficacy,LEDLightingandscopeof EnconinIllumination.

UNIT III THERMALSYSTEMS **9**

Stoichiometry, Boilers, Furnaces and Thermic Fluid Heaters – Efficiency computation andencon measures. Steam: Distribution &U sage: Steam Traps, Condensate Recovery, FlashSteam Utilization, Insulators &Refractories

UNITIV ENERGYCONSERVATIONINMAJORUTILITIES **9**

Pumps,Fans,Blowers,CompressedAirSystems,RefrigerationandAirConditioningSystems –CoolingTowers –D.G.sets

UNITV ECONOMICS **9**

Energy Economics – Discount Rate, Payback Period, Internal Rate of Return, Net PresentValue,LifeCycleCosting–ESCOconcept

TOTALLECTUREPERIODS **45Periods**

ExpectedCourseOutcome: Oncompletionofthecourse,thestudentisexpectedto

1. Remember the knowledge for Basic combustion and furnace design and selection of thermal andmechanicalenergy equipment.
2. StudytheImportanceofStoichiometryrelations,Theoreticalairrequiredforcompletecombustion.
3. Skillsoncombustionthermodynamicsandkinetics.
4. Applycalculationanddesigntubestillheaters.
5. Studieddifferentheattreatmentfurnace.

6.Practicalandtheoreticalknowledge burner design.

TextBook(s):

1.EnergyManagerTrainingManual(4Volumes)availableatwww.energymanagertraining.com. websiteadministeredbyBureauofEnergyEfficiency(BEE),astatutorybodyunderMinistryofPower,GovernmentofIndia,2004.

ReferenceBooks:

1. Witte.L.C.,P.S.Schmidt,D.R.Brown,"IndustrialEnergyManagementandUtilisation"Hemisphere Publ,Washington, 1988.
2. Callaghn,P.W."DesignandManagementforEnergyConservation",PergamonPress,Oxford, 1981.
3. Dryden.I.G.C.,"TheEfficientUseofEnergy"Butterworths,London,1982
4. Turner.W.C.,"EnergyManagementHandbook",Wiley,NewYork,1982.
5. Murphy.W.R.andG.McKAY,"EnergyManagement",Butterworths,London1987

WebLinks:

1. https://www.allaboutcircuits.com/
2. https://www.electrical4u.com/
3. https://www.vlab.co.in/
4. https://electronics.wisc-online.com/
5. https://demonstrations.wolfram.com/topics.php?EngineeringTechnology#7

22OEC10	ENGINEERING ECONOMICS AND FINANCIAL ACCOUNTING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Understanding the concept of Engineering Economics.
2. Implement various micro economics concept in real life.
3. Gaining knowledge in the field of macro economics to enable the students to have better
4. Understanding of various components of macro economics.
5. Understanding the different procedures of pricing.
6. Learn the various cost related concepts in micro economics.

Course Content:

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 LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected 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 Book(s):

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.

Reference Books:

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

22OEC11	FIRE SAFETY ENGINEERING	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To enable the students to acquire knowledge of Fire and Safety Studies
2. To learn about the effect of fire on materials used for construction, the method of test for non combustibility & fire resistance
3. To learn about fire area, fire stopped areas and different types of fire-resistant doors
4. To learn about the method of fire protection of structural members and their repair due to fire damage.
5. To develop safety professionals for both technical and management through systematic and quality-based study programmes

Course Content:

UNIT I INHERENT SAFETY CONCEPTS 9

. Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings. Effect of temperature on the properties of structural materials concrete, steel, masonry and wood; Behavior of non-structural materials on fire- plastics, glass, textile fibres and other house hold materials.

UNIT II PLANT LOCATIONS 9

Compartment temperature-time response at pre-flashover and post flashover periods; Equivalence of fire severity of compartment fire and furnace fire; Fire resistance test on structural elements standard heating condition, Indian standard test method, performance criteria.

UNIT III WORKING CONDITIONS 9

Fire separation between building- principle of calculation of safe distance. Design principles of fire resistant walls and ceilings; Fire resistant screens- solid screens and water curtains; Local barriers; Fire stopped areas-in roof, in fire areas and in connecting structures; Fire doors- Low combustible, Non-combustible and Spark-proof doors; method of suspension of fire doors; Air-tight sealing of doors;

UNIT IV FIRE SEVERITY AND REPAIR TECHNIQUES 9

Fabricated fire proof boards-calcium silicate, Gypsum, Vermiculite, and Perlite boards; Fire protection of structural elements - Wooden, Steel and RCC... Reparability of fire damaged structures- Assessment of damage to concrete, steel, masonry and timber structures, Repair techniques- repair methods to reinforced concrete Columns, beams and slabs, Repair to steel structural members, Repair to masonry structures.

UNIT V WORKING AT HEIGHTS 9

Safe Access - Requirement for Safe Work Platforms- Stairways - Gangways and Ramps-Fall Prevention & Fall Protection - Safety Belts - Safety nets - Fall Arrestors- Working on Fragile Roofs - Work Permit Systems-Accident Case Studies.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Understand the effect of fire on materials used for construction

CO2: Understand the method of test for non-combustibility and fire resistance; and will be able to select different structural elements and their dimensions for a particular fire resistance rating of a building.

CO3: To understand the design concept of fire walls, fire screens, local barriers and fire doors and able to select them appropriately to prevent fire spread.

CO4: To decide the method of fire protection to RCC, steel, and wooden structural elements and their repair methods if damaged due to fire.

CO5: Describe the safety techniques and improve the analytical and intelligence to take the right decision at right time.

Text Book(s):

1. Roytman, M. Y,"Principles of fire safety standards for building construction". Amerind Publishing Co. Pvt. Ltd., New Delhi,1975
2. John A. Purkiss,"Fire safety engineering design of structures" (2nd edn.), Butterworth Heinemann, Oxford, UK, 2009.

Reference Books:

1. Smith, E.E. and Harmathy, T.Z. (Editors),"Design of buildings for fire safety". ASTMSpecial Publication 685, American Society for Testing and Materials, Boston, U.S.A,1979.
2. Butcher, E. G. and Parnell, A. C,"Designing of fire safety". JohnWiley and Sons Ltd., New York, U.S.A.1983.
3. Jain, V.K,"Fire safety in buildings" (2nd edn.). New Age International (P) Ltd., New Delhi, 2010.
4. Hazop & Hazan,"Identifying and Assessing Process Industry Hazards", Fourth Edition ,1999
5. Frank R. Spellman, Nancy E. Whiting,"The Handbook of Safety Engineering: Principles and Applications", 2009

22OEC12	FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To understand the global trends and development methodologies of various types of products and services.
2. To conceptualize, prototype and develop product management plan for a new product based on the type of the new product and development methodology integrating the hardware, software, controls, electronics and mechanical systems
3. To understand requirement engineering and know how to collect, analyze and arrive at requirements for new product development and convert them in to design specification
4. To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
5. To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer

Course Content:

UNIT I BASICS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid

Manufacturing - System Integration, Testing, Certification and Documentation

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT **9**

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY **9**

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Tradeoffs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Define, formulate, and analyze a problem

CO2:Solve specific problems independently or as part of a team

CO3: Gain knowledge of the Innovation & Product Development process in the Business Context

CO4: Work independently as well as in teams

CO5: Manage a project from start to finish

Text Book(s):

1. Karl T Ulrich and Stephen D Eppinger, "Product Design and Development", Tata McGraw Hill, Fifth Edition, 2011.
2. John W Newstorm and Keith Davis, "Organizational Behavior", Tata McGraw Hill, Eleventh Edition, 2005.

Reference Books:

1. Hiriyappa B, “Corporate Strategy – Managing the Business”, Author House, 2013.
2. Peter F Drucker, “People and Performance”, Butterworth – Heinemann [Elsevier], Oxford, 2004.
3. Vinod Kumar Garg and Venkita Krishnan N K, “Enterprise Resource Planning – Concepts”, Second Edition, Prentice Hall, 2003.
4. Mark S Sanders and Ernest J McCormick, "Human Factors in Engineering and Design", McGraw Hill Education, Seventh Edition, 2013.

Course Code	GAME DESIGN AND DEVELOPMENT	L	T	P	C
22OCS16		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To know the basics of 2D and 3D graphics for game development.
2. To know the stages of game development.
3. To understand the basics of a game engine.
4. To survey the gaming development environment and tool kits.
5. To learn and develop simple games using Pygame environment.

Course Content:

UNIT I 3D GRAPHICS FOR GAME DESIGN 9

Genres of Games, Basics of 2D and 3D Graphics for Game Avatar, Game Components – 2D and 3D Transformations – Projections – Color Models – Illumination and Shader Models – Animation – Controller Based Animation.

UNIT II GAME DESIGN PRINCIPLES 9

Character Development, Storyboard Development for Gaming – Script Design – Script Narration, Game Balancing, Core Mechanics, Principles of Level Design – Proposals – Writing for Preproduction, Production and Post – Production.

UNIT III GAME ENGINE DESIGN 9

Rendering Concept – Software Rendering – Hardware Rendering – Spatial Sorting Algorithms – Algorithms for Game Engine– Collision Detection – Game Logic – Game AI – Pathfinding.

UNIT IV OVERVIEW OF GAMING PLATFORMS AND FRAMEWORKS 9

Pygame Game development – Unity – Unity Scripts –Mobile Gaming, Game Studio, Unity Single player and Multi-Player games

UNIT V GAME DEVELOPMENT USING PYGAME 9

Developing 2D and 3D interactive games using Pygame – Avatar Creation – 2D and 3D Graphics Programming – Incorporating music and sound – Asset Creations – Game Physics algorithms Development – Device Handling in Pygame – Overview of Isometric and Tile Based arcade Games– Puzzle Games

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the concepts of 2D and 3d Graphics
2. Design game design documents.
3. Implementation of gaming engines.
4. Survey gaming environments and frameworks.
5. Implement a simple game in Pygame.

Text Book(s):

1. Sanjay Madhav, "Game Programming Algorithms and Techniques: APlatform AgnosticApproach", Addison Wesley,2013.
2. Will McGugan, "Beginning Game Development with Python and Pygame: From Novice toProfessional", Apress,2007

Reference Books:

1. Paul Craven, "Python Arcade games", Apress Publishers,2016.
2. David H. Eberly, "3D Game Engine Design: A Practical Approach to Real-Time ComputerGraphics", Second Edition, CRC Press,2006.
3. Jung Hyun Han, "3D Graphics for Game Programming", Chapman and Hall/CRC, 2011

22OBM10	HOSPITAL MANAGEMENT	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To introduce the relevance of this course to the existing technology through demonstrations, case studies, simulations, contributions of scientist, national/international policies with a futuristic vision along with socio-economic impact and issues
2. The student should be made to understand the principles, practices and areas of application in Hospital management.

Course Content:

UNIT I OVERVIEW OF HOSPITAL ADMINISTRATION **9**

Distinction between Hospital and Industry, Challenges in Hospital Administration –Hospital Planning – Equipment Planning- AMC – Functional Planning - Current Issues in Hospital Management - Telemedicine - Bio-Medical Waste Management

UNIT II HUMAN RESOURCE MANAGEMENT IN HOSPITAL **9**

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

UNIT III MARKETING RESEARCH & CONSUMER BEHAVIOUR **9**

Marketing information systems - assessing information needs, developing & disseminating information - Market Research process - Other market research considerations - Consumer Markets & Consumer Buyer behaviour - Model of consumer behaviour - Types of buying decision behaviour - The buyer decision process - Model of business buyer behaviour - Major types of buying situations - global marketing in the medical sector - WTO and its implications.

UNIT IV HOSPITAL INFORMATION SYSTEMS & SUPPORTIVE SERVICES **9**

Management Decisions and Related Information Requirement - Clinical Information Systems - Administrative Information Systems - Support Service Technical Information Systems – Medical Transcription, Medical Records Department – Central Sterilization and Supply Department – Pharmacy– Food Services - Laundry Services.

UNIT V QUALITY AND SAFETY ASPECTS IN HOSPITAL 9

Quality system – Elements, implementation of quality system, Documentation, Quality auditing, International Standards ISO 9000 – 9004 – Features of ISO 9001 – ISO 14000 – ISO 13485, Environment Management Systems. NABA, JCI, NABL, NABH. Security – Loss Prevention – Fire Safety – Alarm System – Safety Rules. Health Insurance & Managing Health Care - Medical Audit – Hazard and Safety in a hospital Setup.

TOTAL LECTURE PERIODS 45 Periods

TEXT BOOKS

1. R.C.Goyal, "Hospital Administration and Human Resource Management", PHI–4th Edition,2006.

2. G.D.Kunders, "Hospitals – Facilities Planning and Management", TMH, New Delhi – 5th edition Reprint 2007.

3. Cesar A.Caceres and Albert Zara, "The Practice of Clinical Engineering", Academic Press, New York,1977

REFERENCES

1. Peter Berman, "Health Sector Reform in Developing Countries", Harvard University Press, 1995.

2. Norman Metzger , "Handbook of Health Care Human Resources Management", Aspen Publication Inc. Rockville, Maryland, USA, 2nd Edition 1990.

3. Arnold D. Kalcizony & Stephen M.Shortell, "Health Care Management", 6th Edition, 2011.

4. Blane, David, Brunner, Eric , "Health and Social organization: Towards a health policy for the 21st century", Calrendon Press, 1994.

22OCS24	INTRODUCTION TO THEORY OF COMPUTATION	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To introduce students to the fundamental concepts and theories of computation.
2. To provide students with an understanding of formal languages and grammars.
3. To teach students how to apply automata theory and parsing algorithms.
4. To enable students to understand different computational models and advanced topics.

Course Content:

UNIT I INTRODUCTION TO THEORY OF COMPUTATION 9

Basic concepts in theory of computation-Formal languages and grammars-Regular expressions and finite automata-Context-free languages and pushdown automata-Turing machines.

UNIT II COMPUTABILITY AND COMPLEXITY 9

The Church-Turing thesis-Undecidability and the Halting problem-Time and space complexity-P and NP complexity classes-NP-complete problems.

UNIT III FORMAL LANGUAGES AND PARSING 9

Ambiguity and ambiguity resolution-Parsing algorithms-Top-down and bottom-up parsing-Context-free grammars-Chomsky hierarchy

UNIT IV COMPUTATIONAL MODELS 9

Register machines and random-access machines-Lambda calculus and functional programming-Petri nets and process algebra-Cellular automata and computational physics-Neural networks and machine learning.

UNIT V ADVANCED TOPICS 9

Complexity theory and cryptography-Quantum computing and quantum complexity-Approximation algorithms and heuristics-Formal verification-and model checking-Natural language processing and computational linguistics

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the fundamental concepts and theories of computation.
2. Apply formal languages and grammars to problem solving.
3. Apply automata theory and parsing algorithms to language processing.
4. Analyze different computational models and their applications.
5. Evaluate advanced topics in the field of theory of computation.

Text Book(s):

1. "Introduction to Automata Theory, Languages, and Computation" by John E. Hopcroft, et al.
2. "Theory of Computation: Formal Languages, Automata, and Complexity" by J. Glenn Brookshear.

Reference Books:

1. "Introduction to the Theory of Computation" by Michael Sipser
2. "Automata, Computability and Complexity: Theory and Applications" by Elaine Rich.

22OAG12	IT IN AGRICULTURAL SYSTEM	L	T	P	C
		3	0	0	3

Pre-requisite Nil **SyllabusVersion** V0.1

Course Objectives:

1. To introduce the students to area agricultural systems in which IT and computers play a major role.
2. To also expose the students to IT applications in precision farming, environmental control systems, agricultural systems management and weather prediction models.

Course Content:

UNITI PRECISION FARMING **9**

Precision agriculture and agricultural management – Ground based sensors, Remote sensing,GPS,GISand mappingsoftware,Yieldmappingsystems, Crop productionmodeling.

UNIT II ENVIRONMENT CONTROLSYSTEMS **9**

Artificial light systems, management of crop growth in greenhouses, simulation of CO2consumptioningreenhouses,on-linemeasurementofplantgrowthinthegreenhouse,modelsof plantproductionandexpertsystemsinhorticulture.

UNIT III AGRICULTURALSYSTEMSMANAGEMENT **9**

Agricultural systems - managerial overview, Reliability of agricultural systems, Simulation ofcrop growth and field operations, Optimizing the use of resources, Linear programming,Projectscheduling,Artificialintelligenceanddecisionsupportsystems.

UNITIV WEATHER PREDICTION MODELS **9**

Importance of climate variability and seasonal forecasting, Understanding and predictingworld'sclimatesystem, Globalclimatic modelsand theirpotential for seasonalclimateforecasting, Generalsystems approachtoapplying seasonalclimateforecasts.

UNITV E-GOVERNANCE IN AGRICULTURAL SYSTEMS **9**

Expertsystems,decisionsupportsystems,Agriculturalandbiologicaldatabases,e-commerce, ebusiness systems & applications, Technology enhanced learning systems andsolutions,elearning,Rural developmentandinformationsociety

TOTALLECTUREPERIODS **45Periods**

ExpectedCourseOutcome: Oncompletionofthecourse,thestudentisexpectedto

1. The students shall be able to understand the applications of IT in remote sensing applicationssuchas Dronesetc.
2. Thestudentswillbe ableto getaclear understandingofhowagreenhousecanbeautomatedanditsadvantages.
3. Thestudentswillbe ableto apply ITprinciplesandconceptsformanagementoffieldoperations.
4. Thestudentswillgetanunderstandingaboutweathermodels,theirinputs andapplications.

5.Thestudentswillgetanunderstandingofhow ITcanbeusedfore-governanceinagriculture Practicalandtheoreticalknowledge burner design.

TextBook(s):

1. NationalResearchCouncil,"PrecisionAgricultureinthe21stCentury",NationalAcademiesPre ss, Canada, 1997.
2. H.Krug,Liebig,H.P."InternationalSymposiumonModelsforPlantGrowth,EnvironmentalCo ntroland FarmManagement inProtected Cultivation",1989.

ReferenceBooks:

1. Peart, R.M., and Shoup, W. D., "Agricultural Systems Management", Marcel Dekker, NewYork, 2004.
2. Hammer,G.L.,Nicholls,N.,andMitchell,C.,"ApplicationsofSeasonalClimate",Springer,Ger many, 2000.

WebLinks:

1. https://www.allaboutcircuits.com/
2. https://www.electrical4u.com/
3. https://www.vlab.co.in/
4. https://electronics.wisc-online.com/
5. https://demonstrations.wolfram.com/topics.php?EngineeringTechnology#7

22OBM10	MEDICAL ELECTRONICS	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. To gain knowledge about the various physiological parameters both electrical and non electrical and the methods of recording and also the method of transmitting these parameters To study about the various assist devices used in the hospitals
2. To gain knowledge about equipment used for physical medicine and the various recently developed diagnostic and therapeutic techniques.

Course Content:

UNIT I ELECTRO-PHYSIOLOGY AND BIOPOTENTIAL RECORDING **9**

Sources of bio medical signals, Bio-potentials, Biopotential electrodes, biological amplifiers, ECG, EEG, EMG, PCG, typical waveforms and signal characteristics

UNIT II BIO-CHEMICAL AND NON ELECTRICAL PARAMETER MEASUREMENT 9

pH, PO2, PCO2, Colorimeter, Blood flow meter, Cardiac output, respiratory, blood pressure, temperature and pulse measurement, Blood Cell Counters.

UNIT III ASSIST DEVICES 9

Cardiac pacemakers, DC Defibrillator, Dialyser, Ventilators, Magnetic Resonance Imaging Systems, Ultrasonic Imaging Systems.

UNIT IV PHYSICAL MEDICINE AND BIOTELEMETRY 9

Diathermies- Shortwave, ultrasonic and microwave type and their applications, Surgical Diathermy, Biotelemetry.

UNIT V RECENT TRENDS IN MEDICAL INSTRUMENTATION 9

Telemedicine, Insulin Pumps, Radio pill, Endomicroscopy, Brain machine interface, Lab on a chip.

TOTAL LECTURE PERIODS 45 Periods

TEXT BOOKS

1. Leslie Cromwell, ―Biomedical Instrumentation and Measurement‖, Prentice Hall of India, New Delhi, 2007. (UNIT I – V)

REFERENCES

1. Khandpur, R.S., ―Handbook of Biomedical Instrumentation‖, TATA Mc Graw-Hill, New Delhi, 2003.
2. John G.Webster, ―Medical Instrumentation Application and Design‖, 3rd Edition, Wiley India
3. Joseph J.Carr and John M.Brown, ―Introduction to Biomedical Equipment Technology‖, John Wiley and Sons, New York, 2004.

22OEC18 MOBILE COMMUNICATION

L	T	P	C
3	0	0	3

Syllabus Version V 0.1

Course Objectives:

1. Understand the basic concepts of mobile computing.
2. Understand Wireless LAN, Bluetooth and WiFi Technologies
3. Be familiar with the network protocol stack
4. Learn the basics of mobile telecommunication system
5. Be exposed to Ad-Hoc networks

Course Content:

UNIT I INTRODUCTION 9

Introduction to Mobile Computing – Applications of Mobile Computing- Generations of Mobile Communication Technologies-MAC Protocols – SDMA- TDMA- FDMA- CDMA

UNIT II MOBILE TELECOMMUNICATION SYSTEM 9

GSM – Architecture – Protocols – Connection Establishment – Frequency Allocation – Routing – Mobility Management – Security –GPRS- UMTS- Architecture

UNIT III WIRELESS NETWORKS **9**

Wireless LANs and PANs – IEEE 802.11 Standard – Architecture – Services – Blue Tooth-Wi-Fi – WiMAX

UNIT IV MOBILE NETWORK LAYER **9**

Mobile IP – DHCP – AdHoc– Proactive and Reactive Routing Protocols – Multicast RoutingVehicular Ad Hoc networks (VANET) –MANET Vs VANET – Security

UNIT V MOBILE TRANSPORT AND APPLICATION LAYER **9**

Mobile TCP– WAP – Architecture – WDP – WTLS – WTP –WSP – WAE – WTA Architecture – WML

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

1. Explain the basics of mobile telecommunication system
2. Illustrate the generations of telecommunication systems in wireless network
3. Understand the architecture of Wireless LAN technologies
4. Determine the functionality of network layer and Identify a routing protocol for a given Ad hoc networks
5. Explain the functionality of Transport and Application layer

Text Book(s):

1. Jochen Schiller, “Mobile Communications”, PHI, Second Edition, 2003.
2. Prasant Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi – 2012

Reference Books:

1. Dharma Prakash Agarval, Qing and An Zeng, "Introduction to Wireless and Mobile systems", Thomson Asia Pvt Ltd, 2005.
2. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, “Principles of Mobile Computing”, Springer, 2003.
3. William.C.Y.Lee, “Mobile Cellular Telecommunications- Analog and Digital Systems”, Second Edition, Tata McGraw Hill Edition,2006.
4. C.K.Toh, “AdHoc Mobile Wireless Networks”, First Edition, Pearson Education, 2002.

22OBM17	**PROFESSIONAL ETHICS**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Syllabus Version V 0.1

Course Objectives:

1. To create an awareness on Engineering Ethics and Human Values,
2. To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

Course Content:

UNIT I HUMAN VALUES 9

Morals, values and Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress management.

UNIT II ENGINEERING ETHICS 9

Senses of _Engineering Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas –Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest – Customs and Religion – Uses of Ethical Theories.

UNIT III ENGINEERING AS SOCIAL EXPERIMENTATION 9

Engineering as Experimentation – Engineers as responsible Experimenters – Codes of Ethics – A Balanced Outlook on Law.

UNIT IV SAFETY, RESPONSIBILITIES AND RIGHTS 9

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights Intellectual Property Rights (IPR) – Discrimination.

UNIT V GLOBAL ISSUES 9

Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Engineers as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct – Corporate Social Responsibility

TOTAL LECTURE PERIODS 45 Periods

TEXT BOOKS

1. Mike W. Martin and Roland Schinzinger, ―Ethics in Engineering‖, Tata McGraw Hill, New Delhi, 2003.
2. Govindarajan M, Natarajan S, Senthil Kumar V. S, ―Engineering Ethics‖, Prentice Hall of India, New Delhi, 2004.

REFERENCES

1. Charles B. Fleddermann, ―Engineering Ethics‖, Pearson Prentice Hall, New Jersey, 2004.
2. Charles E. Harris, Michael S. Pritchard and Michael J. Rabins, ―Engineering Ethics – Concepts and Cases‖, Cengage Learning, 2009.
3. John R Boatright, ―Ethics and the Conduct of Business‖, Pearson Education, New Delhi, 2003
4. Edmund G Seebauer and Robert L Barry, ―Fundamentals of Ethics for Scientists and

22OBM19 RESEARCH METHODOLOGY

L	T	P	C
3	0	0	3

Course Objectives:

1. To know the research design, data collection, data analysis.
2. To understand about intellectual property rights and patents.

Course Content:

UNIT I RESEARCH DESIGN **9**

Overview of research process and design, Use of Secondary and exploratory data to answer the research question, Qualitative research, Observation studies, Experiments and Surveys.

UNIT II DATA COLLECTION AND SOURCES **9**

Measurements, Measurement Scales, Questionnaires and Instruments, Sampling and methods. Data - Preparing, Exploring, examining and displaying.

UNIT III DATA ANALYSIS AND REPORTING **9**

Overview of Multivariate analysis, Hypotheses testing and Measures of Association. Presenting Insights and findings using written reports and oral presentation.

UNIT IV INTELLECTUAL PROPERTY RIGHTS **9**

Intellectual Property – The concept of IPR, Evolution and development of concept of IPR, IPR development process, Trade secrets, utility Models, IPR & Bio diversity, Role of WIPO and WTO in IPR establishments, Right of Property, Common rules of IPR practices, Types and Features of IPR Agreement, Trademark, Functions of UNESCO in IPR maintenance.

UNIT V PATENTS **9**

Patents – objectives and benefits of patent, Concept, features of patent, Inventive step, Specification, Types of patent application, process E-filling, Examination of patent, Grant of patent, Revocation, Equitable Assignments, Licences, Licensing of related patents, patent agents, Registration of patent agents.

TOTAL LECTURE PERIODS **45 Periods**

Text Books:

1. . Cooper Donald R, Schindler Pamela S and Sharma JK, “Business Research Methods”, Tata McGraw Hill Education, 11e (2012).
2. Catherine J. Holland, “Intellectual property: Patents, Trademarks, Copyrights, Trade Secrets”, Entrepreneur Press, 2007

Reference Books:

1. David Hunt, Long Nguyen, Matthew Rodgers, “Patent searching: tools & techniques”, Wiley, 2007.
2. The Institute of Company Secretaries of India, Statutory body under an Act of parliament, “Professional Programme Intellectual Property Rights, Law and practice”, September 2013.

Engineers‖, Oxford University Press, Oxford, 2001.

5. Laura P. Hartman and Joe Desjardins, ―Business Ethics: Decision Making for Personal Integrity and Social Responsibility‖ Mc Graw Hill education, India Pvt. Ltd.,New Delhi, 2013.
6. World Community Service Centre, _ Value Education‘, Vethathiri publications, Erode, 2011.

WEB SOURCES:

1. www.onlineethics.org
2. www.nspe.org
3. www.globalethics.org
4. www.ethics.org

22OEC25	SPACE SCIENCE	L	T	P	C
		3	0	0	3

Syllabus Version V 0.1

Course Objectives: To outline the space environment and their effects.

1. To extend the origin of universe and development.
2. To classify the galaxies and their evolution.
3. To interpret the variable stars in the galaxies.
4. To explain theory of formation of our solar system.

Course Content:

UNIT I INTRODUCTION **9**

Introduction to space science and applications – historical development – Space Environment Vacuum and its Effects, Plasma & Radiation Environments and their Effects, Debris Environment and its Effects - Newton's Law of gravitation – Fundamental Physical Principles.

UNIT II ORIGIN OF UNIVERSE **9**

Early history of the universe – Big-Bang and Hubble expansion model of the universe – cosmic microwave background radiation – dark matter and dark energy.

UNIT III GALAXIES **7**

Galaxies, their evolution and origin – active galaxies and quasars – Galactic rotation – Stellar populations – galactic magnetic field and cosmic rays.

UNIT IV STARS **10**

Stellar spectra and structure – stellar evolution – Nucleo-synthesis and formation of elements – Classification of stars – Harvard classification system – Hertsprung-Russel diagram – Luminosity of star – variable stars – composite stars (white dwarfs, Neutron stars, black hole, star clusters, supernova and binary stars) – Chandrasekhar limit.

UNIT V SOLAR SYSTEM **10**

Nebular theory of formation of our Solar System – Solar wind and nuclear reaction as the source of energy – Sun and Planets: Brief description about shape size – period of rotation about axis and period of revolution – distance of planets from sun – Bode's law – Kepler's Laws of planetary motion – Newton's deductions from Kepler's Laws – correction of Kepler's third law – determination of mass of earth – determination of mass of planets with respect to earth – Brief description of Asteroids – Satellites and Comets.

TOTAL LECTURE PERIODS **45 Periods**

Expected Course Outcome: On completion of the course, the student is expected to

CO1: Obtain a broad, basic knowledge of the space sciences.
CO2: Explain the scientific concepts such as evolution by means of natural selection, age of the Earth and solar system and the Big-Bang
CO3: Describe the main features and formation theories of the various types of observed galaxies, in particular the Milky Way.
CO4:Explain stellar evolution, including red giants, supernovas, neutron stars, pulsars, white dwarfs and black holes, using evidence and presently accepted theories;
CO5: Describe the presently accepted formation theories of the solar system based upon observational and physical constraints.

Text Book(s):

1. Hess W., "Introduction to Space Science", Gordon & Breach Science Pub; Revised Ed., 1968.
2. Krishnaswami K. S., "Astrophysics: A modern Perspective", New Age International, 2006.

Reference Books:

1. Arnab Rai Choudhuri, "Astrophysics for Physicists", Cambridge University Press, New York, 2010.
2. Krishnaswami K. S., "Understanding cosmic Panorama", New Age International, 2008.

22OAG17 URBAN AGRICULTURE

L	T	P	C
3	0	0	3

Pre-requisite Nil **SyllabusVersion** V0.1

CourseObjectives:

1. Tointroducethestudentstheprinciplesofagriculturalcropproductionandtheproducti onpracticesofcropsinmodernways.
2. Todelineatetheroleofagriculturalengineersinrelationtovariouscropproductionpractices .

CourseContent:

UNITI INTRODUCTION **9**

Benefits of urban agriculture- economic benefits, environmental benefits, social and culturalbenefits,educational,skill-buildingandjobtrainingbenefits,health,nutritionandfoodaccessibilitybenefits.

UNIT II VERTICALFARMING **9**

Vertical farming- types, green facade, living/green wall-modular green wall , vegetated matwallStructuresandcomponentsforgreenwallsystem:plantselection,growingmedia,irrigationa ndplantnutrition:Design,light,benefitsofverticalgardening.Roofgardenanditstypes.Kitchen garden,hangingbaskets:Thehouseplants/indoorplants

UNIT III SOILLESSCULTIVATION **9**

Hydroponics, aeroponics, aquaponics: merits and limitations, costs and Challenges, backyardgardens-tacticalgardens-streetlandscaping-forestgardening,greenhouses,urbanbeekeeping

UNITIV MODERNCONCEPTS **9**

Growth of plants in vertical pipes in terraces and inside buildings, micro irrigation conceptssuitable for roof top gardening, rain hose system, Green house, polyhouse and shade netsystem ofcrop productionon roof tops.

UNITV WASTEMANAGEMENT **9**

Concept,scopeandmaintenanceofwastemanagement-recycleoforganicwaste,gardenwastes-solid waste management-scope, microbiology of waste, other ingredients likeinsecticide,pesticidesandfungicides residues,waste utilization.

TOTALLECTUREPERIOD 45Periods

ExpectedCourseOutcome: Oncompletionofthecourse,thestudentisexpectedto

1. Demonstratetheprinciplesbehindcropproductionandvariousparametersthatinfluencesthecropgrowthonroof tops
2. Explaindifferentmethodsofcropproductiononrooftops
3. Explainnutrient andpestmanagementforcropproductiononrooftops
4. Illustratecropwaterrequirement andirrigationwatermanagementonrooftops
5. Explaintheconceptof wastemanagementonroof tops

TextBook(s):

1. MartellozzoFandJSLandry.2020.UrbanAgriculture.ScitusAcademicsLlc.
2. RobRoggema.2016.SustainableUrbanAgricultureandFoodPlanning.RoutledgeTaylorandFrancis Group.
3. AkrongMO.2012.UrbanAgriculture.LAPLambert AcademicPublishing.

ReferenceBooks:

1. Agha Rokh A. 2008. Evaluation of ornamental flowers and fishes breeding in Bushehrurban wastewater using a pilot-scale aquaponic system. Water and Wastewater, 19 (65):47–53.
2. AgrawalM,SinghB,RajputM,MarshallFandBellJ.N.B.2003.Effectofairpollutiononperiurbanagriculture:Acasestudy.EnvironmentalPollution,126(3):323–329.https://www.sciencedirect.com/science/article/pii/S0269749103002458#aep-section-id24.
3. JacSmitandJoeNasr.1992.Urbanagricultureforsustainablecities:usingwastesandidlelandand water bodiesasresources.Environmentand Urbanization,4 (2):141-152.

WebLinks:

1. https://www.allaboutcircuits.com/
2. https://www.electrical4u.com/
3. https://www.vlab.co.in/
4. https://electronics.wisc-online.com/
5. https://demonstrations.wolfram.com/topics.php?EngineeringTechnology#7

22OAG18	WASTE WATER TREATMENT	L	T	P	C
		3	0	0	3

Pre-requisite Nil **SyllabusVersion** V0.1

Course Objectives:

1. To make the student conversant with the water treatment methods including adsorption and oxidation process.
2. To provide basic understandings about the requirement so water, its preliminary treatment.

Course Content:

UNITI WATERQUALITYANDPRELIMINARYTREATMENT 9

Water Quality - physical- chemical and biological parameter so water -water quality requirement – potable water standards – waste water effluent standards-water quality indices. Water purification systems in natural systems – physical processes-chemical processes and biological processes -primary, secondary and tertiary treatment-Unit operations-unit processes. Mixing, clarification - sedimentation; Types; aeration and gas transfer–coagulation and flocculation, coagulation processes-stability of colloids-destabilization of colloids-transport of colloidal particles, clariflocculation.

UNIT II INDUSTRIALWATERTREATMENT 9

Filtration–sizeandshapecharacteristicsoffilteringmedia–sandfiltershydraulicsoffiltration – design considerations – radial, upflow, highrate and multimedia filters, pressurefilter. Water softening – lime soda, zeolite and demineralization processes – industrial watertreatmentforboilers.

UNIT III CONVENTIONALTREATMENTMETHODS 9

Taste and odour control – adsorption – activated carbon treatment – removal of color – ironand manganese removal – aeration, oxidation, ion exchange and other methods – effects offluorides – fluoridation and defluoridation –desalination - corrosion prevention and control –factorsinfluencingcorrosion–Langelier index– corrosioncontrolmeasures.

UNITIV WASTEWATERTREATMENT 9

Waste water treatment–preand primary treatment–equalization neutralization–screeningandgridremoval–sedimentation–oilseparationgasstrippingofvolatileorganics–biologicaloxidation–lagoonsandstabilizationbasins–aeratedlagoons–activatedsludgeprocess–tricklingfiltration – anaerobicdecomposition.

UNITV ADSORPTIONANDOXIDATIONPROCESSES 9

Chemical process – adsorption – theory of adsorption – ion exchange process – chemicaloxidation – advanced oxidation process– sludgehandling and disposal–miscellaneoustreatmentprocesses.

TOTALLECTUREPERIOD 45Periods S

ExpectedCourseOutcome: Oncompletionofthecourse,thestudentisexpectedto

1. Willhaveknowledgeaboutadsorptionandoxidationprocess.
2. Willgainideaaboutvarious methodsavailablefor watertreatment.
3. Willappreciatethenecessityof waterandacquireknowledge ofpreliminarytreatment.

TextBook(s):

1. MetcalfandEddy,"Wastewater Engineering",4thed.,McGrawHillHigherEdu.,2002.
2. W.WesleyEckenfelder,Jr.,"IndustrialWaterPollutionControl",2ndEdn.,McGrawHillInc.,19 89.

ReferenceBooks:

1. S.P.Mahajan,"Pollutioncontrolinprocessindustries",27thEd.TataMcGrawHillPublishingCo mpany Ltd.,2012.
2. M. Lancaster, "Green Chemistry: AnIntroductory Text", 2nd edition, RSC publishing,2010. 3. C.S. Rao, "Environmental Pollution Control Engineering", New Age International,2007.

WebLinks:

1. https://www.allaboutcircuits.com/
2. https://www.electrical4u.com/
3. https://www.vlab.co.in/
4. https://electronics.wisc-online.com/
5. https://demonstrations.wolfram.com/topics.php?EngineeringTechnology#7

22MC601	INDUSTRIAL SAFETY	L	T	P	C
		0	0	0	0

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To Understand the Introduction and basic Terminologies safety.
2. To enable the students to learn about the Important Statutory Regulations and standards.
3. To enable students to Conduct and participate the various Safety activities in the Industry.
4. To have knowledge about Workplace Exposures and Hazards.
5. To assess the various Hazards and consequences through various Risk Assessment Techniques.

Course Content:

UNIT I SAFETY TERMINOLOGIES 9

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 9

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 9

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 9

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 9

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 LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Understand the basic concept of safety.
2. Obtain knowledge of Statutory Regulations and standards.
3. Know about the safety Activities of the Working Place.

4. Analyze on the impact of Occupational Exposures and their Remedies
5. Obtain knowledge of Risk Assessment Techniques.

Text Book(s):

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

Reference Books:

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

22PBM32	**INTELLECTUAL PROPERTY RIGHTS**	**L**	**T**	**P**	**C**
		3	**1**	**0**	**4**

Pre-requisite	Nil	**Syllabus Version**	V 0.1

Course Objectives:

1. To give an idea about IPR, registration and its enforcement.

Course Content:

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTOto WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 9

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 9

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 9

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. Know about the Intellectual Property - Patents, Copyrights
2. Gain the ability to register practical and industrial design patents
3. Know about agreements and legislations related to IPRs
4. Implement to digital products and law
5. manage enforcement of IPRs

Text Book(s):

1. S.V. Satarkar, Intellectual Property Rights and Copy Rights, Ess Ess Publications, New Delhi, 2002.
2. V. Scople Vinod, Managing Intellectual Property, Prentice Hall of India pvt Ltd, 2012.

Reference Books:

1. Deborah E. Bouchoux, "Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets", Cengage Learning, Third Edition, 2012.
2. Prabuddha Ganguli,"Intellectual Property Rights: Unleashing the Knowledge Economy", McGrawHill Education, 2011.
3. Edited by Derek Bosworth and Elizabeth Webster, The Management of Intellectual Property, Edward Elgar Publishing Ltd., 2013.

22PME20	**TOTAL QUALITY MANAGEMENT**	**L**	**T**	**P**	**C**
		3	**0**	**0**	**3**

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. To facilitate the understanding of Quality Management principles and process
2. To learn the fundamental concepts of Leadership and Motivation
3. To educate the tools of quality and its applications
4. To familiarize the fundamental concepts of quality improvements and measures
5. To understand the importance of quality management system and standards

Course Content:

UNIT I INTRODUCTION 9

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention.

UNIT II TQM PRINCIPLES 9

Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

UNIT III TQM TOOLS AND TECHNIQUES - I 9

The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types.

UNIT IV TQM TOOLS AND TECHNIQUES - II 9

Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures.

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 LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. support to implement Quality Management principles
2. build the strong Leadership and assist for continuous improvement
3. implement tools of quality for various applications
4. Improve the quality of the process in all aspects
5. accomplish the quality management system and its standards

Text Book(s):

1. Dale H.Besterfiled, Carol B.Michna,Glen H. Besterfield,Mary B.Sacre,Hemant Urdhwareshe and Rashmi Urdhwareshe, “Total Quality Management”, Pearson Education Asia, Revised Third Edition, Indian Reprint, Sixth Impression, 2013.

Reference Books:

1. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8 th Edition, First Indian Edition, Cengage Learning, 2012.
2. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. ISO 9001-2015 standards

22OME20	LEARN SIX SIGMA	L	T	P	C
		3	0	0	3

Pre-requisite Nil **Syllabus Version** V 0.1

Course Objectives:

1. Explain the basics of Lean and Six Sigma.
2. Teach the need and the process of integrating Lean and Six sigma.
3. Summarize to identify and select the resources required for LSS Projects and selection of projects including Team building.
4. Teach the DMAIC process and study the various tools for undertaking LSS projects.
5. Illustrate to institutionalize the LSS efforts

Course Content:

UNIT I INTRODUCTION TO LEAN AND SIX SIGMA 9

Introduction to Lean- Definition, Purpose, Features of Lean; Top seven wastes, need for Lean management, the philosophy of lean management, Creating a lean enterprise, Elements of Lean, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six sigma, origin of six sigma, Six sigma concept and Critical success factors for six sigma.

UNIT II INTEGRATION OF LEAN AND SIX SIGMA 9

Evolution of lean six sigma, the synergy of Lean and six sigma, Definition of lean six sigma, the principles of lean six sigma, Scope for lean six sigma, Features of lean six sigma. The laws of lean six sigma, Key elements of LSS, the LSS model and the benefits of lean six sigma. Initiation - Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, the structure of transforming event and Launch preparation.

UNIT III PROJECT SELECTION AND TEAM BUILDING 9

Resource and project selection, Selection of Black belts, Training of Black belts and Champions, Identification of potential projects, top down (Balanced score card) and Bottom up approach – Methods of selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Predicting and improving team performance, Nine team roles and Team leadership

UNIT IV THE DYNAMIC PROCESS AND TOOLS 9

The DMAIC process – Toll gate reviews; The DMAIC tools; Define tools – Project definition form, SIPOC diagram; Measure tools – Process mapping, Lead time/cycle time, Cause and Effect matrix, Idea – generating and organizing tools – Brainstorming, Nominal group technique and Multi-voting; Data collection and accuracy tools- Check sheet, Gauge R&R; Understanding and eliminating variation- run charts; Analyze tools - Scatter plots, ANOVA, Regression analysis, Time trap analysis; Improve tools – Mistake proofing, Set up time reduction (SMED) and the pull system; Control tools – statistical process control.

UNIT V INSTITUTIONALIZING AND DESIGN FOR LSS 9

Institutionalizing lean six sigma – improving design velocity, creating cycle time base line, valuing projects, gating the projects, reducing product line complexity, Design for lean six sigma, QFD, Theory of Inventive Problem solving (TRIZ), Robust design; Case study presentations

TOTAL LECTURE PERIODS 45 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. understand what is Lean and Six sigma and their importance in the globalized competitive world.
2. understand the importance of integrating Lean and Six sigma and also the process of their integration
3. plan the Resources required to undertake the LSS projects and also acquire how to select the suitable projects and the teams
4. apply DMAIC methodology to execute LSS projects and in this regard they will be acquainted with various LSS tools.
5. understand the process of institutionalizing the LSS effort and also understand the Design for LSS.

Text Book(s):

1. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003
2. Michael L. George, Lean Six Sigma, McGraw-Hill., 2002

Reference Books:

1. Ronald G. Askin and Jeffrey B. Goldberg, Design and Analysis of Lean Production Systems, John Wiley &Sons., 2003.
2. Salman Taghizadegan, Essentials of Lean Six Sigma, Elsevier, 2010

Course Code	WEB TECHNOLOGIES	L	T	P	C
22OCS28		2	0	2	3

Pre-requisite HTML, basic java script **Syllabus Version** V 0.1

Course Objectives:

1. TounderstanddifferentInternetTechnologies
2. Tolearnjava-specific webservicesarchitecture
3. ToDevelopwebapplicationsusingframeworks.

Course Content:

UNIT I WEBSITE BASICS,HTML5,CSS 3,WEB2.0 6

Web Essentials: Clients, Servers and Communication – The Internet – World wide web – HTTPRequest Message – HTTP Response Message – Web Clients – Web Servers – HTML5 – Tables –Lists–Image–HTML5controlelements–DragandDrop–Audio–Videocontrols-CSS3– Inline,embedded and external style sheets – Rule cascading – Inheritance – Backgrounds – BorderImages – Colors – Shadows – Text – Transformations – Transitions – Animations. BootstrapFramework

UNIT II CLIENTSIDE PROGRAMMING 6

Java Script: An introduction to JavaScript–JavaScript DOM Model-Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – FunctionFiles

UNIT III SERVER SIDE PROGRAMMING 6

Servlets: Java Servlet Architecture- Servlet Life Cycle- Form GET and POST actions-SessionHandling-UnderstandingCookies-DATABASECONNECTIVITY:JDBC

UNIT IV PHP and XML 6

An introduction to PHP: PHP- Using PHP- Variables- Program control- Built-in functions-FormValidation.XML:BasicXML-DocumentTypeDefinition-XMLSchema,XMLParsersandValidation,XSL

UNIT V INTRODUCTIONTOANGULARandWEB APPLICATIONSFRAMEWORKS 6

Introduction to AngularJS, MVC Architecture, understanding attributes, Expressions and databinding, Conditional Directives, Style Directives, Controllers, Filters, Forms, Routers, Modules,Services; Web Applications Frameworks and Tools – Firebase- Docker- Node JS-React- Django-UI& UX

TOTAL LECTURE PERIODS 30 Periods

Expected Course Outcome: On completion of the course, the student is expected to

1. ConstructabasicwebsiteusingHTMLandCascadingStyleSheets
2. Build dynamic web page with validation using Java Script objects and by applying differenteventhandling mechanisms.
3. Developserversideprogramsusing ServletsandJSP.

4. Constructsimplewebpagesin PHPandtorepresentdatainXMLformat.
5. Developinteractivewebapplications.

Text Book(s):

1. DeitelandDeitelandNieto,InternetandWorldWideWeb-HowtoProgram,PrenticeHall,5thEdition,2011.
2. JeffreyCandJackson,WebTechnologiesAComputerSciencePerspective,Pearson Education, 2011.
3. Angular6forEnterprise-ReadyWebApplications,DoguhanUluca,1stedition,PacktPublishing

Reference Books:

1. StephenWynkoopandJohnBurke“RunningaPerfectWebsite”,QUE,2ndEdition,1999.
2. ChrisBates,WebProgramming–BuildingIntranetApplications,3rdEdition,WileyPublications, 2009

List of Experiments:

1.	Createawebpagewiththefollowing usingHTML a) Toembedanimagemapin awebpage. b) Tofixthehot spots. c)Showalltherelatedinformationwhenthehotspots areclicked	**4**
2.	Createawebpagewithalltypes of Cascadingstylesheets.	**4**
3.	Client SideScriptsforValidatingWebFormControlsusingDHTML	**4**
4.	InstallationofApacheTomcatwebserver	**4**
5.	WriteprogramsinJava usingServlets: a) ToinvokeservletsfromHTMLforms. b) SessionTracking	**4**
6.	Writeprograms in Javatocreatethree-tier applicationsusing JSPandDatabasesa)Forconductingon-lineexamination.b)For displaying student mark list. Assume that student information is available in a databasewhichhas beenstored ina databaseserver	**5**
7.	ProgramsusingXML– Schema–XSLT/XSL	**5**
	TOTAL PRACTICAL PERIODS	**30 Periods**
	TOTAL LECTURE CUM PRACTICAL PERIODS	**60 Periods**

List of Equipments: (for batch of 30 students)

1.	Dream Weaver or Equivalent, MySQL or Equivalent, Apache Server, WAMP/XAMPP	30 nos
2.	Standalone desktops	30 nos