MGM University

Vision

- To ensure sustainable human development which encourages self-reliant and self-content society.
- To promote activities related to community services, social welfare and also Indian heritage and culture.
- To inculcate the culture of non-violence and truthfulness through vipassana meditation and Gandhian Philosophy.
- To develop the culture of simple living and high thinking

Mission

- To impart state of art education and technical expertise to students and give necessary training to teachers to create a self-reliant society for future.
- To encourage students to participate in Indian and International activities in sports, literature, etc. so that future generation becomes base for free and liberal society
- To educate students in areas like Management, Finance, Human relations to inculcate philosophy of simple living and high thinking value of simple economic society.
- To inculcate a culture of non-violence and truthfulness through Vipassana.
- To sustain activities of Indian culture (viz. classical dance, music and fine arts) through establishing institutes like Mahagami, Naturopathy, etc.

विद्यापीठ गीत

अत्त दिप भव भव प्रदिप भव,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

अत्ताहि अत्त नो नाथो ,

अत्ताहि अत्त नो गति

अत्त मार्गपर अप्रमादसे है तुझे चलना

सब्ब का कल्याण हो ,

वो कार्यकुशल करना

सब्ब का उत्तम मंगल , पथप्रदर्शक हो

अत्त दिप भव भव प्रदिप भव ,

स्वरूप रूप भव हो

ज्ञान सब्ब विज्ञान सब्ब भव ,

सब्ब दिप भव हो

बुद्धमं शरनं गच्छामि :

धम्मं शरनं गच्छामि :

संघं शरनं गच्छामि :

Jawaharlal Nehru Engineering College (JNEC) at a Glance

Jawaharlal Nehru Engineering College is a premier institute of engineering that has carved a niche for itself in the field of technical education in a very short span of time. The college has made its presence felt in the world of technical education. JNEC is a conducted college of MGM University, Chhatrapati Sambhajinagar from the academic year 2020-21.

Unique in its structure, methods and goals, the college is strongly rooted in the philosophy of training and research that enhances the relationship between knowledge and its application and seeks to promote the creation of an ideal society. The college also provides facilities for research leading to Ph. D. through its Research Center. JNEC provides a congenial atmosphere for diligent academic pursuits. This has been reflected through the results. Most of our students are among the toppers in various engineering disciplines.

Vision

To create self-reliant, continuous learner & competent technocrats imbued with human values.

Mission

- Imparting quality technical education to the students through participative teaching –learning process.
- Developing competence amongst the students through academic learning and practical experimentation.
- Inculcating social mindset and human values amongst the students.

Programs offered at JNEC

Undergraduate Programmes	Postgraduate Programmes	Ph.D. Programmes	PG Diploma Programmes	Certificate Programmes
B. Arch. - Architecture	M. Arch. Environmental Architecture	Ph.D. Architecture		
B. Tech. Artificial Intelligence & Data Science	M. Tech. Computer Science and Engineering (Digital Transformation)	Ph.D. Chemical Engineering		
B. Tech. Chemical Engineering	M. Tech. Electrical Power Systems	Ph.D. Civil Engineering		
B. Tech. Civil Engineering	M. Tech. Mechanical Engineering	Ph.D. Electrical Engineering		
B. Tech. Computer Science & Engineering	M. Tech. Structural Engineering	Ph.D. Electronics Engineering		
B. Tech. Electrical & Computer Engineering	M. Tech. VLSI & Embedded Systems	Ph.D. Mechanical Engineering		
B. Tech. Electronics & Computer Engineering	Master of Computer Applications - MCA	Ph.D. Computer Science & Engineering		
B. Tech. Mechanical Engineering		Ph.D. Computer Applications		
B. Tech. Mechanical & Mechatronics Engineering (Additive Manufacturing)				
B. Tech. Robotics & Artificial Intelligence				

Department of Electronics and Telecommunications Engineering

The Bachelor of Technology (B. Tech.) in Electronics and Computer Engineering degree program started in the year 2021 and is approved by the All India Council for Technical Education (AICTE), New Delhi and offers Choice Based Credit System education. In addition to core courses, students can opt for discipline specific elective subjects, open elective subjects from different institutes of the University. In addition, this program is uniquely designed to increase the employability and to prepare students to work in a Multi-disciplinary work environment. The program offers a Major degree in Electronics and Computer Engineering and is open to students opting for minor specializations as per their interests. Pedagogies concentrating on student's active participation are extensively used in the teaching-learning process.

Name of Program – B. Tech. in Electronics and Computer Engineering with Multidisciplinary Minor

Duration – Four Years

Eligibility –

1. Maharashtra State Candidate.

(i) The Candidate should be an Indian National and having domicile of Maharashtra state and/or born in Maharashtra state.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies, and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and the candidate should have appeared in MGMU-CET/ MHT-CET/ PERA CET/ JEE (Main) Paper-I and should obtain non zero score in MGMU-CET/ MHT-CET/ PERA CET/ JEE (Main) Paper-I. However, preference

shall be given to the candidate obtaining non-zero positive score in MGMU-CET over the candidates who obtained non-zero score in MHT-CET/ PERA CET.

OR

(ii)Passed Diploma in Engineering and Technology and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only).

2. All India Candidates –

(i) The Candidate should be an Indian National.

(ii) Passed HSC or its equivalent examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry or Biotechnology or Biology or Technical Vocational subject or Computer Science or Information Technology or Informatics Practices or Agriculture or Engineering Graphics or Business Studies , and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only) in the above subjects taken together and candidate should have appeared in MGMU-CET/ MHT-CET/ PERA CET/ JEE (Main) Paper-I and should obtain non-zero score in MGMU-CET/ MHT-CET/ PERA CET/ JEE (Main) Paper-I. However, preference shall be given to the candidate obtaining non-zero positive score in JEE Mains Paper-I over the candidates who obtained non-zero score in MGMU-CET/ MHT-CET/ PERA CET.

OR

(ii) Passed Diploma in Engineering and Technology and obtained at least 45% marks (at least 40% marks, in case of Backward class categories and Persons with Disability candidates belonging to Maharashtra State only)

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

First Year - Semester I (Group A)												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
BSC	APS21BSL101	Single and Multivariable Calculus	Lecture	4	4	-	60	40	100	-	16	40
BSC	APS21BSL102	Engineering Physics	Lecture	3	3	-	60	40	100	-	16	40
ESC	APS21ESL101	Python Programming	Lecture	2	2	-	60	40	100	-	16	40
ESC	APS21ESL102	Engineering Graphics	Lecture	2	2	-	60	40	100	-	16	40
AEC	MGM54AEL101	Communicative English	Lecture	1	1	-	30	20	50	-	8	20
VSEC	APS21VSP101	Engineering Exploration	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP101	Engineering Physics Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP101	Python Programming Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP102	Engineering Graphics Studio	Practical	2	-	4	30	20	50	-	8	20
ESC	APS21ESP103	Recent Trends in Integrated Technology	Practical	1	-	2	30	20	50	-	8	20
AEC	MGM54AEP101	Communicative English Lab	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP101 MGM82CCP102 MGM82CCP103	NCC / Yoga / Sports	Practical	2	-	4	30	20	50	-	8	20
		TOTAL		22	12	20	510	340	850	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

First Year - Semester II (Group A)												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
BSC	APS21BSL103	Linear Algebra and Differential Equations	Theory	4	4	-	60	40	100	-	16	40
BSC	APS21BSL104	Engineering Chemistry	Theory	3	3	-	60	40	100	-	16	40
ESC	APS21ESL103	Engineering Mechanics	Theory	2	2	-	60	40	100	-	16	40
ESC	APS21ESL104	Building Programming logic in C	Theory	1	1	-	30	20	50	-	8	20
PCC	APS21PCL101	Basics of Electrical and Electronics Engineering	Theory	2	2	-	60	40	100	-	16	40
IKS	APS21IKL1XX	Indian Knowledge System	Theory	2	2	-	60	40	100	-	16	40
VSEC	APS21VSP102	Workshop Practices	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP102	Engineering Chemistry Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP104	Engineering Mechanics Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP105	Building Programming logic in C Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	APS21PCP101	Electrical and Electronics Technology Lab	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP104 MGM73CCP105 MGM73CCP106	NSS/ Fine Art/ Visual Art	Practical	2	-	4	30	20	50	-	8	20
TOTAL				22	14	16	540	360	900	-	-	-

Note:
Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

First Year - Semester I (Group B)												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
BSC	APS21BSL101	Single and Multivariable Calculus	Theory	4	4	-	60	40	100	-	16	40
BSC	APS21BSL104	Engineering CHEMISTRY	Theory	3	3	-	60	40	100	-	16	40
ESC	APS21ESL101	Python Programming	Theory	2	2	-	60	40	100	-	16	40
ESC	APS21ESL103	Engineering Mechanics	Theory	2	2	-	60	40	100	-	16	40
AEC	MGM54AEL101	Communicative English	Theory	1	1	-	30	20	50	-	8	20
PCC	APS21PCL101	Basics of Electrical and Electronics Engineering	Theory	2	2	-	60	40	100	-	16	40
VSEC	APS21VSP102	Workshop Practices	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP102	Engineering Chemistry Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP101	Python Programming Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP104	Engineering Mechanics Lab	Practical	1	-	2	30	20	50	-	8	20
AEC	MGM54AEP101	Communicative English Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	APS21PCP101	Electrical and Electronics Technology Lab	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP101 MGM82CCP102 MGM82CCP103	NCC / Yoga / Sports	Practical	2	-	4	30	20	50	-	8	20
TOTAL				23	14	18	570	380	950	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

First Year - Semester II (Group B)												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
BSC	APS21BSL103	Linear Algebra and Differential Equations	Theory	4	4	-	60	40	100	-	16	40
BSC	APS21BSL102	Engineering Physics	Theory	3	3	-	60	40	100	-	16	40
ESC	APS21ESL102	Engineering Graphics	Theory	2	2	-	60	40	100	-	16	40
IKS	APS21IKL1XX	Indian Knowledge System	Theory	2	2	-	60	40	100	-	16	40
ESC	APS21ESL104	Building Programming logic in C	Theory	1	1	-	30	20	50	-	8	20
VSEC	APS21VSP101	Engineering Exploration	Practical	2	-	4	60	40	100	-	16	40
BSC	APS21BSP101	Engineering Physics Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP102	Engineering Graphics Studio	Practical	2	-	4	30	20	50	-	8	20
ESC	APS21ESP105	Building Programming logic in C Lab	Practical	1	-	2	30	20	50	-	8	20
ESC	APS21ESP103	Recent Trends in Integrated Technology	Practical	1	-	2	30	20	50	-	8	20
CCA	MGM82CCP104 MGM73CCP105 MGM73CCP106	NSS/ Fine Art/ Visual Art	Practical	2	-	4	30	20	50	-	8	20
TOTAL				21	12	18	480	320	800	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

Semester III												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ETC21PCL201	Digital System Design	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP201	Digital System Design Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL202	Data Structures	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP202	Data Structures Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL203	Electronic Circuits and Networks	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP203	Electronic Circuits and Networks Lab	Practical	1	-	2	30	20	50	-	8	20
EEMC	ETC21HSL204	Business Management and Financial Accounting	Lecture	2	2	-	60	40	100	-	16	40
CEP	ETC21CEP205	Community Engagement	Practical	2	-	4	30	20	50	-	8	20
MDM		Refer MDM Basket (Annexure A)	Lecture	2	2	-	60	40	100	-	8	20
OE		Refer MGMU Basket of Open Electives	Lecture	2	2	-	30	20	50	-	8	20
OE		Refer MGMU Basket of Open Electives	Lecture	2	2	-	30	20	50	-	8	20
VEC	MGM56VEL102	Constitution of India	Lecture	2	2	-	30	20	50	-	8	20
TOTAL				**21**	**16**	**10**	**510**	**340**	**850**	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

Semester IV												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ETC21PCL251	Object Oriented Programming using C++	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP251	Object Oriented Programming using C++ Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL252	Analog and Digital communication	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP252	Analog and Digital communication Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL253	Microprocessors and Microcontrollers	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP253	Microprocessors and Microcontrollers Lab	Practical	1	-	2	30	20	50	-	8	20
VSEC	ETC21VSP254	Basics of Data Analytics and Visualization	Practical	2	-	4	30	20	50	-	8	20
EEMC	ETC21HSL255	Entrepreneurship Development	Lecture	2	2	-	60	40	100	-	16	40
AEC		Refer MGMU Basket of AEC	Lecture	2	2	-	30	20	50	-	8	20
MDM		Refer MDM Basket (Annexure A)	Lecture	2	2	-	60	40	100	-	16	40
OE		Refer MGMU Basket of Open Electives	Lecture	2	2	-	30	20	50	-	8	20
VEC	MGM21VEL101	Environment Studies	Lecture	2	2	-	30	20	50	-	8	20
TOTAL				**21**	**16**	**10**	**510**	**340**	**850**	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

Semester V												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ETC21PCL301	Computer Networks	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP301	Computer Network Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL302	Operating Systems	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP302	Operating Systems Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL303	Database Management System	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP303	Database Management System Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL304	Analog Circuits	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP304	Analog Circuits Lab	Practical	1	-	2	30	20	50	-	8	20
Program Elective - I												
PEC	ETC21PEL305	Group A: Embedded Systems Design	Lecture	3	3	-	60	40	100	-	16	40
PEC	ETC21PEL306	Group B: Basics of IOT										
PEC	ETC21PEL307	Group C: Python for AIML										
PEC	ETC21PEP305	Group A: Embedded Systems Design Lab	Practical	1	-	2	30	20	50	-	8	20
PEC	ETC21PEP306	Group B: Basics of IOT Lab										
PEC	ETC21PEP307	Group C: Python for AIML Lab										
MDM		Refer MDM Basket (Annexure A)	Lecture	4	4	-	60	40	100	-	16	40
OE		Refer MGMU Basket of Open Electives	Lecture	2	2	-	30	20	50	-	8	20
TOTAL				**22**	**17**	**10**	**540**	**360**	**900**	-	-	-

Note:
Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

Semester VI													
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ETC21PCL351	Information Theory and Coding	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP351	Information Theory and Coding Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL352	Digital Signal Processing	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP352	Digital Signal Processing Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL353	Computer Architecture	Lecture	2	2	-	60	40	100	-	16	40
Program Elective - II												
PEC	ETC21PEL354	Group A : System Design using Verilog	Lecture	3	3	-	60	40	100	-	16	40
PEC	ETC21PEL355	Group B : Hardware and Communication Protocols in IOT										
PEC	ETC21PEL356	Group C : Machine Learning										
PEC	ETC21PEP354	Group A : System Design using Verilog Lab	Practical	1	-	2	30	20	50	-	8	20
PEC	ETC21PEP355	Group B : Hardware and Communication Protocols in IOT Lab										
PEC	ETC21PEP356	Group C : Machine Learning Lab										
Program Elective - III												
PEC	ETC21PEL357	Cloud Computing	Lecture	3	3	-	60	40	100	-	16	40
PEC	ETC21PEL358	Automotive Electronics										
PEC	ETC21PEL359	Robotics and Automation										
PEC	ETC21PEP357	Cloud Computing Lab	Practical	1	-	2	30	20	50	-	8	20
PEC	ETC21PEP358	Automotive Electronics Lab										
PEC	ETC21PEP359	Robotics and Automation Lab										
VSEC	ETC21VSL360	Computer Hardware and Networking	Lecture	2	2	-	60	40	100	-	16	40
MDM		Refer MDM Basket (Annexure A)	Lecture	2	2	-	60	40	100	-	16	40
TOTAL				**20**	**16**	**8**	**540**	**360**	**900**	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

Semester VII												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ETC21PCL401	Software Engineering	Lecture	3	3	-	60	40	100	-	16	40
PCC	ETC21PCL402	Soft computing	Lecture	3	3	-	60	40	100	-	16	40
Program Elective - IV												
PEC	ETC21PEL403	Group A : CMOS Digital VLSI Design	Lecture	2	2	-	60	40	100	-	16	40
PEC	ETC21PEL404	Group B : Wireless Sensor Network										
PEC	ETC21PEL405	Group C : Artificial Intelligence										
OJT	ETC21JTI406	Internship	Internship	12	-	24	100	50	150	-	20	60
MDM		Refer MDM Basket (Annexure A)	Lecture	2	2	-	60	40	100	-	16	40
TOTAL				**22**	**10**	**24**	**340**	**210**	**550**	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Name of Faculty: Engineering and Technology

Name of the College/Institute/Department/School: JNEC

Name of the Programme: Electronics and Computer Engineering with Multidisciplinary Minor

Programme Type (UG/PG): UG

Duration: 04 Years

Semester VIII												
Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
PCC	ETC21PCL451	Digital Image Processing	Lecture	2	2	-	60	40	100	-	16	40
PCC	ETC21PCP451	Digital Image Processing Lab	Practical	1	-	2	30	20	50	-	8	20
PCC	ETC21PCL452	Cyber security	Lecture	2	2	-	60	40	100	-	16	40
Program Elective - V												
PEC	ETC21PEL453	Big Data Analytics	Lecture	3	3	-	60	40	100	-	16	40
PEC	ETC21PEL454	Digital Forensics										
PEC	ETC21PEL455	Industry 4.0										
Program Elective - VI												
PEC	ETC21PEL456	Data Science	Lecture	3	3	-	60	40	100	-	16	40
PEC	ETC21PEL457	E-Vehicle										
PEC	ETC21PEL458	Agriculture Electronics										
RM	ETC21RML459	Research Methodology	Lecture	4	4	-	60	40	100	-	16	40
RP	ETC21RPJ460	Project	Project	4	-	8	60	40	100	-	16	40
MDM		Refer MDM Basket (Annexure A)	Lecture	2	2	-	60	40	100	-	16	40
TOTAL				**21**	**16**	**10**	**450**	**300**	**750**	-	-	-

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Exit Options after FY

Exit option to qualify for Certification, common at Institute level: After securing all credits of First Year and securing 8 credits in work-based vocational courses or internship / apprenticeship offered during summer vacation will be awarded a One Year UG certificate in Tech (Electronics and Computer Engineering with Multidisciplinary Minor).

Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
VSEC	ETC21VSI101	Electrical Vehicles	Internship	8	-	16	60	40	100	-	16	40

Exit Options after SY

Exit option to qualify for UG Diploma in Electronics and Computer Engineering with Multidisciplinary Minor: After securing all credits of first and second year and provided the student secures additional 8 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc) offered during summer vacation after the first year or second year and will be awarded a UG Diploma in Electronics and Computer Engineering with Multidisciplinary Minor.

Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
VSEC	ETC21VSI201	Home Appliances Maintenance and Repair	Internship	8	-	16	60	40	100	-	16	40

Exit Options after TY

Exit option to qualify for B.Voc in Electronics and Computer Engineering with Multidisciplinary Minor: After securing all credits of first, second and third year with additional 6 credits in skill-based vocational courses (skill-based courses, internship, mini projects etc) offered during summer vacation after the sixth semester and will be awarded a B.Voc in Electronics and Computer Engineering with Multidisciplinary Minor.

Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)		
					L	P	Internal	External	Total	Internal	External	Total
VSEC	ETC21VSI301	Industrial Automation	Internship	6	-	12	60	40	100	-	16	40

Honors Degree

Students after FY can opt for B.Tech. Degree with Honors. Eligibility for admission will be a minimum CGPA of 7.5 at First Year.

The students will have to take additional 5 courses of 20 credits in Electronics and Computer Engineering discipline distributed over semesters III to VIII and will be awarded B. Tech in Electronics and Computer Engineering with Multidisciplinary Minor and Honors in VLSI and ESD.

Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)			Semester
					L	P	Internal	External	Total	Internal	External	Total	
PCC	ETC21HNL201	Programming Languages for Embedded Software	Lecture	4	4	-	60	40	100	-	16	40	III
PCC	ETC21HNL202	Embedded Networking	Lecture	4	4	-	60	40	100	-	16	40	IV
PCC	ETC21HNL301	Digital CMOS VLSI Design	Lecture	4	4	-	60	40	100	-	16	40	V
PCC	ETC21HNL302	Low Power VLSI Design	Lecture	4	4	-	60	40	100	-	16	40	VI
PCC	ETC21HNL401	Analog CMOS VLSI Design	Lecture	4	4	-	60	40	100	-	16	40	VIII
TOTAL				**20**	**20**	**0**	**300**	**200**	**500**	-	-	-	

Note:
Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Students after FY can opt for B.Tech. Degree with Double Minor. Eligibility for admission will be a minimum CGPA of 7.5 at First Year.

The students will have to take additional 5 courses of 20 credits in another Technology discipline/ Emerging areas specialization distributed over semesters III to VIII and will be awarded B. Tech in Electronics and Computer Engineering with Double Minors (Multidisciplinary and Specialization Minors).

Name of the Specialization Double Minor: Applied Electronics and Chip Design

Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)			Semester
					L	P	Internal	External	Total	Internal	External	Total	
DM	ETC21DML201	Semiconductor Devices and Circuits	Theory	4	4	0	60	40	100	-	16	24	III
DM	ETC21DML202	Digital and Analog circuits	Theory	4	4	0	60	40	100	-	16	24	IV
DM	ETC21DML301	Digital CMOS VLSI Design	Theory	4	4	0	60	40	100	-	16	24	V
DM	ETC21DML302	Low Power VLSI Design	Theory	4	4	0	60	40	100	-	16	24	VI
DM	ETC21DML401	Analog CMOS VLSI Design	Theory	4	4	0	60	40	100	-	16	24	VIII
TOTAL				**20**	**20**	**0**	**300**	**200**	**500**	-	-	-	

Note:
Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Students after TY can opt for the B.Tech. Degree - Honors with Research and Multidisciplinary Minor. Eligibility for admission will be a minimum CGPA of 7.5 at third year.

The students will work on a research project or dissertation for 18 credits in the IV year in the Electronics and Computer Engineering with Multidisciplinary Minor distributed over semesters VII and VIII and will be awarded B. Tech in Electronics and Computer Engineering Honors with Research and Multidisciplinary Minor.

Course Category	Course Code	Course Title	Nature of Course	No of Credits	Teaching (Contact hrs/ week)		Evaluation Scheme (Marks)			Minimum Passing (Marks)			Semester
					L	P	Internal	External	Total	Internal	External	Total	
RP	ETC21RPJ401	Research Project Part I	Project	8	-	18	50	100	150	-	40	60	VII
RP	ETC21RPJ402	Research Project Part II	Project	10	-	18	50	100	150	-	40	60	VIII
TOTAL				**18**	**0**	**36**	**100**	**200**	**300**	-	-	-	

Note:

Nature of Course : L- Lecture, P-Practical, S-Seminar, J-Project, I-Internship, D-Dissertation,

Course Category: PCC-Program Core Course, PEC-Program Elective Course, MDM-Multidisciplinary Minor, OE-Open Elective, EEMC-Entrepreneurship/Economic/Management Course, VSEC-Vocational Skill and Skill Enhancement Course, AEC-Ability Enhancement Course, IKS-Indian Knowledge System, VEC-Value Education Course, OJT-On Job Training / Internship / Apprenticeship, FP-Field Project, CEP-Community Engagement and Service, CC-Cocurricular course, RM-Research Methodology, RP-Research Project

Syllabus
Semester –I

Course Code: APS21BSL101 **Course Name:** Single and Multivariable Calculus **Course Category:**

Credits: 4 **Teaching scheme:** L-4 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Pre-university mathematics.

Course Objectives:
1. To provide the basic tools of calculus for the purpose of modelling the engineering problems mathematically and obtaining solutions.
2. To convey a sense of the utility of calculus and develop technical competence of the student.

Course Outcomes:
On completion of the course, the student should be able to:
CO1. Compute derivatives in engineering problems.
CO2. Compute definite integrals arise in the problems such as arc length, surface of revolution, Work and Fluid Forces.
CO3. Find the partial derivatives and apply the knowledge of partial differentiation to find maxima and minima of functions, Jacobians, estimating error and approximation.
CO4. Calculate Area, Volume, Center of mass and Gravity using Double and Triple integral.
CO5. Solve the problems on fundamental theorems of vector calculus such as Green's, Stokes and Divergence theorems.

Contents:

Unit	Content	Teaching Hours
1	**Differentiation and its Applications:** Limit ,Continuity and Differentiation, Rate of Change in sciences and Engineering, Chain Rule and implicit differentiation, Related rates, Extreme value theorem, Rolle's Theorem, Lagrange's Mean value theorems, Nth derivatives, Taylor and Maclaurin series Expansions, Linear approximations and Differentials.	10
2	**Integration and its Applications:** Integration, Reduction formulae, Beta and gamma function, Properties, Evaluation of integrals using Beta and gamma functions, Application of Definite integrals to volume, arc length, surface of revolution, Work and Fluid Forces.	10
3	**Partial Differentiation and its Applications:** Limit and Continuity, Partial derivatives of first and higher orders, Total differentials, Errors and Approximations, Total derivative, Extreme values and saddle points, Method of Lagrange multipliers, Jacobians, Vector differentiation, Gradient, Curl and Divergence, directional derivatives.	10
4	**Multiple Integrals and its Applications:** Double integrals ,Evaluation of Double integrals**,** Change of order of integration in double integrals,Change of variables (Cartesian to polar), Applications: Area and Volume, Root mean square value, Center of mass and Gravity (constant and variable densities); Triple integrals (Cartesian),Volume by triple integration.	10

5	**Vector Integration and its Applications:** Line integrals, Surface integrals, Green's Theorem, Stokes Theorems, Divergence theorems.	10

Text Books:

1. James Stewart, Calculus Early Transcendental, 7th edition, Cengage.

2. George B. Thomas, Ross L. Finney, Calculus and Analytical Geometry, 9th edition, Pearson.

3. Howard Anton, Irl Bivens, Stephens Davis, Calculus, 10th Edition, Wiley.

Reference Books:

1. Shanti Narayan, Differential Calculus, S. Chand & Co.

2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New York.

3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.

4. P. N. Wartikar, J. N. Wartikar, Applied Mathematics (Vol I & II) , Pune Vidyarthi Griha Prakashan, Pune.

5. H. K. Das and Rajnish Verma, Higher Engineering Mathematics , S. Chand & CO. Pvt. Ltd., New Delhi.

6. K. D Joshi, Calculus for Scientists and Engineers, CRC Press.

7. Prasad and Reena Garg, Advanced Engineering Mathematics, Khanna Publishing Company Private Limited, New Delhi.

Course Code: APS21BSL102 **Course Name:** Engineering Physics **Course Category:**

Credits: 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Student should know Basic Physics and basic Mathematics

Course Objectives:

1. To impart knowledge in basic concepts of physics relevant to engineering applications
2. To introduce advances in technology for engineering applications.

Course Outcomes:

On completion of the course, the student should be able to:

- CO.1 Summarize fundamentals of electron optics, modern physics and ultrasonic waves related to the engineering fields.
- CO.2 Identify the importance of the optical phenomenon i.e. interference, diffraction and polarization in relevance with its engineering applications.
- CO.3 Classify the material on the basis of electric conductivity as semiconductor and superconductors and dielectric materials this leads to their fascinating applications.
- CO.4 Recognize the use of laser and optical fibers in various fields.
- CO.5 Outline basics of crystallography and X- rays and demonstrate the applications of nano-materials relevant to engineering program.

Contents:

Unit	Content	Teaching Hours
1	**Modern Physics:** Electron Optics: e/m by Thomson's method, Positive ray, Bainbridge mass spectrograph. Quantum Mechanics: Role and concepts, De- Broglie's hypothesis, Uncertainty Principle, Fundamentals of quantum computing, Quantum features Ultrasonic Waves: Production of ultrasonic waves (Magnetostriction & Piezoelectric method), Applications. Numericals.	8
2	**Wave Optics:** Interference- Interference in thin films (reflected light), Newton's Rings, Engineering applications of Interference. Diffraction- Fresnel's and Fraunhofer Diffraction, Theory of plane transmission Grating. Polarization-Polarization by reflection and double refraction, Optical activity, Specific rotation, Construction and working of Laurent's half shade polarimeter, Engineering applications of Polarization. Numericals.	8
3	**Materials of Technological Importance:** Dielectric Materials: Introduction, Types of polarizations: Electronic and Ionic, Orientation Polarizations - Applications of Dielectrics	8

	Semiconducting Materials: Introduction, Fermi energy in Intrinsic semiconductors and extrinsic semiconductors, Hall effect, Applications of Semiconductors. Numericals. Superconducting Materials: Introduction, Type – I and Type – II superconductors, Meissner effect, BCS Theory, Application	
4	**Optoelectronic Materials and Devices:** LASER : Absorption, spontaneous and stimulated emission, population inversion n, pumping mechanism, Construction and working of Ruby laser, Construction and working of He-Ne laser. Lasers in various technological applications. Introduction to Optical Fibers-Introduction Acceptance Angle-Numerical Aperture, Applications of optical fibers. Numericals.	8
5	**Physics of Materials:** Crystal structure: Unit cell, Coordination number, atomic radius, packing density of cubic system. X-rays: Bragg's law, X-Ray Diffraction (XRD), Industrial Applications of X-Rays. Numericals. Particle detector: G.M. Counter Nano-Materials: Basic principles of nano science and technology, properties, applications of nanotechnology.	8

Text Books:

1. Engineering Physics- H.K. Malik & A.K. Singh, McGraw Hill publication.
2. Engineering Physics - R.K. Gaur and S. L. Gupta. Dhanpat Rai Publications Pvt. Ltd.-New Delhi
3. M. N.Avadhanulu, P.G.Kshirsagar "A Text book of Engineering Physics"-S. Chand Publications.
4. B.K. Pandey and S. Chaturvedi, Engineering Physics, Cengage Learning, 2012.

Reference Books:

1. Fundamental of Physics - Halliday and Resnik. Willey Eastern Limited.
2. Introduction to Electrodynamics –David R. Griffiths.
3. Concept of Modern Physics – Arthur Beizer. Tata McGraw-Hill Publishing Company Limited.
4. Optics – AjoyGhatak.MacGraw Hill Education (India) Pvt. Ltd.
5. Science of Engineering Materials- C.M. Srivastava and C. Srinivasan. New Age International Pvt.Ltd.
6. Solid State Physics – A.J. Dekker. McMillan India –Limited.
7. The Feynman Lectures on Physics Vol I, II,III.
8. Introduction to solid state physics – Charles Kittel. John Willey and Sons
9. T Pradeep "A Text book of Nano Science and Nano Technology"-Tata Mc GrawHill 2019.

E-Resources:

1. https://nptel.ac.in/courses/122107035/ Engineering Physics
2. https://youtu.be/98xoZknQjl8 Polarization
3. https://youtu.be/yINtzw63KncMaxwell's Equations and EM theory
4. https://youtu.be/bwreHReBH2AMaxwell's Equations and EM theory
5. https://www.youtube.com/playlist?list=PLuv3GM6-gsE3-hVNaw-YEb7EeY5XVPZdz
6. Maxwell's Equations and EM theory(nptel)
7. https://nptel.ac.in/courses/115105120/ Experimental Physics
8. https://youtu.be/2CsMpEBl5QY Crystal Structure and X- rays
9. https://youtu.be/z_8aJPLr21E Crystal Structure and X- rays
10. https://youtu.be/_Ckh-60B6LY Condensed matter Physics
11. https://youtu.be/QQZ6EGf0Ju8 Magnetic Properties

12. https://youtu.be/DDLljK1ODeg Magnetic Materials
13. https://youtu.be/etjZmdmrjSU Dielectrics
14. https://youtu.be/k6ZxP9Yr02E Semiconductor
15. https://youtu.be/D-9M3GWoBrw Superconductivity
16. https://youtu.be/GglT1RoBPzg Superconductivity
17. https://youtu.be/VHp2Ff5N_bs Superconductivity
18. https://youtu.be/FNp81kkxj5c LASER
19. https://youtu.be/YvrwVK9ZqQY LASER
20. https://nptel.ac.in/courses/115107095/ Optic Fiber
21. https://youtu.be/cjBPnIXK60U Quantum Mechanics (Prof.H.C. Verma)
22. https://youtu.be/BDuqChhUhM0 Divergence and Curl(Prof.H.C. Verma)
23. https://youtu.be/sCviGSMaYfI Divergence and Curl (Prof.H.C. Verma)
24. https://youtu.be/SZCsFS9izfQ Divergence and Curl

And other related videos from following resources

25. www.nptel.ac.in ;www.swayam.gov.in;https://inflibnet.ac.in/
26. www.sciencedirect.com
27. http://vlabs.iitb.ac.in/vlab/
28. www.youtube.com

Course Code: APS21ESL101 **Course Name:** Python Programming **Course Category:**

Credits: 3 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40

1. **Pre-requisites:** Basic Computer Knowledge & Knowledge of any programming language(optional)

Course Objectives:

1. To understand fundamental concepts in Python Programming
2. To learn the different Conditional Loops and Iteration
3. To understand various data structures and packages

Course Outcomes:

CO1: Describe programming fundamentals of python.
CO2: Interpret the python syntax and semantics of control flow statements.
CO3: Identify the methods to create and manipulate programs with python data structures.
CO4: Use modular approach for problem solving.
CO5: Apply advanced features and packages of python programming required for data science.

Contents:

Unit	Content	Teaching Hours
1	**Python for everybody:** Why Program, Hardware Overview, Python as a Language, Why Python, Installation Python Jupyter notebook, Using the Python Playground ,how to write program and compile in Jupyter notebook. Writing input and output statements in Python, output formatting, Writing comments, keywords in Python .variables and variable assignments, Operators ,writing expressions	6
2	**Conditional Loops and Iteration:** Conditional Statements, in Python, Loops and Iteration, Definite Loops, Finding the Largest Value, Loop Idioms	6
3	**Data Structures in Python:** Strings, Manipulating Strings, Files, Processing Files, Dictionaries, sets, Tuples, Lists, Manipulating Lists, Lists and Strings, Strings, Manipulating Strings	6
4	**Functions, Modules and Packages:** Functions, Lambda functions, Recursive function, Types of functions, modules and packages.	6
5	**Packages in Python for Data Science:** Numpy introduction, Numerical operations on Numpy, Introduction of Matplotlib, getting started with Pandas, Data frames basics in Pandas, key operations on data frames. Introduction to Data Science, Binary search, finding elements in common in lists using Hash, Finding largest elements, Introduction of SQL	6

Text Books:

1. Kent D. Lee, “Python Programming Fundamentals”, Second Edition, Springer Publication.

2. Wes McKinney, “Python for Data Analysis” O’Reilly Publication.

Reference Books:

1. The Python Language Reference: http://docs.python.org/2/reference/index.html

2. The Python Standard Library: http://docs.python.org/2/library/

3. https://docs.scipy.org/doc/scipy/reference/tutorial/stats.html

4. http://matplotlib.org/api/mlab_api.html#module-matplotlib.mlab

5. http://conference.scipy.org/proceedings/scipy2010/pdfs/seabold.pdf

6. http://seaborn.pydata.org

7. https://www.datacamp.com/community/data-science-cheatsheets

8. PEP 20 -- The Zen of Python: https://www.python.org/dev/peps/pep-0020/

9. https://docs.scipy.org/doc/numpy-dev/user/numpy-for-matlab-users.html

General Instructions:

The theory classes are to be conducted batch wise in Lab. Each class should be divided into four batches.

Course Code: APS21SL102 **Course Name:** Engineering Graphics **Course Category:**

Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Nil

Course Objectives:

1. Understand the basic principles of engineering graphics and improve the visualization skills
2. To gain knowledge on projection of points, straight lines, planes, solids.
3. To understand the real life objects through Drawings.
4. To know the principles of orthographic and isometric projections.

Course Outcomes:

CO 1. Identify basic concepts in drawing and its application.
CO 2. Plan and prepare neat orthographic drawings of points, straight lines, planes and solids.
CO 3 To visualize and draw orthographic and isometric projection of solids.
CO 4. Acquire skill to draw real life engineering objects by using the engineering drawing.

Contents:

Unit	Content	Teaching Hours
1	**Projections of Straight Lines:** Introduction to Engineering Graphics, Need of Engineering Drawing, Drawing Instruments, BIS code of practice for general engineering drawing, Projections of Points in Four Quadrants, Projections of Points in Reference Plane, Line Parallel to both the Plane, Line Parallel to One Plane and Perpendicular to the other, Line Inclined to One Plane and Parallel to The Other, Line Inclined to Both the Reference Planes, Traces of Line (Only first quadrant to be considered)	5
2	**Engineering Curves:** Curves used in Engineering Practice, Conic sections, Construction of conics by different methods, Rectangular-hyperbola, Cycloidal curves, Epi and hypo-cycloids, Involutes and Archimedean spiral.	5
3	**Projections of Planes:** Plane with Surface Parallel to One Plane and Perpendicular to other, Plane Inclined to One Plane and Perpendicular to other, Projections of Planes Inclined to both the Planes	5
4	**Projections of Solids:** Introduction to Solids: Prisms, Pyramid, Cylinder, Cone, Cube, Tetrahedron, Sphere, Projections of above Solids with Axis inclined to one plane, Projections of above solids with Axis inclined to both the Planes, Projection of composite solids (different arrangement of Spheres with above Solids).	5
5	**Orthographic Projections:** Orthographic projections of different Machine Parts (First Angle Projection method only)	5

6	**Isometric Projections ,Introduction to CAD:** Introduction to Pictorial views, Converting Orthographic Projections into Isometric Projections and Isometric views. Listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects	5

Text Books:

1. N. D. Bhatt and Panchal V. M., "Engineering Drawing", Charotar Publishing House, Anand
2. P. J. Shah , " A Text Book of Engineering Drawing", S.Chand, New Delhi
3. Shah M.B. & Rana B.C, "Engineering Drawing & Computer Graphics", Pearson Publications,
4. Agrawal B.& Agrawal C.M, "Engineering Graphics", TMH Publications
5. Narayana K.L. & P. Kannaiah, "Engineering Drawing", Scitech Publications
6. P.I Vargese, "Engineering Graphics", Mcgraw Hill Publications
7. D.A.Hindoliya," Engineering Graphics", B. S. Publications

Reference Books:

1.Dabhade M. L., "Engineering Graphics", Vol.-I and Vol.-II, Vision Publications, Pune

2.K.Venugopal, "Engineering Drawing and Graphics" ,New Age International Publishers

Course Code: MGM54AEL101 **Course Name:** Communicative English **Course Category:**

Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Basic knowledge of English

Course Objectives:
The course aims at grooming the professional ethics of the students through various personality traits and behavioral patterns focusing on communication skills.

Course Outcomes:

CO.1 communicate formally with enhanced communication Competency

CO.2 to adapt professional nonverbal communication

CO.3 construct English formal syntax and apply corporate vocabulary in written and verbal communication

CO.4 acquire listening and drafting skills with professional competency

Contents:

Unit	Content	Teaching Hours
1	**Communication and Communication Process:** Introduction to Communication, Forms and functions of Communication, Barriers to Communication and overcoming them, Ways of Effective Communication.	5
2	**Non-verbal Communication And its types:** Kinesiccs, Occulesics, Appearance, Proxemics, Chronemics, Paralanguage, Qualities of effective speech	3
3	**English Grammar:** Overview of basic Mid-level grammar, Tenses& concept of time, Sentence construction, Corporate vocabulary, Difference between formal and informal sentences, phrases and words	3
4	**Listening Skills and Writing Skills:** Listening : Active and Passive Listening writing styles layouts Business Letters- job application, resignation, resume	4

Text Books/ Reference Books:

1 Ashraf Rizvi, Communication Skills for Engineers, Tata McGraw Hill

2 Sanjay Kumar, Pushp Lata, Communication Skills, Oxford University Press, 2016.

3 Meenakshi Raman, Sangeeta Sharma, Communication Skills, Oxford University Press, 2017.

4 Teri Kwal Gamble, Michael Gamble, Communication Works, Tata McGraw Hill Education,2010.

5 Anderson, Kenneth. Joan Maclean and Tossny Lynch. Study Speaking: A Course in Spoken English for Academic Purposes. Cambridge: CUP, 2004.

6 Bellare, Nirmala. Reading Strategies. Vols. 1 and 2. New Delhi. Oxford University Press,1998

7 Bhasker, W. W. S & Prabhu, N. S.: English through Reading, Vols. 1 and 2. Macmillan,1975

8 BoveeCourtland,L and Thrill, John V. Business Communication, Today McGraw Hill, NewYork, Taxman Publication (1989).

9 Murphy, Raymond. Essential English Grammar, Cambridge: University Press (2000)

10 Hewings Martin Advanced English Grammar Cambridge: University press(2003)

11 Bansal Harrison. Spoken English

Course Code: APS21VSP101 **Course Name:** Engineering Exploration **Course Category:**

Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Nil

Course Objectives:

1. Understand the principles of Engineering Design and apply them to identify product requirements, objectives, and constraints through interactions with clients, users, and relevant stakeholders.
2. Develop critical thinking and problem-solving skills to analyze existing technologies, conduct surveys, study literature, and generate creative design concepts using various means and combinations.
3. Acquire proficiency in using appropriate tools and techniques to generate electronic and mechanical simulations, schematic diagrams, and product concept sketches or CAD models for effective communication of design ideas.
4. Demonstrate competency in categorizing inputs and outputs of systems in terms of materials, information, and energy, enabling a holistic understanding of engineering projects.
5. Cultivate effective teamwork and communication skills to collaborate with peers, mentors, and team members during the development and presentation of engineering prototypes.
6. Develop the ability to evaluate, defend, and communicate design decisions, progress, and project outcomes, showcasing awareness of course concepts and their application in real-world scenarios.

Course Outcomes:

On completion of the course, the student should be able to:

LO 1. Effectively interact with clients, users, and stakeholders to gather relevant information and derive product requirements, thereby demonstrating proficiency in Requirement Analysis and Client Interaction.

LO 2. Analyse and compare existing technologies, conduct surveys, and study literature to identify potential solutions, and develop objective trees and function trees, reflecting their competency in Conceptual Design and Analysis.

LO 3. Create product concept diagrams, combining different means, and prepare sketches or CAD models to present their design ideas aesthetically and coherently, indicating proficiency in Product Concept Development.

LO 4. Categorize system inputs and outputs in terms of materials, information, and energy, illustrating their understanding of System Categorization and Analysis.

LO 5. Exhibit hands-on skills in physical assembly, connection, and demonstration of engineering prototypes, showcasing Proficiency in Prototyping and Implementation.

LO 6. Explain and defend their design choices, project progress, and outcomes during presentations, demonstrating Communication Skills, Project Evaluation, and Awareness of Engineering Concepts.

Contents:

Sr. No.	List of Practical	Lab Hours
1	The course is conducted in the following modules: 1. Introduction to Engineering Exploration 2. Engineering Design	10

	3. Platform Based Development 4. Mechanisms 5. Data acquisition and analysis 6. Engineering Ethics 7. Project Management	
2	The following practical contents are delivered in an integrated mode along with theory: 1. Conceptualizing a product 2. Designing a product with constraints 3. Simulation of electronic circuits (at least 10 sets) 4. Implementation of electronic circuits (at least 5 sets) 5. Implementation of four bar chain mechanism 6. Conversion of problem statement to need statement 7. Identification of objectives, constraints and functions 8. Generation of black box, glass box and expanded class box 9. Generation of morphological chart 10. Generation of concepts 11. Comparison of concepts 12. Selection of concept 13. Implementation and testing of prototype	20

Reference Books:

- George E. Dieter and Linda C. Schmidt (2009), Engineering Design, 4ed, Mc Graw Hill Higher Education
- Clive L. Dym, Patrick Little, and Elizabeth J. Orwin (2014), Engineering Design: A project-based introduction, 4ed, John Wiley and Sons
- G. Pahl, W. Beitz, J. Feldhusen and K.-H. Grote (2007), Engineering Design: A systematic approach, 3ed, Springer, New York

Course Code: APS21BSP101 **Course Name:** Engineering Physics Lab **Course Category:**

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Student should know the basic aspects of measurements like least count and range of instrument, scale identification, accuracy, error etc.

Course Objectives:
The Objective of this course is
1. To make the students gain practical knowledge to co-relate with the theoretical studies.
2. To achieve perfectness in experimental skills.
3. The study of practical applications will bring more confidence.

Course Outcomes:
At the end of the laboratory course, the students will be able to,
LO1: Plot the I-V characteristics of pn junction diode and determine the value of band gap energy which can be used for core engineering Courses.
LO2: Perform optical experiments; using light properties like interference, polarization, diffraction and their applications.
LO3: Interpret the results and analyze the data and use the experimental data to plot the graph for a best fit.
LO4: Discuss the characteristics of plateau region and determine operating voltage of G.M. counter
LO5: Determine the numerical aperture and bending loss of optical fibre cable

Contents:

Sr. No.	List of Practical	Lab Hours
1	Thomson's Bar Magnetic method -Determination of e/m of electron	02
2	Newton's rings -Determination of radius of curvature of Plano convex lens.	02
3	Polarization - Half shade Polarimeter -Determination of specific rotation of optically active material.	02
4	Diffraction - Determination of wavelength of light by plane transmission grating.	02
5	Wedge Shaped film -Determination of thickness of thin wire	02
6	Semiconductors – To study of forward and reverse bias characteristic of Semiconductors diode	02
7	Fibre Optics – Determination of Bending losses in optical fibre	02
8	Fibre Optics – Determination of Numerical Aperture of given optical fibre	02
9	Determination of operating voltage of G.M. tube and characteristics of plateau region	02
10	Determination of wavelength of laser source	02

Course Code: APS21ESP101 **Course Name:** Python Programming Lab **Course Category:**

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:
The Objective of this course is

Course Outcomes:
LO1 : Demonstrate python program using development environment.
LO2: Develop logical thinking to solve the problems using programming fundamental concepts.
LO3 : Construct python program using various data structures.
LO4 : Apply modularization approach for solving complex problem.
LO5: Make use of various packages in Python for data science.
LO6 : Implement different SQL commands in python.

Contents:

Sr. No.	List of Practical	Lab Hours
1	Program to perform input/output operations Write a program to take input (integer, float, string) and print it.	02
2	Program based on operators 1.Write a program to simulate a simple calculator (+ - / * %) that takes two operands as input and displays the result 2.Write a program to find area and perimeter of geometric objects. 3.The distance between two cities (in km.) is input through the keyboard. Write a program to convert and print this distance in meters, feet, inches and centimeters. 4. Write a Program to interchange two numbers. 5.Write a program to compute Fahrenheit from centigrade	02
3	Programs based on Decision making. 1.Write a program to read marks from keyboard and your program should display equivalent grade according to following table(else-if) (ladder) Marks Grade 100 - 80 Distinction 79 - 60 First Class 59 - 40 Second Class < 40 Fail 2.Write a program to input basic salary of an employee and calculate gross salary according to given conditions. Basic Salary <= 10000 : HRA = 20%, DA = 80% Basic Salary is between 10001 to 20000 : HRA = 25%, DA = 90% Basic Salary >= 20001 : HRA = 30%, DA = 95% 3.If the ages of three brothers are input through the keyboard, write a C Program to determine the youngest and oldest of the three. 4.Write a program to calculate overtime pay of employee. Overtime is paid at the rate of Rs. 12.00 per hour for every hour worked above 40 hours. Assume that employee do not work for fractional part of an hour.	02

	5.Write a program for checking the speed of drivers. If speed is less than 70, it should print "Ok". Otherwise, for every 5km above the speed limit (70), it should give the driver one demerit point and print the total number of demerit points. For example, if the speed is 80, it should print: "Points: 2". If the driver gets more than 12 points, the function should print: "License suspended"	
4	Programs using while and for loops 1.WAP to find factorial of given number 2.WAP to check whether given number is Palindrome or not 3.WAP to check whether given number is Armstrong or not 4.WAP to print Fibonacci series 5.Write a Python program which iterates the integers from 1 to 50. For multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz". 6.WAP to check whether given number is Perfect number or not 7.WAP to check whether given number is Prime number or not 8.Write C program to print given star and number patterns and reverse it. • * 1 • ** 12 • *** 123 **** 1234	02
5	Programs on string 1.Write Python Program to find length of string without using len() function. 2.Count all letters, digits, and special symbols from a given string. 3.Python Program to Count the Number of Vowels in a String. 4.Python Program to Calculate the Number of Upper Case Letters and Lower Case Letters in a String. 5.Python Program to Check whether given string is palindrome or not	02
6	Programs on List and Tuple 1.Write a Python program to sum all the items in a list. 2.Write a Python program to multiply all the items in a list 3.Write a Python program to get the largest number from a list. 4.Write a Python program to get the smallest number from a list 5.Write a Python program to count all elements in list and count Occurrences Of A List Item In Python 6.Write a Python program to create a tuple with different data types 7. Write a Python program to check whether an element exists within a tuple 8.Write a Python program to reverse a tuple 9. Write a Python program calculate the product of all the numbers given in tuple. Original Tuple: (2, 4, 8, 8, 3, 2, 9) Product - multiplying all the numbers of the said tuple: 27648	02
7	Programs on set and dictionary 1.Write a Python program to concatenate following dictionaries to create a new one. Sample Dictionary : dic1={1:10, 2:20} dic2={3:30, 4:40} dic3={5:50,6:60} Expected Result : {1: 10, 2: 20, 3: 30, 4: 40, 5: 50, 6: 60} 2.Write a Python program to check whether a given key already exists in a dictionary	02

	3.Write a Python script to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x) Sample Dictionary (n = 5) : Expected Output : {1: 1, 2: 4, 3: 9, 4: 16, 5: 25} 4.Write a Python program to merge two Python dictionaries 5.Write a Python program to get the maximum and minimum value in a dictionary 6.Write a Python program to create set difference, Union and intersection 7.Write a Python program to check if two given sets have no elements in common	
8	Programs using function 1. Write Functions to calculate your trip's costs: 2. Define a function called hotel_cost with one argument nights as input 3. Define a function called plane_ride_cost that takes a string, city, as input. 4. Define a function called rental_car_cost with an argument called days. 5. Define a function called trip_cost that takes two arguments, city and days. Like the example above, have your function return the sum of calling the rental_car_cost(days), hotel_cost(days), and plane_ride_cost(city) functions. 6. Write a program in to check a given number is even or odd using the function. 7. Write a function Exchange to interchange the values of two variables, say x and y. illustrate the use of this function in a calling function. 8. Write a program to find Sum of natural number using recursion. **9.** Write a program to print Fibonacci series number using recursion	02
9	Program using NumPy, Matplotlib and Pandas library 1.Write a program to perform matrix addition, substraction, multiplication. 2.Plot all types of graph using Matplotlib. 3.Write a program which perform basic operation of Pandas.	02
10	Program on SQL Commands 1. Write a program of binary search 2. Write a program which perform basic SQL commands 3. Programs based on real life problems/GUI based programs	02

Course Code: APS21ESP102 **Course Name:** Engineering Graphics Lab **Course Category:**

Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:
The Objective of this course is

Course Outcomes:
Students will be able to,

1. Develop competence in correct expression of the visualized objects
2. Dimension and annotate two-dimensional engineering drawings
3. Plan and prepare neat orthographic drawings of points, straight lines, planes and solids
4. Develop the ability to visualize and draw orthographic and isometric projection of solids

Contents:

Sr. No.	List of Practical	Lab Hours
1	Drawing three problems based on projections of lines on half imperial size drawing sheet	02
2	Drawing three problems based on engineering curves on half imperial size drawing sheet	02
3	Drawing three problems based on projections of planes on half imperial size drawing sheet	02
4	Drawing three problems based on projections of solids on half imperial size drawing sheet	02
5	Drawing three problems based on orthographic projections on half imperial size drawing sheet	02
6	Drawing three problems based on isometric projections on half imperial size drawing sheet	02
7	Demonstration of CAD software in CAD lab, drawing simple objects using various commands	02

Course Code: APS21ESP103 **Course Name:** Recent Trends in Integrated Technologies Lab **Course Category:**

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:

1.To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
2.To recognize industrial control problems suitable for Industrial Robotics.
3.To acquire basic skills in exploring the potential of the drone technology in professional activities
4.Ability to recognize industrial automation problems suitable for PLC control.

Course Outcomes:

LO1. Prepare 3D Model (slice & print) in either Stratasys or Zortrax & generate scan data through Hexagon portable scanning arm.
LO2.Describe basic industrial robotics & it's applications
LO3.Operate a small drone in a controlled environment
LO4.Explain principles of sensor, PLC & applications.

Contents:

Sr. No.	List of Practical	Lab Hours
1	Scan to CAD, CAD to STL conversion& patching, machine setup & processes for printing	02
2	Programming the TATA Robot(pendant) for pick & place, programming the Yaskawa Robot(pendant) for motion planning, Demonstrate welding exercise by the instructor	02
3	Introduction to components of drone, Demonstration of assembly of drone, Demonstration of mission planning & flying the drone	02
4	Controller & sensor & their interfacing, basic ladder logic instructions, pneumatic& hydraulic actuator	02

Reference Books:

1. A Step-by-Step Guide For Beginners: Aircraft Design & Construction Design Guide by :Merlin Debrie
2. Industrial Automation & Robotics By A.K. Gupta & S.K.Arora
3. Additive Manufacturing Principles, Technologies & Applications By C.P.Paul (TMH)
4. Basics of unmanned aerial vehicle By Garvit Pandya (Motion press)

Course Code: MGM54AEP101 **Course Name:** Communicative English Lab **Course Category:**

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Basic knowledge of English

Course Objectives:
The course aims at grooming the professional ethics of the students through various personality traits and behavioural patterns focusing on communication skills.

Course Outcomes:
The Students will be able to
LO.1 Introduce themselves formally and informally through practice.
LO.2 Pronounce English vowel and Consonant sounds effectively
LO.3 Participate effectively in G.Ds, Presentations, & Interviews
LO.4 Face Interviews competently
LO.5 Draft resume, business letters, reports formally
LO.6 Comprehend the meaning of English text by comprehension techniques.

Contents:

Sr. No.	List of Practical	Lab Hours
1	Self Introduction	02
2	Pronunciation of Vowel sounds in English	02
3	Pronunciation of consonant sounds in English	02
4	Group discussion	04
5	Presentation techniques	04
6	Interview techniques	04
7	Letter writing	04
8	Email writing, Agenda of the meeting and notices	02
9	Resume Writing	02
10	Report writing	02
11	Skimming & Scanning	02

Course Code: MGM82CCP101 **Course Name:** National Cadet Corps **Course Category: CCA**

Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:
Nil

Course Outcomes:
Nil

Contents:

Unit No.	Content	Hours
1	**NCC General, National Integration and Awareness, Social Service and Community Development, Drill:** Aims, Objectives and Organization of NCC, Duties of NCC Cadet, National Integration Importance and Necessity, Factors Affecting National Integration, Foot Drill, Drill With Arms, Ceremonial Drill with Arms, Social Service and Community Development Activities- Pollution, Mission Indradhanush, Beti Bachao Beti Padhao, Tree Plantation, Digital Awareness.	12
2	**Personality Development, Disaster Management, Weapon Training, Map Reading :** Critical and Creative Thinking, Decision Making, Self Awareness, Public Speaking, Interview Skills, Types, Org, Capability and Role of NCC cadets, Initiative Trg, Organizing Skills, Do's & Don't , Introduction and Characteristics of .22 rifle, Handling of .22 rifle, Introduction to Map Reading, Conduct of MR- Google and Tourist Maps and Apps.	10
3	**Health and Hygiene, Environmental Awareness and Conservation, Adventure, Obstacle Training:** Hygiene & Sanitation (Personal & Camp Hygiene) Soch Vichar, First Aid in Common Medical Emergencies, Treatment & Care of Wounds, Introduction Yoga & Exercises, Water Conservation, Energy Conservation, Introduction Adventure Activities. Obstacle Course.	10
4	**Leadership, Introduction to Infantry Weapons and Equipments:** Traits, Indicators, Motivation, Ethics, Case Studies- Chhatrapati Shivaji Maharaj, Maharana Pratap, Jhasi ki Rani, Ratan Tata, Narayan Murty, Rabindra Nath Tagor, Organization of Infantry Battalion and its weapons.	08
5	**Armed Forces, Field Craft and Battle Craft, :** Armed Forces, Army, CAPF, Police, Modes of Entry to Army, CAPF, Police, Introduction to Field Craft, Indication of Landmark, Observation, Camouflage and Concealment, Fire and Move Capsule.	08

References:

- Cadet's Handbook- Common Subject, all wings by DG NCC, New Delhi.
- Cadet's Handbook- Common Subject by NCC Directorate- Bhubaneshwar.
- Cadet's Handbook- Specialised Subjects, Army, Navy, Air-Force by DG NCC, New Delhi.
- NCC OTA Precise by DG NCC, New Delhi.
- Chanakya's 7 Secrets of Leadership by Radhakrishanan Pillai and D. Shivnandhan.
- National Cadets Corps (India) by Lambert M. Suvarkar.

E-Resources:

1. National Cadet Corps, Youth in Action (Google eBook).

https://indiancc.nic.in/dg-ncc-lt-gen-gurbirpal-singh/

www.youtube.com

Course Code: MGM82CCP103 **Course Name:** Sports **Course Category: CCA**

Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:

1. To understand the importance of sports in physical and mental development.
2. To learn about the different types of sports.
3. To learn about the different types of indoor games.
4. To participate in indoor games.
5. To learn about the different types of outdoor games.
6. To participate in outdoor games.

Course Outcomes:

- Upon completion of this course, students will be able to
- Demonstrate knowledge of the history, benefits, types, equipment, and safety of sports
- Demonstrate proficiency in the basic skills of indoor and outdoor games
- Understand the rules and regulations of selected sports
- Participate in sports competitions

Contents:

Sr. No.	Content	Hours
1	Football: History of Football: The earliest forms of football can be traced back to ancient China, Greece, and Rome. In England, the game of football developed in the 19th century, with different rules being used by different schools and organizations. In 1863, the Football Association (FA) was founded, and it standardized the rules of the game. The first international match was played between England and Scotland in 1872. Football became an Olympic sport in 1900, and the first World Cup was held in 1930. Today, football is the most popular sport in the world, with billions of fans around the globe. **Fundamental Skills of Football**	12

	Dribbling: Dribbling is the ability to move the ball with your feet while keeping control of it. It is a essential skill for all footballers, as it allows you to move past defenders and create scoring opportunities. Passing: Passing is the ability to accurately and effectively throw the ball to your teammates. It is another essential skill, as it allows you to move the ball up the field and create scoring opportunities. Shooting: Shooting is the ability to kick the ball with power and accuracy. It is the most important skill for scoring goals, and it is essential for all footballers to develop a good shot. Heading: Heading is the ability to use your head to control and direct the ball. It is a valuable skill for both attacking and defending, and it is important for all footballers to learn how to head the ball effectively. Tackling: Tackling is the ability to take the ball away from an opponent. It is an important skill for defenders, but it is also valuable for midfielders and attackers.	
2	**Basket Ball** **History of Basketball** Basketball was invented by James Naismith in 1891 at the International YMCA Training School in Springfield, Massachusetts. Naismith was a physical education instructor who was looking for a game that would be less injury-prone than football. He nailed two peach baskets to the lower rail of a balcony and used a soccer ball to play the game. The first game of basketball was played on December 21, 1891, with nine players on each team. The rules of basketball have evolved over time, but the basic premise of the game has remained the same. Today, basketball is one of the most popular sports in the world, with millions of players and fans around the globe. **Fundamental Skills of Basketball** Dribble: Dribbling is the ability to move the ball with your hands while keeping control of it. It is an essential skill for all basketball players, as it allows you to move past defenders and create scoring opportunities. Passing: Passing is the ability to accurately and effectively throw the ball to your teammates. It is another essential skill, as it allows you to move the ball up the court and create scoring opportunities. Shooting: Shooting is the ability to throw the ball through the hoop with power and accuracy. It is the most important skill for scoring points, and it is essential for all basketball players to develop a good shot. Rebounding: Rebounding is the ability to catch the ball after it has been missed by a shooter. It is an important skill for both offense and defense, as it allows teams to get second chances at scoring. Defense: Defense is the ability to prevent the other team from scoring points. It is an essential skill for all basketball players, as it is impossible to win a game without playing good defense.	10
3	**Volley Ball** **History of Volleyball** Volleyball was invented in 1895 by William G. Morgan, a physical education instructor at the Young Men's Christian Association (YMCA) in Holyoke, Massachusetts.	10

	Morgan was looking for a game that would be less vigorous than basketball, and he created volleyball as a way to keep his students active during the winter months. The original name of the game was "mintonette," but it was renamed "volleyball" in 1896. Volleyball quickly spread throughout the United States and around the world, and it became an official Olympic sport in 1964. **Fundamental Skills of Volleyball** Passing: Passing is the ability to receive the ball from the opponent and direct it to a teammate. It is an essential skill for all volleyball players, as it allows the team to keep possession of the ball and start an attack. Setting: Setting is the ability to control the height and direction of the ball so that a teammate can spike it. It is a critical skill for setters, as they are responsible for setting up the team's offense. Spiking: Spiking is the ability to hit the ball over the net with power and accuracy. It is the most important skill for scoring points in volleyball, and it is essential for all attackers to develop a good spike. Blocking: Blocking is the ability to prevent the opponent from spiking the ball over the net. It is an important skill for blockers, as they can prevent the other team from scoring points. Digging: Digging is the ability to prevent the opponent from scoring a point by returning the ball over the net. It is an important skill for all defenders, as they are responsible for preventing the other team from scoring points	
4	**Kabaddi** **History of Kabaddi** Kabaddi is a contact team sport that originated in India. It is believed to have originated in the Indian subcontinent over 4,000 years ago. The game is mentioned in the Sangam literature of Tamil Nadu, which dates back to the 3rd century BC. Kabaddi was first played as a competitive sport in the Indian Olympic Games in 1938. It was included as a demonstration sport at the 1982 Asian Games in Delhi, and it became a full medal sport in the 1990 Asian Games in Beijing. Kabaddi is now played in over 100 countries around the world. **Fundamental Skills of Kabaddi** Dabki: Dabki is the act of entering the opponent's half of the court while chanting "kabaddi, kabaddi." It is a fundamental skill for all raiders, as it allows them to enter the opponent's half of the court without being tackled. Touch: Touching an opponent is the most important skill in kabaddi. It is how raiders score points for their team. There are many different ways to touch an opponent, such as touching their arm, leg, or torso. Tackling: Tackling is the act of preventing a raider from touching an opponent. It is a fundamental skill for all defenders, as it allows them to prevent the other team from scoring points. There are many different ways to tackle a raider, such as grabbing them, pushing them, or tripping them. Stamina: Stamina is essential for all kabaddi players, as the game is very physically demanding. Players need to be able to run, jump, and tackle for long periods of time. Agility: Agility is also important for kabaddi players, as they need to be able to change direction quickly and avoid being tackled.	08
5	**Badminton**	08

	History of Badminton The game of badminton originated in ancient Greece, China, and India. It was brought to England in the 1870s by British army officers stationed in India. The first badminton club was founded in 1873 at Badminton House, the country estate of the Duke of Beaufort. The first official all-England badminton championships for men were held in 1899, and the first badminton tournament for women was arranged the next year. Badminton became an Olympic sport in 1992. Today, badminton is a popular sport played by millions of people around the world. **Fundamental Skills of Badminton** Grip: The grip is the most important fundamental skill in badminton. It allows you to control the racket and hit the shuttlecock with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip. Footwork: Footwork is essential for moving around the court and positioning yourself to hit the shuttlecock. There are many different footwork drills that you can practice to improve your footwork. Racket control: Racket control is the ability to hit the shuttlecock with power and accuracy. It is important to practice hitting the shuttlecock in different directions and with different levels of power. Timing: Timing is the ability to hit the shuttlecock at the right time. It is important to practice hitting the shuttlecock at the peak of its flight. Stamina: Stamina is essential for badminton, as it is a physically demanding sport. You need to be able to run, jump, and hit the shuttlecock for long periods of time.	
6	**Soft Tennis** **History of Soft Tennis** Soft tennis is a racquet sport that originated in Japan in the early 20th century. It was created as a less dangerous alternative to lawn tennis, as the ball used in soft tennis is made of foam rubber and does not travel as fast as a regular tennis ball. The first soft tennis tournament was held in Japan in 1921, and the sport quickly spread to other countries in Asia. Soft tennis was first introduced to the United States in the 1950s, and it has since become a popular recreational sport in the country. **Fundamental Skills of Soft Tennis** Grip: The grip is the most important fundamental skill in soft tennis. It allows you to control the racquet and hit the ball with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip. Footwork: Footwork is essential for moving around the court and positioning yourself to hit the ball. There are many different footwork drills that you can practice to improve your footwork. Racket control: Racket control is the ability to hit the ball with power and accuracy. It is important to practice hitting the ball in different directions and with different levels of power. Timing: Timing is the ability to hit the ball at the right time. It is important to practice hitting the ball at the peak of its flight.	

	Stamina: Stamina is essential for soft tennis, as it is a physically demanding sport. You need to be able to run, jump, and hit the ball for long periods of time. **Here are some additional fundamental skills of soft tennis:** Ball control: The ability to control the direction and speed of the ball. Serve: The ability to serve the ball accurately and with power. Volley: The ability to hit the ball before it bounces. Overhead smash: The ability to hit the ball forcefully and accurately overhand. Drop shot: The ability to hit the ball softly and precisely so that it bounces low and close to the net.	
7	**Tennis** **History of Tennis** The origins of tennis can be traced back to a 12th–13th-century French handball game called jeu de paume ("game of the palm"), from which was derived a complex indoor racket-and-ball game: real tennis. The modern game of lawn tennis was invented in England in the 1870s by Major Walter Wingfield. Wing field created a set of rules and equipment for the game, and he called it "Sphairistike". The game quickly became popular, and it was renamed "lawn tennis" in 1874. The first lawn tennis tournament was held in 1877 at the All England Club in Wimbledon, England. Tennis became an Olympic sport in 1896. Today, tennis is a popular sport played by millions of people around the world. **Fundamental Skills of Tennis** Grip: The grip is the most important fundamental skill in tennis. It allows you to control the racket and hit the ball with power and accuracy. There are many different grips, but the most common are the forehand grip and the backhand grip. Footwork: Footwork is essential for moving around the court and positioning yourself to hit the ball. There are many different footwork drills that you can practice to improve your footwork. Racket control: Racket control is the ability to hit the ball with power and accuracy. It is important to practice hitting the ball in different directions and with different levels of power. Timing: Timing is the ability to hit the ball at the right time. It is important to practice hitting the ball at the peak of its flight. Stamina: Stamina is essential for tennis, as it is a physically demanding sport. You need to be able to run, jump, and hit the ball for long periods of time.	
8	**Fencing** **History of Fencing** The earliest evidence of fencing dates back to ancient Egypt, Greece, and Rome. Fencing was used as a form of training for warfare and as a way to settle disputes. The modern sport of fencing developed in Italy in the 15th century. The first fencing competition was held in 1550 in Paris. Fencing became an Olympic sport in 1896, and it has been a part of every Games since then. Fencing is now a popular sport all over the world, and there are three main disciplines: foil, épée, and sabre. **Fundamental Skills of Fencing**	

	Footwork: Footwork is essential in fencing, as it allows you to move quickly and efficiently around the piste. There are many different footwork drills that you can practice to improve your footwork. Bladework: Bladework is the ability to use the sword effectively. There are many different bladework techniques, and you need to practice them in order to become proficient. Parrying: Parrying is the ability to deflect an opponent's attack. There are many different parrying techniques, and you need to practice them in order to become proficient. Riposte: The riposte is the counterattack that follows a parry. It is an important skill in fencing, as it allows you to score points. Mental Focus: Mental focus is also an important skill in fencing, as it allows you to stay focused on the opponent and to avoid making mistakes.	
9	**Athletics** **History of Athletics** The history of athletics can be traced back to the ancient Olympic Games, which were held in Greece from 776 BC to 393 AD. The original events included running, jumping, throwing, and wrestling. The modern Olympic Games were revived in 1896, and athletics has been a part of every Games since then. Athletics is now a global sport, with competitions held at all levels, from local to international. **Fundamental Skills of Athletics** Running: Running is the most basic skill in athletics. It is the ability to move forward quickly and efficiently. There are many different types of running, including sprinting, distance running, and middle-distance running. Jumping: Jumping is the ability to move upwards from the ground. There are many different types of jumping, including high jump, long jump, and triple jump. Throwing: Throwing is the ability to propel an object through the air. There are many different types of throwing, including shot put, discus throw, javelin throw, and hammer throw. Sprinting: Sprinting is a type of running that involves short bursts of speed. Sprinters need to be able to accelerate quickly and maintain their speed for a short period of time. Distance Running: Distance running is a type of running that involves running for long distances. Distance runners need to be able to pace themselves and maintain their energy levels for long periods of time. Middle-Distance Running: Middle-distance running is a type of running that involves running for distances between 800 meters and 1500 meters. Middle-distance runners need to be able to combine speed and endurance. High Jump: High jumping is a type of jumping that involves clearing a bar that is raised progressively higher. High jumpers need to be able to generate a lot of power in their legs and have good timing. Long Jump: Long jumping is a type of jumping that involves jumping as far as possible. Long jumpers need to have good speed and coordination. Triple Jump: Triple jumping is a type of jumping that involves jumping three times in a row. Triple jumpers need to have good speed, coordination, and power. Shot Put: Shot put is a type of throwing that involves throwing a heavy ball as far as possible. Shot putters need to have good upper body strength and technique.	

	Discus Throw: Discus throw is a type of throwing that involves throwing a disc as far as possible. Discus throwers need to have good upper body strength and technique. Javelin Throw: Javelin throw is a type of throwing that involves throwing a spear as far as possible. Javelin throwers need to have good upper body strength and technique. Hammer Throw: Hammer throw is a type of throwing that involves throwing a heavy ball on a chain as far as possible. Hammer throwers need to have good upper body strength and technique.	
10	**Kho-Kho** **History of Kho-Kho** Kho-Kho is a tag game that originated in India. It is believed to have originated in the Indian subcontinent over 4,000 years ago. The game is mentioned in the Sangam literature of Tamil Nadu, which dates back to the 3rd century BC. Kho-Kho was first played as a competitive sport in the Indian Olympic Games in 1938. It was included as a demonstration sport at the 1982 Asian Games in Delhi, and it became a full medal sport in the 1990 Asian Games in Beijing. Kho-Kho is now played in over 100 countries around the world. **Fundamental Skills of Kho-Kho** Touch: Touching an opponent is the most important skill in Kho-Kho. It is how raiders score points for their team. There are many different ways to touch an opponent, such as touching their arm, leg, or torso. Dive: Diving is a fundamental skill for all Kho-Kho players. It allows players to avoid being touched by the opponents. There are many different types of dives, such as front dive, side dive, and back dive. Stamina: Stamina is essential for all Kho-Kho players, as the game is very physically demanding. Players need to be able to run, jump, and dive for long periods of time. Agility: Agility is also important for Kho-Kho players, as they need to be able to change direction quickly and avoid being touched by the opponents. Teamwork: Teamwork is essential for Kho-Kho, as it is a team sport. Players need to be able to work together to score points and defend their territory.	
11	**Cricket** **History of Cricket** The history of cricket can be traced back to the 16th century in England. The game is believed to have originated from a game called "stoolball", which was played by children in the 15th century. The first recorded cricket match was played in 1611 between two teams of Kentish cricketers. Cricket became a popular sport in England during the 18th century, and it was first played in Australia in 1826. Cricket became an international sport in the 19th century, and the first Test match was played between England and Australia in 1877. Cricket is now played in over 100 countries around the world. **Fundamental Skills of Cricket** Batting: Batting is the act of hitting the ball with a bat. It is the most important skill in cricket, as it is how runs are scored. There are many different batting techniques, such as the defensive technique and the attacking technique.	

	Bowling: Bowling is the act of delivering the ball to the batsman. There are many different bowling techniques, such as the fast bowling technique and the spin bowling technique. Fielding: Fielding is the act of catching the ball and preventing the batsman from scoring runs. It is an important skill for all cricketers, as it helps to prevent the other team from scoring runs. Running: Running is essential for scoring runs in cricket. Players need to be able to run quickly between the wickets to score runs. Stamina: Stamina is essential for all cricketers, as the game is very physically demanding. Players need to be able to run, jump, and field for long periods of time. Agility: Agility is also important for cricketers, as they need to be able to change direction quickly and avoid being run out. Teamwork: Teamwork is essential for cricket, as it is a team sport. Players need to be able to work together to score runs and prevent the other team from scoring runs.	
12	**Rifle Shooting** **History of Rifle Shooting** The history of rifle shooting can be traced back to the 16th century in Europe. The first recorded rifle shooting competition was held in 1533 in Zurich, Switzerland. Rifle shooting became a popular sport in Europe during the 18th century, and it was first introduced to the United States in the 1770s. Rifle shooting became an Olympic sport in 1896, and it has been a part of every Games since then. Rifle shooting is now a popular sport all over the world. **Fundamental Skills of Rifle Shooting** Accuracy: Accuracy is the most important skill in rifle shooting. It is the ability to hit the target with the bullet. There are many different factors that affect accuracy, such as the stance, the grip, the breathing, and the trigger control. Consistency: Consistency is also important in rifle shooting. It is the ability to hit the target with the same accuracy shot after shot. There are many different factors that affect consistency, such as the mental focus and the physical preparation. Stance: The stance is the position of the body when shooting. It is important to have a stable stance in order to be accurate. There are many different stances that can be used, such as the standing stance, the kneeling stance, and the prone stance. Grip: The grip is the way that the rifle is held. It is important to have a firm grip in order to be accurate. There are many different grips that can be used, such as the weaver grip and the isosceles grip. Breathing: Breathing is important in rifle shooting because it can affect the accuracy of the shot. It is important to breathe slowly and evenly before and after the shot. Trigger Control: Trigger control is the ability to pull the trigger smoothly and evenly. It is important to avoid jerking the trigger, as this can cause the shot to go off target.	
13	**Yoga** **History of Yoga** Yoga is a mind and body practice with a 5,000-year history in ancient Indian philosophy.	

	The word "yoga" comes from the Sanskrit word "yuj," which means "to yoke" or "to unite." Yoga is a system of physical postures, breathing exercises, and meditation designed to help practitioners achieve physical, mental, and spiritual well-being. The earliest written records of yoga date back to the 2nd century BCE, and the practice has been evolving ever since. Yoga has spread to all corners of the world, and there are now many different styles of yoga practiced today. **Fundamental Skills of Yoga** Postures: The postures, or asanas, are the physical component of yoga. There are many different postures, and they can be practiced in a variety of ways. Breathing: Breathing, or pranayama, is an important part of yoga. There are many different breathing techniques, and they can be used to help relax the body and mind. Meditation: Meditation is the mental component of yoga. There are many different meditation techniques, and they can be used to help focus the mind and achieve a state of peace.	
14	**Swimming** **History of Swimming** Swimming is one of the oldest sports in the world, with evidence of swimming dating back to 2500 BC. The earliest recorded swimming competitions were held in ancient Greece and Rome. Swimming became an Olympic sport in 1896, and it has been a part of every Game since then. Swimming is now a popular sport all over the world, and there are many different types of swimming, including freestyle, backstroke, breaststroke, butterfly, and individual medley. **Fundamental Skills of Swimming** Breathing: Breathing is one of the most important skills in swimming. It is important to be able to breathe efficiently while swimming in order to avoid getting tired. Body Position: Body position is another important skill in swimming. It is important to maintain a good body position in order to be hydrodynamic and to swim efficiently. Stroke Technique: Stroke technique is the way that the arms and legs are used to propel the body through the water. There are many different stroke techniques, and it is important to develop a good stroke technique in order to swim efficiently. Drills: Drills are exercises that can be used to improve swimming skills. There are many different drills, and they can be used to improve different aspects of swimming, such as breathing, body position, and stroke technique. Mental Toughness: Mental toughness is also an important skill in swimming. It is important to be able to stay focused and motivated during long swims, especially in competitions.	

Semester –II

Course Code: APS21BSL103 **Course Name:** Linear Algebra and Differential Equations **Course Category:**

Credits: 4 **Teaching scheme:** L-4 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Pre-university mathematics.

Course Objectives:

1. This course aims to make the students become familiar with the basic concepts of linear algebra with a thorough understanding of vector spaces, linear transformations and matrix operations enhancing the students' ability to reason mathematically and able to apply this knowledge to many fields in engineering, statistics and computer science.

2. Create and analyze mathematical models using differential equations.

Course Outcomes:

On completion of the course, the student should be able to:

1. Understand basic concepts such as vector spaces, linear dependence / independence of vectors, basis and linear maps.

2. Analyze and calculate eigen values, eigen vectors, rank nullity of a matrix / linear map.

3. Prove theorems, apply Gram-Schmidt process on inner product spaces, diagonalize special matrices.

4. Solve ordinary differential equations of first order and apply knowledge of differential of equations to solve engineering problems.

5. Find the solution of linear differential equations having their applications in mechanical and electrical systems.

Contents:

Unit	Content	Teaching Hours
1	**Matrices and Vector Spaces:** Basic properties of matrices, row operations and Gauss elimination, Inverse of a matrix. Basic concepts in linear algebra: vector spaces, subspaces, linear independence and dependence of vectors, bases, dimensions. Row and Column spaces, rank. Applications to systems of linear equations, Inverse transformation.	10
2	**Linear mappings and Diagonalization:** Linear mappings, representation by matrices, rank-nullity theorem, Diagonaliazation, Eigen values, Eigen vectors and their basic properties, Cayley Hamilton Theorem.	10
3	**Inner Product Spaces and Quadratic Forms:** Inner Product Spaces , Orthogonality, Gram-Schmidt process, Geometric Applications of Linear Transformation, Quadratic Forms: Positive Definiteness and applications	10
4	**First order ordinary differential equations and Applications:**	10

	Exact , Linear ,Bernoulli and separable differential equations, Applications to Population growth/decay, Mixing problems, Draining tank/Torricelli's Law problems, Newton's Law of Cooling, Electric circuits, Falling bodies.	
5	**Ordinary differential equations of higher orders and Applications:** Linear differential equations with constant and variable coefficients, method of variation of parameters, Applications to mass spring systems and electrical circuits and Bending of beam and columns.	10

Text Books:

1. Introduction to Linear Algebra (2nd edition) by Serge Lang, Springer

2. Elementary Linear Algebra (10th edition) by Howard Anton and Chris Rorres, John Wiley and sons.

3. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

4. S. L. Ross, Differential Equations, 3rd Edition, Wiley India, 1984.

Reference Books:

1. Shanti Narayan, Differential Calculus, S. Chand & Co.

2. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, New York.

3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, New Delhi.

4. P. N. Wartikar, J. N. Wartikar, Applied Mathematics (Vol I & II) , Pune Vidyarthi Griha Prakashan, Pune.

5. Differential Equations with Applications and Historical notes by George Simmons, Tata McGraw Hill publishing company Ltd, New Delhi

6. K.D Joshi, Calculus for Scientists and Engineers, CRC Press.

7. Prasad and Reena Garg, Advanced Engineering Mathematics, Khanna Publishing Company Private Limited, New Delhi.

8. Schaum's outlines of Linear Algebra (5th edition) by Seymour Lipschutz, Marc Lipson, McGraw-Hill Education (India) Private Limited, New Delhi

Course Code: APS21BSL104 **Course Name:** Engineering Chemistry **Course Category:**

Credits: 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–40, MSE-20, ESE–40

Pre-requisites: Fundamentals of basic chemistry.

Course Objectives:

1. The primary objective of an engineering chemistry course is to familiarize the students with new developments in engineering chemistry.
2. To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
3. The objectives of the laboratory sessions are to enable the learners to get hands-on experience on the principles discussed in theory sessions and to recognize the applications of these concepts in engineering.

Course Outcomes:

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

CO.1 : Illustrate the water quality parameters, water softening processes and causes of hard water in industries.

CO.2 : Demonstrate a comprehensive understanding of advanced concepts in polymer chemistry.

CO.3 : Apply fundamental concepts of corrosion science to solve problems arising in engineering applications.

CO.4 : Interpret physical, chemical properties and applications of fuels and lubricants.

CO.5 Describe the functions of batteries and applications of modern instrumental techniques like conductometry, pH metry, TLC, gas chromatography, UV-Visible and IR spectroscopy.

Contents:

Unit	Content	Teaching Hours
1	**Water Treatment:** Natural sources of water, Impurities in water, Water quality parameters and its BIS standards, Hardness- Definition, Types, Estimation of hardness by EDTA method, Numerical based on hardness calculation, Disadvantages of hard water, Boiler troubles (causes, effect on boiler operation and methods of prevention), Internal and external treatments, Alkalinity and its determination, Water softening: Ion exchange process, Sewage water analysis- Dissolved oxygen (DO) and its determination, Biological oxygen demand (BOD), Chemical oxygen demand (COD) and their significance, Sewage water treatment.	09
2	**Polymer Chemistry:** Introduction, Classification of polymers, Use and disposal of polymers, Polymerization and its types, Plastics and its types- Thermoplastic and thermosetting plastics, Preparation, properties and engineering applications of: PVC, PMMA, Bakelite and Epoxy resin, Moulding constituents of plastics,	08

	Methods for moulding of plastics into articles, Conducting polymers and Biopolymers (Introduction, types, examples and its applications.	
3	**Corrosion and its Control:** Introduction, Types of corrosion, Mechanism of dry & wet corrosion, Factors influencing on corrosion – Nature of metal &Nature of environment. Methods of corrosion control, Cathodic and anodic protection, Use of Inhibitors, Protective Coatings: a) Metallic coatings: Types of coatings methods of applications, (hot dipping, cladding and electroplating), b) Nonmetallic coatings: Chemical conversion coatings, Powder coatings.	08
4	**Fuels and Lubricants:** **Fuels:** Introduction, Classification of fuel, Calorific value of a fuel, Characteristics of a good fuel, Solid fuel- Coal, Various types of Coal, Analysis of coal- Proximate and Ultimate analysis, Numerical based on analysis of coals, Liquid fuel- Refining of Petroleum, Gaseous fuels- LPG and CNG. **Lubricants**: Introduction, Mechanism of lubrication, Classification of lubricants, Solid, Semi-solid and Liquid Lubricants, Properties of lubricants, Physical properties – Viscosity & Viscosity index, Surface tension, Flash and Fire point, Cloud and pour point. Chemical properties – Acid value, Saponification value, Aniline point.	10
5	**Electrochemistry and Instrumental Methods of Chemical Analysis**: **Electrochemistry**: Introduction - Basic concepts: Conductance, Specific Conductance, Equivalent conductance, Molecular conductance, Effect of dilution on conductance, Cell constant. Battery: Primary & secondary batteries, Ni-Cd cell, Lithium-air battery, Fuel cell- H_2-O_2 Cell. **Instrumental Methods of Chemical Analysis**: Basic principle, instrumentation and applications of pH metry, Conductometry, Thin layer chromatography, Gas Chromatography, Ultraviolet-Visible spectroscopy and Infra-Red Spectroscopy	10

Text Books:

1. Jain P.C & Jain Monica, Engineering Chemistry, Dhanpat Rai & Sons, Delhi.
2. O. G. Palanna , Engineering Chemistry, Tata McGraw-Hill Publication, New Delhi.
3. S. S. Dara, A textbook of Engineering Chemistry, McGraw-Hill Publication, New Delhi.
4. Shashi Chawla, Engineering Chemistry, Dhanpat Rai and Co Education and Technical Publishers.
5. Shikha Agrawal, Engineering Chemistry- Fundamentals and Applications, Cambridge Publishers

Reference Books:

1. Barrow G.M., Physical Chemistry, McGraw-Hill Publication, New Delhi.
2. Atkins, Physical Chemistry, OUP Oxford.
3. Bhal & Tuli, Text book of Physical Chemistry, S. Chand & Company, New Delhi.
4. V. R Gowarikar, Polymer Science, New Age International Ltd.
5. B. K. Sharma, Instrumental Methods of Chemical Analysis, Krishna Prakashan Medi
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E-Resources:

Name of the website/ E-Journals/ Online Videos

1. NPTEL Basic Courses Engineering Chemistry (https://nptel.ac.in/courses/122/101/122101001/)
2. https://www.ncertbooks.guru/engineering-chemistry/

3. Coursera Chemistry Courses (https://www.coursera.org/browse/physical-science-and-engineering/chemistry?languages=en&page=2)
4. "Introduction to Polymer Physics" NPTEL Course (https://www.youtube.com/playlist?list=PLwdnzlV3ogoXe67WsgE8f1fOIWcc5GKKS)
5. "Introduction to Corrosion" NPTEL Course (https://www.youtube.com/playlist?list=PL8lylDWRkaW8BXestE4baRnN0699S11Lq)
6. "Tribology & Lubrication" NPTEL Course (https://www.youtube.com/playlist?list=PLLwnvFq-JAltJvWAfEVU4gcUK27hEA7FD)
7. "Electrochemistry" NPTEL Course (https://www.youtube.com/playlist?list=PLVFqK_9GOGXnnriQpsn0z1Rss96Rh0vsm)
8. "Modern Instrumental Methods of Analysis" NPTEL Course (https://www.youtube.com/playlist?list=PL400CAFBA72E94CF8)

Course Code: APS21ESL103 **Course Name:** Engineering Mechanics **Course Category:**

Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites:

1. Coordinate Geometry, Trigonometry, Sine & Cosine Rule, Unit Conversions
2. Fundamentals of Physics

Course Objectives:

To develop capacity to predict the effect of force and motion in the course of carrying out the design functions of engineering.

Course Outcomes:

Students are able to,

CO1.Identify the force system for given conditions by applying the basics of mechanics.

CO2. Determine the unknown forces of different engineering systems by applying equilibrium conditions.

CO3. Apply the principles of friction and to locate Center of Gravity and find Moment of Inertia of plane lamina.

CO4.Establish the relations between kinematic parameters for different types of motion.

CO5.Formulate the relevant equations for types of motion in kinetics.

Contents:

Unit	Content	Teaching Hours
1	**Force System**: Introduction to Mechanics, Laws of mechanics, Newton's Laws, Law of Parallelogram, Law of transmissibility, Characteristics of force, System of Forces, Method of resolution and composition moment of a force, Law of Moments, Varignon's Theorem, Problems on moment, Resultant, Equivalent force& couple,properties of couple	08
2	**Equilibrium:** Introduction to Equilibrium and its types, Equilibrant, Concept of FBD,Analytical conditions of equilibrium, Equilibrium of different force system, Lami's Theorem, Types of loads, beams and supports.	07
3	**Friction, Centre of Gravity and Moment of Inertia:** Friction: Introduction to friction, types and application, Laws of friction, Angle of friction, Angle of repose, Cone of friction, Problems on horizontal & inclined plane, block, and ladder. CG & MI: Centroid of regular and composite plane lamina, MI and its application, Perpendicular axis Theorem, Parallel Axis Theorem, Radius of Gyration, Problems on plane and composite lamina.	08
4	**Kinematics:** Introduction and classification of dynamics, motion and its classification,	04

	Rectilinear Motion, Equation of Motion, Motion curves, Curvilinear Motion, rectangular and tangential components of acceleration, Projectile Motion: General Equation of Projectile Motion	
5	**Kinetics**: Basic concepts and laws of motion, D'Alemberts Principle, Problems on rectilinear motion, Curvilinear motion, Work Energy Principle, Work Done by force, Work Done by weight force, Work Done by frictional force, Work Done by spring force, Kinetic and Potential energy of the particle, Problems on all cases of Work Done, Principle of Impulse and Momentum, Principle of Conservation Momentum, Impact and its types, Coefficient of restitution, Problems on impact, Problems on impulse and momentum, Kinetics of rigid body problems.	03

Text Books:

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers (In SI Units): Statics and Dynamics", 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004).
2. Vela Murali, "Engineering Mechanics", Oxford University Press (2010).
3. S. Timoshenko, D. H. Young, "Engineering Mechanics", McGraw Hill, 1995.
4. Tayal A. K., "Engineering Mechanics", Umesh Publications, 2010.
5. Singer F. L., "Engineering Mechanics - Statics & Dynamics", Harper and Row Pub. York.
6. Khurmi R. S., "Engineering Mechanics", S. Chand Publications, N. Delhi.

Reference Books:

1. McLean, Nelson,"Engineering Mechanics",Schaum's outline Series,McGraw Hill Book Company, N. Delhi,Publication.
2. Hibbeller, R.C and Ashok Gupta, "Engineering Mechanics: Statics and Dynamics", 11thEdition,Pearson Education (2010).
3. Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P)Limited Publishers, (1998).
4. Irving H. Shames and Krishna Mohana Rao. G., "Engineering Mechanics – Statics and Dynamics",4th Edition, Pearson Education (2006).
5. RajasekaranSandSankarasubramanianG.,"EngineeringMechanicsStaticsandDynamics",3rdEdition,VikasPublishingHousePvt. Ltd., (2005).
6. Meriam J.L. and Kraige L.G., " Engineering Mechanics- Statics - Volume 1, Dynamics- Volume 2",Third Edition, John Wiley & Sons,(1993).
7. Kumar, K.L., "Engineering Mechanics", 3rd Revised Edition, Tata McGraw-Hill Publishing company, New Delhi (2008).

General Instructions:

E-Resources :

1. www.nptel.ac.in (Learning platform from IIT professors)
2. http://www.asnu.com.au (For Engineering applications)
3. www.discoveryforengineers.com (Investigating Discoveries)

Course Code: APS21ESL104 **Course Name:** Building Programming logic in C **Course Category:**

Credits: 1 **Teaching scheme:** L-1 **Evaluation scheme:** CA–60, ESE–20

Pre-requisites: Pre-university mathematics.

Course Objectives:

1. The primary objective of an engineering chemistry course is to familiarize the students with new developments in engineering chemistry.
2. To impart a sound knowledge on the principles of chemistry involving the different application oriented topics required for all engineering branches.
3. The objectives of the laboratory sessions are to enable the learners to get hands-on experience on the principles discussed in theory sessions and to recognize the applications of these concepts in engineering.

Course Outcomes:

After the completion of this course, students will be able to:
CO1: Illustrate and explain the basic computer concepts and programming principles of C language.
CO2: Develop C programs to solve simple mathematical and decision making problems.
CO3: Develop C programs to solve simple engineering problems using looping constructs.
CO4: Develop C programs to demonstrate the applications of derived data types such as arrays, pointers, strings and functions.

Contents:

Unit	Content	Teaching Hours
1	**Introduction To C Programming:** **Fundamentals of C Programming: Overview of C:** History of'C, Algorithm and Structure of C program. Keywords, Tokens, Data types, Constants, Literals and Variables. **Operators and Expressions:** Arithmetic operators, Relational operator, Logical operators, Expressions, Operator: operator precedence and associatively, Type casting, Console FO formatting, Unformatted I/O functions: getch(), getchar, getche(), getc(), putc(), putchar().	03
2	**Array and String:** **Control statements:** If-else, conditional operators, switch and break, nested conditional branching statements, loops: do while, while, for, Nested loops, break and continue, goto and label, exit function. **Array:** Array declaration, One and Two dimensional numeric and character arrays, Multidimensional arrays, operations on array. **String:** String declaration, initialization, string manipulation with/without using library function.	03
3	**Control Statements and Functions:**	03

	Functions: Definition, function components: Function arguments, return value, function call statement, function prototype, Types of function, Scope and lifetime of variable, Call by value,and call by reference. Function using arrays, function with command line argument. User defined function: maths and character functions, Recursive function.	
4	**Structure and Union:** **Structure:** Basics, declaring structure and structure variable, typedef statement, array of structure, array within structure, Nested structure; passing structure to function, function returning structure. **Union:** basics, declaring union and union variable, Difference between Structure and Union **Enum:** declaring enum and enum variable.	03
5	**Pointers**: **Pointer:** Definition of pointer, advantage and disadvantage using pointer, Pointer declaration, Using & and * operators. Void pointer, Pointer to pointer, Pointer in math expression, Pointer arithmetic, Pointer comparison, **Dynamic memory allocation functions**: malloc, calloc, realloc and free, Pointer vs. Array, Array of pointer, Pointer to array, Pointers to function, Function returning pointer, Passing function as Argument to function, Pointer to structure, Dynamic array of structure through pointer to structure.	03

Text Books:

1. Programming in ANSI C, E Balagurusamy, Tata McGraw-Hill, Third Edition.

2. Let Us C, YashwantKanetkar, Infinity Science Press, Eighth Edition.

3. Mastering C, K R Venugopa1,Tata McGraw-Hill.

Reference Books:

1. The C Programming Language, Brian W. Kernighan, Dennis M. Ritchie, Prentice Hall, 2nd Edition.
5.Applications Programming in ANSI C, R. Johnsonbaugh , Martin Kalin, Macmillan, 2nd Edition.

2. The Spirit of C, Mullish Cooper, Jaico publishing House.

3. How to solve it by Computer, R.G.Dromey, Pearson Education.

Course Code: APS21PCL101 **Course Name:** Basics of Electrical and Electronics Engineering
Course Category:

Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Pre-university mathematics.

Course Objectives:

1. Understand Electrical circuits and classify circuits as per laws.
2. Understand Magnetic circuits and apply them in transformer devices.
3. Understand the working principle of semiconductor devices.
4. Understand the basics and applications of digital electronics.

Course Outcomes:

After completion of this course, students will be able to:

1. Solve simple DC and single-phase AC circuits using KCL, KVL and network theorems.
2. Explain fundamentals of magnetic circuit and transformers.
3. Explain the working of diodes and transistors.
4. Explain the importance of number systems and logic gates.

Contents:

Unit	Content	Teaching Hours
1	**Electrical Circuits:** Voltage and current sources: independent, dependent, ideal and practical; V-I relationships of resistor, inductor, mutual inductor and capacitor; Kirchhoff's laws, mesh and nodal analysis, superposition, Thevenin's, maximum power transfer theorems. Alternating voltages and currents, RMS, average, maximum values, Single Phase RL, RC, RLC series circuits, Power in AC circuits, Power Factor, Three phase balanced systems.	08
2	**Magnetic Circuits & Transformer:** Concepts of m.m.f, flux, flux density, reluctance, permeability and field strength, their units and relationship, right hand thumb rule and cork screw rule, Faraday's law of electromagnetic induction, Fleming's right-hand rule, statically and dynamically induced EMF's self and mutual inductance coefficient of coupling, energy stored in magnetic circuit, Single phase transformers: Construction, principle of working, e.m.f. equations.	08
3	**Semiconductor Devices:** Introduction to Semiconductors, P-type and N-type Semiconductors, P-N	07

	Junction Diode: Construction and working, V-I characteristics of Diode, Reverse breakdown mechanism. Special purpose diodes: Zener Diode, Light Emitting Diode (LED) and PhotoDiode - Construction, working and applications. Bipolar Junction Transistor (BJT): types, construction and regions of operation.	
4	**Digital Electronics:** Binary, Decimal, Octal, Hexadecimal number systems and their inter-conversion, Binary Addition, Binary Subtraction, One's complement, Two's complement, Logic Gates: Basic, Universal and Special. Boolean Laws (AND, OR, NOT) and Demorgan's theorems, Realization of basic logic gates using universal gates.	07

TEXT BOOKS:

1. V. N. Mittal and Arvind Mittal, "Basic Electrical Engineering" McGraw Hill
2. Edward Hughes, "Electrical Technology,", Pearson Education
3. Electrical Technology Vol.1 & Vol.4 by B. L. Theraja & A. K. Theraja, S. Chand Publications
4. "Principles of Electronics", V.K. Mehta, S.Chand Publications.
5. "Electronics Devices and Circuits", S Salivahanan, McGraw Hill Publications.
6. "Modern Digital Electronics", R.P. Jain, McGraw Hill Publications.

REFERENCE BOOKS:

1. Vincent Del Toro, "Electrical engineering Fundamentals", PHI second edition 2011
2. Robert Boylestad, "Electronics Devices and Circuits Theory", Pearson Education India
3. "Electronics Devices and Circuits Theory", Robert Boylestad, Pearson Education India.

E-Resources:

1. Online course on NPTEL "Basic Electrical Engineering"
2. NPTEL Course on "Introduction to Basic Electronics", Prof. T.S. Natarajan, IIT Madras.
3. NPTEL Course on "Digital Electronic Circuits", Prof. Goutam Saha, IIT Kharagpur.

Course Code: APS21IKL1XX **Course Name:** Indian Knowledge Systems **Course Category:**

Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Nil

Course Objectives:
The objective of this course is
1. To make students understand foundational concepts in IKS for science, engineering and technology.
2. To explore ancient Indian pursuits and accomplishments in the various domains of engineering

Course Outcomes:
On completion of the course, the student should be able to:
CO 1: familiarise with key components of the IKS & develop appreciation for Indian philosophical systems.
CO 2: understand key features of Indian Numeral System, units of measurement and the framework for establishing the right knowledge.
CO 3:appreciate the unique & specific contributions of ancient Indian mathematicians in Arithmetic, Geometry & Trigonometry.
CO 4:develop awareness about engineering & technology heritage of India and understand ancient Indian contributions in various engineering domains.

Contents:

Unit	Content	Teaching Hours
1	**Introduction to IKS:** Importance of ancient knowledge, defining IKS, Classification framework for IKS, Historicity of IKS, Indian philosophical systems, Vedic schools of philosophy(Sankhy and yoga, Nyaya and Vaisesika, Purva- Mimamsa and Vedanta), Non- Vedic philosophical systems (Jain, Bauddha and Carvaka) , Wisdom through the ages: Issues of interest in the Puranas, Itihasa as a source of wisdom (Uniqueness of the two epics), Nitisastras.	08
2	**Foundational Concepts for Science and Technology:** Number system in India, salient features of the Indian numeral system, Measurements for Time, Distance and weight, The knowledge triangle, Prameya- a Vaisesikan approach to Physical Reality, Pramana – The means of valid knowledge, Framework for establishing valid knowledge.	07
3	**Science in IKS:** Mathematics: Great mathematicians and their contributions, Arithmetic (square of a number, square root, series and progressions), Geometry (Property of right angled triangle in Sulba- sutras, value of π), Trigonometry, Algebra, Binary Mathematics and combinatorial problems in Chandah- Sastra of Pingala	07
4	**Engineering and Technology in IKS:** The Indian Science and Technology Heritage, Mining and ore extraction, Metals and metal working technology, Iron and Steel in India, Lost wax casting of idols and artefacts, apparatuses used for extraction of metallic components.	08

	Literary sources for Science and Technology, Physical Structures in India, Irrigation & Water Management, Dyes and Painting Technology, Shipbuilding.	

Textbooks:

- Mahadevan B.,Bhat Vinayak Rajat & Nagendra Pavana R.N. "Introduction to Indian Knowledge System Concepts and Applications"PHI,2023.
- Jha Amit "Traditional Knowledge System in India" Atlantic Publishers and Distributors (P) Ltd,2023
- Chauhan Bhag Chand "IKS: The Knowledge system of Bharata" Garuda Prakashan,2023
- Bag A.K., "Mathematics in Ancient and Medieval India" Chaukhambha Orientalia, 1979
- Sengupta Nirmal,"Traditional Knowledge in Modern India"Springer,2019

Reference Books:

- Bag A.K., "Historyof Technology in India,Vol.I" Indian National Science Academy,1997
- Kumar Alok, "Ancient Hindu Science" Jaico Publishing House,2019
- Datta B and Singh A.N."History of Hindu Mathematics:Parts I and II" Asia Publishing House,1962
- Kapoor Kapil, Singh Awdhesh Kumar "Indian Knowlege Systems Vol.-I & II" D.K. Print World Ltd,2005

E-Resources:

https://www.youtube.com/watch?v=-cBd6JYPWtY&list=PLRfu94TCePTtWtu0x145H_63WgoeYickE
https://www.youtube.com/watch?v=yvj5ROYbP2E&list=PLRfu94TCePTtLuEYSzmJXNYK_EnDSvY3N
https://iksindia.org/book-list.php

Course Code: APS21VSP102 **Course Name:** Workshop Practices **Course Category:**

Credits: 2 **Teaching scheme:** L-4 **Evaluation scheme:** CA–60, ESE–40

Pre-requisites: Pre-university English.

Course Objectives:

1.To know about the different carpentry tools and perform various carpentry operations to complete the job.

2. To understand different welding tools, joints, defects and perform welding operation to complete useful article/job.

3. To learn various types of pipes, plumbing tools, operations and perform thread cutting on GI pipes.

4. To know different sheet metal tools, operations, applications and perform various operations to complete job.

Course Outcomes:

On completion of the course, the student should be able to:

1. Perform basic carpentry operation on wood and prepare carpentry article.

2. Perform welding processes and prepare welding article by performing various welding operations.

3. Use plumbing tools, processes and perform threading on GI pipe.

4. Use sheet metal tools, processes and prepare sheet metal article.

Contents:

Unit	Content	Teaching Hours
1	**Carpentry Shop:** Carpentry shop: Types of woods, tools, joints, operations, applications, safety measures etc. Job: Exercises on wood involving operations marking, sawing, chiselling, planning, grooving etc to make useful wooden article/ job e.g. Wooden Trophies, Showpiece articles, Stools etc.	08
2	**Welding Shop:** Welding Shop: Types of welding, welding joints, tools, welding defects, applications, safety measures etc. Job: Exercise in Arc welding to make useful articles like Grills, Stools, Tree Guards, Flower pot stand, Shoe rack, Bag Stand, Showpiece Articles from Scrap etc.	07
3	**Plumbing Shop:** Plumbing shop: Study of types of pipe, pipe joints, operations, applications, safety measures etc. Job: Prepare threading on GI pipe to make useful items like Nipple, Pipe joints etc.	07
4	**Sheet Metal Shop:**	08

	Sheet Metal Shop: Sheet metal tools, operations, applications, safety measures etc. Job: Making an utility item using G I sheet involving development, marking, cutting , bending, spot welding/riveting Parts like i) Tray, ii) Funnel etc.	

- **Termwork:** Students shall maintain workshop diary which contains Job Drawing, information of tools, operations required to complete the jobs, records of job completions etc.
- **End Semester Exam:** ESE will be viva-voce based on jobs prepared by the students during the term.

Text Books:

2. Hazra and Chaudhary, Workshop Technology-I, Media promoters & Publisher private limited.

3. Hazra and Chaudhary, Workshop Technology-II, Media promoters & Publisher private limited.

Reference Books:

1. K. C. John, Mechanical Workshop Practice, Prentice Hall Publication, New Delhi, 2010.

Course Code: APS21BSP102 **Course Name: Engineering Chemistry Lab Course Category:**

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:

Course Outcomes:
Upon completion of the Lab Experiments, the students should able to,

LO.1 **:** Perform the experiments as well as accurately record the readings and analyze the results of such experiments.

LO.2 : Estimate the impurities present in water using titrimetric and instrumental methods.

LO.3 : Employ the basic techniques used in chemistry laboratory for analysis such as volumetric titrations, complexometric titrations, Conductometry, pH metry, viscometer, Stalagmometer and TLC

Contents:

Sr. No.	List of Practical	Lab Hours
1	Determination of hardness of water sample by EDTA method.	02
2	Determination of chloride content in water sample by precipitation titration method.	02
3	Determination of dissolved oxygen in water by Iodometric method.	02
4	Determination of percentage purity of bleaching powder.	02
5	Determination of strength of acid / base using pH metric titration.	02
6	Determination of strength of acid / base using conductometric titration.	02
7	To determine the cell constant of the given conductivity cell.	02
8	To determine relative surface tension of unknown liquids by using stalagmometer.	02
9	To determine the viscosity of unknown liquids by using Ostwald / Redwood viscometer.	02
10	To determine acidity of given water sample.	02
11	Determination of acid value of an oil sample.	02
12	Determination of saponification number of an oil sample.	02
13	To determine alkalinity of given water sample.	02
14	Preparation of phenol- formaldehyde / urea-formaldehyde resin.	02

15	To find out the Rf value of given sample by thin layer chromatography.	02
16	To separate the given mixture using thin layer chromatography.	02
17	Proximate analysis of coal (moisture content, volatile matter, ash content).	02
18	To study factors influencing on rate of electrochemical corrosion.	02
19	To determine flash and fire point of given oil by Pensky-Marten flash point apparatus.	02
20	To determine cloud and pour point of lubricating oil.	02

Reference Books:

1. A Text book on Experiments and Calculations in Engineering Chemistry by Dr. S. S. Dara, S Chand Publication.
2. Laboratory manual on Engineering Chemistry by S. K. Bhasin & Sudha Rani, Dhanpat Rai Publishing Company.
3. Engineering Chemistry with Laboratory Experiments by M. S. Kaurav, Asia-Pacific the holdings Private Ltd.

Course Code: APS21ESP104 **Course Name:** Engineering Mechanics lab **Course Category:**

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:

Course Outcomes:
Upon completion of the Lab Experiments, the students should able to,
1.Describe the working principle of mechanics and correlate them with day to day engineering applications.
2.Formulate and solve mechanics problems based on law of moments, conditions of equilibrium.
3.Verify theoretical concepts through analytical, experimental and graphical methods.

Contents:

Sr. No.	List of Practical	Lab Hours
1	Verification of law of Machine using Screw jack	02
2	Polygon law of coplanar forces.	02
3	Bell crank lever	02
4	Lami's theorem	02
5	Support reactions for beam	02
6	Problems on beam reaction by graphics statics method	02
7	Inclined plane (to determine coefficient of friction).	02
8	Centroid of irregular shaped bodies	02
9	Determine center of gravity for composite sections	02
10	Determine moment of inertia for composite sections	02
11	Moment of Inertia of fly wheel	02
12	Simple / compound pendulum	02

References:

1. **"College of Engineering, Pune"**
2. **"University of Mumbai"**

Course Code: APS21ESP105 **Course Name:** Programming in C - LAB **Course Category:**

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives: Nil

Course Outcomes: Nil

Contents:

Sr. No.	List of Practical	Lab Hours
1	a) Write a C program to find sum and average of three numbers. b) Write a C program to find the sum of individual digits of a given positive integer.	02
2	a) Write a C program to generate the first n terms of the Fibonacci sequence b) Write a C program to generate prime numbers between 1 to n. c) Write a C program to check if the given number is Armstrong or not	02
3	a) Write a C program to check whether the given number is perfect or not b) Write a C program to check whether the given number is strong or not	02
4	a) Write a C program to find the roots of a quadratic equation. b) Write a C program perform arithmetic operations using switch statement.	02
5	a) Write a C program to find factorial of a given integer using non-recursive function b) Write a C program to find factorial of a given integer using recursive function	02
6	a) Write C program to find GCD of two integers by using recursive function. b) Write C program to find GCD of two integers by using non-recursive function.	02
7	a) Write a C program to find the largest and smallest number in a list of integers. b) Write a C program to Sort the Array in an Ascending Order. c) Write a C program to find whether the given matrix is symmetric or not.	02
8	a) Write a C program to perform addition of two matrices. b) Write a C program using function to perform multiplication of two matrices.	02
9	a) Write a c program to use function to insert a sub-string in to given main string from a given position. b) Write a c program to swap the values of two variables using (i) call by value (ii) call by reference	02
10	a) Write a C program using user-defined functions to determine whether the given string is palindrome or not. b) Write a C program that displays the position or index in the main string S where the sub string T begins, or - 1 if S doesn't contain T.	02

11	a) Write C program to count the number of lines, words and characters in a given text. b) Write a C program to find the sum of integer array elements using pointers.	02
12	a) Write a C Program to Calculate Total and Percentage marks of a student using structure.	02

Course Code: APS21PCP101 **Course Name:** Basics of Electrical and Electronics Engineering Lab
Course Category:

Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:

1. Understand the DC circuit as per KCL & KVL and AC circuits as per theorems.
2. Understand the working of a single-phase transformer.
3. Understand the working of electronic instruments, components and logic gates.
4. Understand the working of a PN junction diode.

Course Outcomes:

After completion of this lab, students will be able to:

1. Use of KCL & KVL to solve DC circuits as well as use of AC theorems to solve AC circuits.
2. Demonstrate a single-phase transformer & its working.
3. Use electronic instruments, working of electronic components and logics gates.
4. Use of PN Junction Diode and its applications.

Contents:

Sr. No.	List of Practical	Lab Hours
1	Verification of Loop Analysis and Nodal Analysis for DC Circuits.	02
2	Verification of Thevenin's Theorem for DC Circuits.	02
3	Verification of Maximum Power Transfer Theorem for DC Circuits.	02
4	Determination of Voltage, Current and Power Flow in Single Phase AC Circuit including R, L and C with Combination.	02
5	Determination of Magnetic Material Terms and EMF Induction.	02
6	Demonstration and Determination of Single-Phase Transformer Terms like Voltage Ratio and Turns Ratio.	02
7	Study of Electronic Instruments.	02
8	Study of Electronic Components.	02
9	Study of Logic Gates.	02
10	Study of V-I characteristics of a PN Junction Diode using V-Lab.	02
11	Study of Rectifier Circuits using Every Circuit simulation application.	02
12	Study of working and troubleshooting of Smartphone, Computer & TV (Case Study Approach).	02

Course Code: MGM82CCP104 **Course Name:** National Service Scheme (NSS) **Course Category:**

Credits: 2 **Teaching scheme:** P-2 **Evaluation scheme:**

Pre-requisites: Nil

Course Objectives: Nil

Course Outcomes: Nil

Contents:

Sr. No.	List of Practical	Lab Hours
1	**Introduction to National Service Scheme (NSS):** **Emergence of NSS in India (Historical Background) and its development.** Organizational Structure of National Service Scheme from National Level to College Level. Objectives of National Service Scheme (NSS) National Service Scheme (NSS) – Symbol and its meaning **Symbol of NSS and its meaning** Motto of National Service Scheme (NSS) Various prayers, inspirational songs to be used in NSS Programme.	08
2	**National Service Scheme (NSS) Regular Activities:** **Guidelines of Distribution of working hours or academic year.** **Classification of Regular Activities in the Society** ● Rural ● Urban ● Campus ● Need base with association **Associations in NSS Activities** ● Govt. Organization ● NGO Scope for Innovation (Self-Generated)	08
3	**Social Issues in India:** **Concept of Society, Community (Steps involved in evaluation of society)** ● Features of Indian Society ● Communities in India **Basic Social Issues in India** Family System, Division of labour, Cast System in India, Gender Issues, Regional Imbalance	07
4	**Indian Constitution and Social Justice:** **Indian Constitution** ● Preamble	07

	● Structure ● Features ● Fundamental Rights & Duties **Social Justice** ● Social Justice – the Concept and its features Contribution for Social Justice – Mahatma Jyotiba Phule, Dr. Babasaheb Ambedkar, Shahu Maharaj.	

References:

1. National Service Scheme Manual (Revised) 2006, Government of India, Ministry of Youth Affairs and Sports, New Delhi.
2. University of Mumbai National Service Scheme Manual 2009.
3. Avhan Chancellor's Brigade-NSS Wing, Training camp on Disaster Preparedness Guidelines, March 2012.
4. Rashtriya Seva YojanaSankalpana- Prof. Dr. SankayChakane, Dr. Pramod Pabrekar, Diamond Publication, Pune.
5. National Service Scheme Manual for NSS District Coordinators, National Service Scheme Cell, Dept. of Higher and Technical Education, Mantralaya,
6. Annual report of National Service Scheme (NSS) published by Dept. of Higher and Technical Education, Mantralaya,
7. NSS Cell, Dept. of Higher and Technical Education, Mantralaya, UTKARSHA- Socio and cultural guidelines.

Course Code: MGM73CCP203 **Course Name:** Fine Art **Course Category:**

Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:
The objective of this course is
- Students will be able to draw clean lines.
- Students will be able to explore shading from light to dark.
- Students will be able to draw perspective drawing.
- Students will be able to sketch landscape and portrait drawing.

Course Outcomes:
On completion of the course, the student should be able to:
- Students will be able to pay attention to core details in visualization.
- Students will be able to represent on paper what they have observed in terms of 3 and 2 dimensional objects and light and dark play of perspective.
- Students will be able to draw clean lines and neat figures which will gradually help them in fashion illustrations.

Contents:

Sr. No.	List of Practical	Lab Hours
1	**Introduction to Drawing:** ● Explore pencil as medium for drawing and exploration of different types of grade of pencils. ● Lines – Freeing hand movement by practicing various ways to draw lines (wavy/zigzag/diagonal/vertical/horizontal)	08
2	**3D objects with Shading:** ● Exploring and sketching 3D objects with Shading/Hatching – Light to Dark (HB/2B/3B/4B/5B/6B) ● Space Division – Studying of proportion, Perspectives- Coin / Box / Landscape.	07
3	**Sill Drawing:** ● Introduction to landscape and portrait drawing. ● Still drawing (perspective drawing of man- made object)	07
4	**Exploration of color mediums:** ● Exploration of color mediums (chalk/ink/poster/pastels/water) ● Landscape perspective of natural and man- made, charcoal rendering. ● Still drawing of man- made and natural object by rendering and defining perspective.Ambedkar, Shahu Maharaj.	08

Reference Books:
- Mellem , Jeff; Sketching people & Live drawing basics.
- Belleville- Van Stone, France; Sketch: the Non-Artist's guide to inspiration technique & drawing life

Course Code: MGM73CCP204 **Course Name:** Visual Art **Course Category:**

Credits: 2 **Teaching scheme:** P-4 **Evaluation scheme:** CA–30, ESE–20

Pre-requisites: Nil

Course Objectives:
The objective of this course is
- To understand the actual work process in advertising market.
- To understand the growth and necessity of advertising in market.

Course Outcomes:
On completion of the course, the student should be able to:
- Students will be able to choose a topic for campaign design.
- Students will understand that how campaign design is necessary
- Student will understand the actual work process in advertising market.
- Student will understand the process of designing.

Contents:

Sr. No.	List of Practical	Lab Hours
1	Introduction to Campaign Design**:** ● Topic for campaign design ● It should be either product, service or social topic. ● Mind mapping	08
2	**:** ● Different types of media ● New digital medias ● Use of elective subject in campaign ● Software use in designing	11
3	**Sill Drawing:** ● Final layout ● Printing in actual size media ● Presentation on ppt of the topic includes artwork with rough work.	11

Reference Books:
- **Advertising Campaign Design Just the Essentials - By Robyn Blakeman**
- **Campaign Strategies and Message Design: A Practitioner's Guide from Start to Finish - by Mary Moffitt (Author)**
- **Student should refer the previous knowledge about medias and refer the internet for help.**

Suggested Tutorial / Practical:

Assignment I: Students will be required to submit mind map.

Assignment II: Students will be required to submit list of media selection.

Assignment III: Students will be required to submit different medias in digital form.

Assignment IV: Students will be required to submit different medias in print form.

Teaching Methods and learning activities-

- **Lecture with power point projections**
- **Demonstration with practical**
- **Documentaries and Presentation**
- **Use of different medium and art form to make a new concept of work**

Assessment Strategies-

Classroom lecture

Power point presentations

- **Group discussion**

Syllabus
Semester-III

Course code: ETC21PCL201	**Course name:** Digital System Design	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basic knowledge of Electronic Circuits, Number system and logic gates.		
Course Objectives:		
1. Learn TTL and CMOS logic Families.		
2. Learn various reduction techniques to design combinational logic circuits.		
3. Learn 1-bit memory cell (FF) and its conversion.		
4. Learn Sequential logic circuits & PLDs.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain the fundamental concepts and techniques used in digital electronics.		
CO2: Implement different functions and combinational circuits using various reduction techniques.		
CO3: Explain operation of flip flops.		
CO4: Design simple sequential Circuits.		

Contents –

Unit	Content	Teaching hours
1	**Digital Logic Families** Classification of logic families, Characteristics of digital ICs. TTL logic, Operation of TTL NAND gate. CMOS logic – CMOS inverter, NAND, NOR gates.	07
2	**Combinational Logic Design** Standard representations for logic functions, K-Map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions Design Examples: Arithmetic Circuits, Code converters (Binary to Gray, Gray to Binary, Binary to Excess3, Excess3 to Binary), Digital Comparator, Parity generators/checkers, Design of Multiplexers and Demultiplexers, Decoders.	08
3	**Flip Flops** 1-Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops.	07
4	**Sequential Logic Design** Application of Flip-flops:- Shift registers, Counters (ring counters, twisted ring counters), ripple counters, up/down counters, synchronous counters, Sequence Generators. Programmable logic devices:- Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD.	08

Text Books:

1. R.P. Jain - Modern digital electronics, 3rd edition, 12th reprint Tata McGraw Hill Publication, 2007.
2. Anand Kumar, ―Fundamentals of digital circuits‖ 1st edition, Prentice Hall of India, 2001.

Reference Books: 1. Morris Mano ―Digital Logic and Computer Design‖ 4th edition, Prentice Hall of India, 2013.

Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PCP201	**Course name:** Digital System Design Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Basic knowledge of Electronic Circuits, Number system and logic gates.

Course Objectives:

1 Design Arithmetic circuits using K-Maps
2 Understand Code Conversion: Binary to Gray and Gray to Binary.
3 Understand multiplexer and demultiplexer operations.
4 Understand operation.of Flip flop using IC
5 Understand applications of flip flops.

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

1 Construct Arithmetic building blocks .
2 Demonstrate Code Conversion Binary to Gray and Gray to Binary.
3 Verify multiplexer and demultiplexer.
4 Verify the operation of Flip flops.
5 Demonstrate the ability to work independently and in a group and to prepare lab reports.

Contents –

Unit	Content	Lab hours
1	Study of Basic Logic Gates and Universal Gates.	02
2	Design the circuit for given Boolean algebraic equation (SOP and POS) using K-Map	02
3	Study of Half Adder and Half Subs tractor	02
4	Study of Binary to Gray Code Conversion	02
5	Study of Gray to Binary Code Conversion	02
6	Study of Multiplexer	02
7	Study of Demultiplexer	02
8	Study of Flip- Flops	02
9	Study of Counter	02

Course code: ETC21PCL202	**Course name:** Data Structures	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basics of C - language		
Course Objectives:		
1. The course aims to teach programming and introduce elementary data structures.		
2. To introduce the student to the concept of data structures through abstract data structures including lists, stacks, queues and graphs.		
3. To assess how the choice of data structures and algorithm design methods affects the performance of programs		
4. To choose the appropriate data structure and algorithm design method for a specified application.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Apply knowledge of basic programming constructs to design algorithms and programs		
CO2: To use appropriate data structures like arrays, linked lists, stacks and queues to solve real-world problems efficiently.		
CO3: To analyse different possible solutions to a program and select the most efficient one.		
CO4: To impart familiarity with various sorting, searching and hashing techniques and their performance comparison.		
CO5: Ability to analyze algorithms and algorithm correctness.		

Contents –

Unit	Content	Teaching hours
1	**Introduction -** Introduction to Data & Data Structures, types of Data Structure -Primitive & Non- Primitive, Concept of Abstract Data Type, Arrays, Types of Arrays, Memory representation of Array, traversing linear array, inserting and deleting elements in array. Structures, Functions, Recursive Functions, Introduction to time & space complexity.	06
2	**Stack & Queues -** Stacks: Definition, Array Representation of stacks, Linked representation of stacks. Evaluation of a Prefix, Infix and Postfix Expression, Transforming Infix into Postfix expression. Queues: Definition, Array Representation of Queues, Linked representation of Queues, Types of Queues: Circular Queues, Double ended Queue, Priority Queue, Stack using two queues, Queue using two stacks.	08
3	**Linked List & Hashing -** Linked List: Representation of Linked Lists in memory, Insertion & deletion from Linked List, Traversing & Searching a Linked List, Types of Linked List : Circular Linked List and Doubly Linked Lists. Hashing: Hashing (Hash Function), Hash Collision, Collision resolution : Chaining Open Addressing, Linear Probing, Quadratic Probing, Double Hashing.	08
4	**Trees –** Terminology, Binary Trees, Properties of Binary Trees, Array and linked representation of Binary Trees, Traversals-In order, Post order, Preorder, Threaded Binary trees, Binary Search trees- Definition, Insertion, Deletion, Traversal, and Searching. Evaluation of Expression, AVL Trees. **Graph :** Definitions, Terminologies, Matrix and adjacency list representation of graphs. Traversal Methods: Breadth First Search and Depth First Search	08

Text Books: 1. "Data Structures with C", S. Lipschutz, McGraw Hill.
2. "Fundamentals of Data Structures in C++", E. Horowitz, Sartaj Sahni, D.Mehta, Universities Press.
Reference Books: 1. "Data Structures using C", E. Balaguruswamy, McGraw Hill
2. "Introduction to Algorithms", T. H. Cormen, C. E. Leiserson, R. L. Rivest, C. Stein, MIT Press, 3rd Edition, 2009.
Online Resources: 1. https://archive.nptel.ac.in/courses/106/106/106106127/
2. https://nptel.ac.in/courses/106102064

Course code: ETC21PCP202	**Course name:**Data Structures Lab	
Course category: PCC		
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Prerequisites: Programming in C		
Course Objectives:		
1. The course aims to teach programming and introduce elementary data structures.		
2. To introduce the student to the concept of data structures through abstract data structures including lists, stacks, queues and graphs.		
3. To assess how the choice of data structures and algorithm design methods affects the performance of programs		
4. To choose the appropriate data structure and algorithm design method for a specified application.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Apply basic programming skills such as Array, Functions and Decision making statements.		
CO2: Implement different programs for Linear Data Structures such as Stack and Queues.		
CO3: Demonstrate the use of Linear Data Structures such as Linked List.		
CO4: Apply the knowledge of Non Linear Data Structure such as Tree and Graph		

Contents –

Sr. No.	List of Practicals	Lab hours
1	Write a program to insert/delete an element from the array. Read and display array elements WAP to search an element in the list of arrays. WAP to merge two arrays in one single array.	02
2	Write a program to implement stack using arrays.	02
3	Write a program to evaluate a given postfix expression using stacks.	02
4	Write a program to convert a given infix expression to postfix form using stacks.	02
5	Write a program to implement queues using arrays.	02
6	Write a program to implement a stack using two queues such that the push operation runs in constant time and the pop operation runs in linear time	02
7	Write a program to implement double ended queue (de queue) using arrays.	02
8	Write a program to create a singly linked list, and perform insertion, deletion and updation of items of the list.	02
9	Write a program to implement a doubly Linked List.	02
10	Write a program to implement hashing with open addressing methods: a. Linear b. Quadratic Hashing methods	02

11	Write a program for the implementation of graph traversals by applying. a. BFS b. DFS	02
12	Write a program to implement the following sorting algorithms. i) Bubble sort ii) Insertion Sort iii) Selection Sort	02

Course code: ETC21PCL203 **Course name:** Electronic Circuits and Networks
Course category: PCC
Credits: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours
Pre-requisites: Basic components R, L & C **,** Elementary Mathematics. Basic electrical parameters. Semiconductor basics.
Course Objectives:
1) To understand the working of circuits having diodes, transistors, and MOSFET as circuit elements.
2) To understand the working of voltage regulators, multivibrators and oscillators.
3) To understand network theorems.
4) To understand two port network parameters.
Course Outcomes: At the end of the course, the students will be able to -
CO1:.Analyze simple BJT and MOSFET circuits.
CO2: Analyze simple rectifiers and voltage regulators using IC.
CO3: Apply network theorems to the circuit to find currents and voltages.
CO4: Evaluate two port networks parameters and resonance circuits.

Contents –

Units	Content	Teaching hours
1	**Electronic Devices:-** Diode parameters ,data sheet, Bipolar junction transistor construction, symbols, operation of a BJT, BJT circuit configurations, current gain of BJT in common base and common emitter configuration , input and output characteristics of BJT in CE configuration , Frequency response of CE amplifier, BJT datasheet , heat sink , LED , photo transistor. MOSFET : Construction ,operation , types , circuit symbol , drain and transfer characteristics, CMOS : Construction, CMOS as a switch, Handling precautions of CMOS devices	08
2	**Electronic Circuits :** Transistor switch **,** Rectifiers , ripple factor , capacitor and LC filters , Line and load regulation, Fixed and variable IC linear voltage regulator, switching voltage regulator. Multivibrators **:** Astable & Monostable multivibrators using IC555 Oscillators **:** Principle of Positive feedback, RC phase shift , Hartley ,and crystal oscillator.	07
3	**Network Analysis :** Series parallel combination of resistors, Voltage division current division, Voltage and Current laws (KVL/KCL), Mesh analysis, Node analysis, Source transformation Network Theorems: Superposition, Thevenin's, Nortons and Maximum Power Transfer Theorems	08
4	**Terminal characteristics of network and resonance** Z Parameters , Y Parameters, Series Resonance ,selectivity, bandwidth, Q factor, Circuit magnification factor, parallel resonance ,comparison of series and parallel resonance	07

Text Books: 1. A textbook of Applied Electronics by Dr R S Sedha S Chand Publication
2. Network Analysis and Synthesis by Ravish Singh
Reference Books: 1. Electronic Devices and Circuits : Jacob Millman & C Halkias Tata McGraw Hill
2. Network and Systems : D Roy Choudhary New Age International Publishers
Online Resources: 1. NPTEL / SWAYAM lectures

Course code: ETC21PCP203 **Course name:** Electronic Circuits and Networks Lab **Course category:** PCC
Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic components R, L & C **,** Elementary Mathematics. Basic electrical parameters. Semiconductor basics.
Course Objectives:
1) To understand the working of circuits having diodes, transistors, and MOSFET as circuit elements.
2) To understand the working of voltage regulators, multivibrators and oscillators.
3) To understand network theorems.
4) To understand two port network parameters.
Course Outcomes: At the end of the course, the students will be able to -
CO1:.Analyze simple BJT and MOSFET circuits.
CO2: Analyze simple rectifiers and voltage regulators using IC.
CO3: Apply network theorems to the circuit to find currents and voltages.
CO4: Evaluate two port networks parameters and resonance circuits.
Contents –

Unit	Content	Lab hours
1	Plotting VI characteristics of voltage and current source and determine its source resistance.	02
2	Plotting VI characteristics of a PN junction diode.	02
3	Use BJT/ MOSFET as a switch.	02
4	Building a monostable/ astable multivibrator using IC 555.	02
5	Study of Hartley and RC phase shift oscillator.	02
6	Designing a linear variable voltage regulator.	02
7	Verification of Network theorems.	02
8	Plotting frequency response of a series/parallel resonant circuit.	02
9	Determination of two port network parameters.	02

Course code: ETC21HSL204	**Course name:** Business Management and Financial Accounting
Course category: EEMC	
Credits:2 **Teaching scheme:** L-2	**Evaluation scheme:** CA–60 ESE–40
Duration of ESE: 02 Hours	
Pre-requisites: Basic Management	
Course Objectives:	
1.To help the students to analyze the risk and return of alternative sources of financing.	
2. To enable students to describe the estimated cash flows from a project, including operating, net working capital, and capital spending.	
3. To provide the students to understand the related information of business Finance. Students can prepare basic financial statements.	
4. To enable students to prepare final financial statements.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Analyze the risk and return of alternative sources of financing.	
CO 2. Estimate cash flows from a project, including operating, net working capital, and capital spending.	
CO 3. Define basic terminology used in finance and accounts.	
CO 4. Prepare Financial Statements.	

Contents –

Unit	Content	Teaching hours
1	**Introduction to Business Management:** Aims, Objective And Function of Business Management, Principles of Management, Concept of business finance, Goals & objectives of financial management, Sources of financing-Long Term financing and Short Term Financing	07
2	**Business Capital Management:** Concept of business working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, financing approaches for working capital, Methods of forecasting, working capital requirements	08
3	**Basics of Financial Accounting:**Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger, Cash book & Trial balance.	07
4	**Financial Statement Preparation and analysis:**Preparation of financial statements. Profit & Loss Account, Balance Sheet, Ratio Analysis.	08

Text Books: 1.Financial Management by Khan & Jain, Text, Problem & Cases, Tata McGraw Hill Publication 5th Edition.
2. Tulsian Financial Management by Dr.P.C.Tulsian, S Chand Publication 5th Edition.
3. Taxman's Financial Management by Ravi M. Kishore, Taxmann 2017 Edition.

Reference Books: 1.A Textbook of Financial, Cost & Management Accounting by Dr.P.Periasamy, Himalaya Publishing House.
2. Fundamentals of Financial Management by Bhabhtosh Banerjee, PHI publication, 2nd Edition.

Course code: ETC21CEP205	**Course name:** Community Engagement	**Course category:** CEP
Credits:2	**Teaching scheme:** P-4	**Evaluation scheme:** TW–30, PR–20
Course Objectives:		
1. To develop an appreciation of rural culture, life-style and wisdom amongst students		
2. To learn about the status of various agricultural and development programmes		
3. To understand causes for distress and poverty faced by vulnerable households and explore solutions for the same		
4. To apply classroom knowledge of courses to field realities and thereby improve quality of learning		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Gain an understanding of rural life, Indian culture & ethos and social realities		
CO2: Develop a sense of empathy and bonds of mutuality with local community		
CO3: Appreciate significant contributions of local communities to Indian society and economy		
CO4: Learn to value the local knowledge and wisdom of the community		
CO5: Identify opportunities for contributing to community's socio-economic improvements		

Contents –

Sr. No.	Content	Session hours
1	**Appreciation of Rural Society** Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of "soul of India lies in villages' (Gandhi), rural infrastructure. Assignment - Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.	12
2	**Understanding rural and local economy & livelihood** Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour. Assignment - Describe your analysis of rural household economy, its challenges and possible pathways to address them.	16
3	**Rural and local Institutions** Traditional rural & community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas & municipalities, local civil society, local administration. Assignment - How effectively are Panchayati Raj & Urban Local Bodies (ULBs) institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual).	16
4	**Rural & National Development Programmes** History of various /development in India, current national programmes: Sarva Shiksha Abhiyan, Beti Bachao, Beti Padhao, Ayushman Bharat, Swatchh Bharat, PM Awas Yojana, Skill India, Gram Panchayat Decentralised Planning, NRLM, MNREGA, SHRAM, Jal Jeevan Mission, SFURTI, Atma Nirbhar Bharat,etc. Assignment - Describe the benefits received and challenges faced in the delivery of one of these programmes in the local community; give suggestions about improving implementation of the programme for the poor.	16

Ref doc: 1906947_Revised-Draft-Framework-in-the-light-of-NEP-2020.pdf
https://www.ugc.gov.in/pdfnews/1906947_Revised-Draft-Framework-in-the-light-of-NEP-2020.pdf

Course code: MGM56VEL102	**Course name:**Constitution of India	**Course category:** VEC
Credits:2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–30, ESE–20
Duration of ESE: 01 Hours		
Course Objectives:		
1. To make students understand the Constitution and its importance		
2. To sensitise the students about Fundamental Rights and duties enshrined under Indian Constitution		
3. To familiarise students with the working of Indian Constitution		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand and explain the significance of Indian Constitution as the fundamental law of the land.		
CO2: Exercise his fundamental rights in proper sense at the same time identifies his responsibilities in national building.		
CO3: Analyse the Indian political system, the powers and functions of the Union, State and Local Governments in detail.		
CO4: Understand Electoral Process, Emergency provisions and Amendment procedure.		

Contents –

Unit	Content	Teaching hours
1	**Historical Background and Philosophy of Indian Constitution** • Societies before and after the Constitution adoption. • Introduction to the Indian constitution. • Making of the Constitution. • Role of the Constituent Assembly. • Preamble and Nature of Indian Constitution • Salient features of Indian Constitution	04
2	**Fundamental Rights & Duties** • Right to equality • Right to freedom • Right against exploitation • Right to freedom of religion • Cultural and educational rights • Right to Constitutional remedies • Fundamental Duties	06
3	**Directive principles of state policy** • Meaning and significance of Directive Principles • Economic Principles • Political Principles	04
4	**Organs of Government** • Centre and State Legislature • Centre and State Executive • Centre and State Judiciary • Local Self Government	04
5	**Other Important Constitutional Provisions** • Emergency Provisions under Indian Constitution • Election Commission	04

Text Books:
1. D. D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2013.
2. Subhash Kashyap, Our Constitution (An Introduction of Indin constitution and Constitutional Law), National Book Trust, India, 2001
3. M. P. Jain, Outline of Indian Legal and Constitutional History, Lexis Nexis, 2014
4. Constitutional Law of India-J.N.Pandey-

Reference Books:
1. G. Austin, The Constitution of India, Cornerstone of a Nation. Oxford University press 1966.
2. M.V.P ylee- Constitutional Government in India, Bombay Asia publishing House 1975.
3. Chandra, Bipan and Others, India Since Independence, Penguin Books, New Delhi, 20015.
4.H.M.Seervai Constitution of India.
5. Narendra Chapalgaonker, Mahatma Gandhi and the Indian Constitution, Routledge (Manohar) Publoication, 2016.

Semester-IV

Course code:ETC21PCL251 **Course name:** Object oriented Programming using C++ **Course category:** PCC	
Credits: 2	**Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours	
Pre-requisites: Knowledge of programming and C language.	
Course Objectives: To impart students with knowledge of Object Oriented Programming.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Write simple programs in C++ using control structures.	
CO2: Understand the concepts of classes and objects.	
CO3: Design programs using inheritance and polymorphism.	
CO4: Understand Exceptional Handling mechanisms.	

Contents –

Unit	Content	Teaching hours
1	**Introduction to C++:** Introduction to C++, Layout of C++ program, Data types, variables, constants, Keywords, Operators. **Control statements:** Branching Statements: if, if-else, nested if, Break, continue and switch statement. Looping Statements: While, Do-while and for Statement.	06
2	**Objects, Classes and Templates: Object & Classes:** Features of Object Oriented Programming, Class specification, Access Specifiers, Defining Member Functions, Objects Declaration, Accessing Data Members and Member Functions, Constructors, Destructor, Friend Functions. **Templates:** Function Templates, Class Templates	08
3	**Inheritance and Polymorphism:** Introduction to inheritance, Base Class, Derived class, Types of Inheritance. **Polymorphism:** Function Overloading, Function Overriding, Virtual Functions, Operator Overloading.	08
4	**Exception Handling:** Introduction, Exception Handling Mechanism, Handling Multiple Exceptions.	08

Text Books: E. Balagurusamy , Object Oriented Programming with C++ , MC Graw Hill Publication
Reference Books: 1. Tony Gaddis, Starting out with C++: from control structures through objects (7e)
2. B. Stroupstrup, The C++ Programming Language, Addison Wesley, 2004.
3. Problem Solving with C++ by Walter Savitch, Addison Wesley
Online Resources: NPTEL

Course code:ETC21PCP251 **Course name:** Object oriented Programming using C++ Lab **Course category:** PCC	
Credits: 1	**Teaching scheme:** P-2 **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Knowledge of programming and C language.	
Course Objectives: To impart students with knowledge on basics of programming and Object Oriented Programming concepts.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Demonstrate fundamentals of object oriented programming.	
CO2: Develop C++ programs using classes and objects.	
CO3: Implement Inheritance, Polymorphism.	
CO4: Apply Exception Handling in c++.	
CO5: Construct a portable module for solving real life applications.	

Contents –

Sr. No.	List of Experiments	Lab hours
1	Write a program to demonstrate basic syntactical constructs of C++. ● Operators & Expressions ● Looping Statement ● Decision Making Statement	02
2	Write a program to demonstrate decision making statements and control structure, Arrays in C++.	02
3	Write a program to demonstrate Classes and Objects, methods constructor in C++.	02
4	Write a program to implement function overloading.	02
5	Write a program to implement operator overloading.	02
6	Write a program to implement a friend function.	02
7	Write a program to implement all types of constructors and destructors.	02
8	Write a program to implement inheritance.	02
9	Write a program to implement Polymorphism.	02
10	Write a program to implement exception handling.	02

Course code: ETC21PCL252 **Course name:** Analog & Digital communication **Course category:** PCC	
Credits: 2	**Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours	
Pre-requisites: Basics of electronics engineering.	
Course Objectives:	
1. To understand the basic elements of communication system and amplitude modulation.	
2. To develop skill to design FM trans-receiver.	
3. To Interpret importance of sampling theorem for digital communication system.	
4. To be aware of noise in communication systems.	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Demonstrate the basic concept of communication system and Amplitude modulation.	
CO2: Evaluate the behavior of FM in frequency domain.	
CO3: Apply the concept of sampling theorem to design pulse analog and digital modulation.	
CO4: Compute noise parameters in the communication systems.	

Contents –

Unit	Content	Teaching hours
1	**Introduction to communication system and Amplitude Modulation** Elements of communication system, types of communication system, need of modulation, classification of modulation, electromagnetic spectrum & its applications, multiplexing techniques. **Amplitude Modulation**: Definition, Mathematical equation of AM, modulation index, frequency spectrum of AM, Bandwidth, Power Calculation, AM receiver and AM detectors.	10
2	**Frequency Modulation** Definition, mathematical equation of FM, Frequency spectrum, FM generation methods by reactance modulators, pre-emphasis and de-emphasis, FM receiver, FM detectors, slope detector and ratio detector.	07
3	**Pulse Modulation** Classification of Pulse Analogue modulation, sampling theorem, digital modulation techniques, quantization and encoding, Linear prediction, DPCM, shift keying techniques.	07
4	**Noise** Noise in analogue and digital communication system, Sources of noise, SNR, noise figure, Noise Factor, Noise resistance, Noise temperature.	06

Text Books:	1. Electronic Communication, Dennis Roddy & coolen, TMH
	2. Principles of Communication System, Taub schilling,Mcgraw-HILL
	3. Electronic Communication System,George kennedy, TMH
	4. Digital Communication, Sanjay Sharma, Katariya & Sons

Reference Books:	1. An Introduction to Analog and Digital Communication, Haykin Simon, John wiley
	2. Digital Communication, Prokis. J. G. Pearson Education
	3. Digital Communications Fundamentals and Applications, Sklar Bernard, Pearson Education
	4. Principles of Communication Engineering, Anokh Singh,S Chand.
Online Resources:	1. Analog Communication By Prof. Goutam Das, IIT Kharagpur https://onlinecourses.nptel.ac.in/noc19_ee46/preview
	2. Digital Communication By Prof. Bikash Kumar Dey, IIT Bombay http://nptel.ac.in/courses/117101051/

Course code: ETC21PCP252 **Course name:** Analog and Digital communication Lab **Course category:** PCC		
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basics of Electronics Engineering.		
Course Objectives:		
1. To understand the usage of various equipment in communication Engineering.		
2. To understand various modulation techniques.		
3. To learn the transmitters and receivers in electronic communication.		
4. To study multiplexing techniques.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Demonstrate the use of various equipment in communication Engineering.		
CO2: Compare various modulation techniques.		
CO3: Interpret pre-emphasis and de-emphasis.		
CO4: Demonstrate the multiplexing techniques.		

Contents –

Sr. No.	Content	Lab hours
1	To Study RF signal generator	02
2	To find MI of AM by direct and indirect Method.	02
3	To study the AM Transmitter and receiver.	02
4	To study the FM Transmitter and receiver.	02
5	To study four channel analog TDM system	02
6	Sampling and reconstruction of lower sampling rate and higher sampling.	02
7	To perform PAM/Demodulator	02
8	To perform PWM/Demodulator	02
9	To perform PPM/Demodulator	02
10	To plot frequency response of, pre-emphasis and de-emphasis	02

Course code:ETC21PCL253		**Course name:**Microprocessors and Microcontrollers
Course category:PCC		
Credits:2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Digital system Design		
Course Objectives:		
1 To introduce to the students the fundamentals of Microprocessor and Microcontroller.		
2 To learn interfacing of input and output devices.		
3 To understand Microprocessor and Microcontroller applications.		
4 To study hardware and software tools for developing applications.		
Course Outcomes: At the end of the course, the students will be able to		
CO1: Explain the basic concepts and architecture of 8085 microprocessor.		
CO2: Apply the knowledge for developing 8085 based assembly language programs.		
CO3: Apply the knowledge to interface memory, I/O with 8085.		
CO4: Explain the basic concepts and architecture of 8051 microcontroller.		
CO5: Apply the knowledge for developing 8051 based assembly language programs.		
CO6: Apply the knowledge to interface memory, I/O with 8051.		

Contents –

Unit	Content	Teaching hours
1	**Introduction to Microprocessor 8085.** Introduction to RISC and CISC processors, Harvard and Von Neumann architecture,8085-Architecture, Pin Configuration, Addressing Modes. Instruction Set of 8085 and Assembly Language Programs, Timing Diagrams (basic machine cycles), Interrupt Structure, Counters & time delays, Stack & Subroutines.	08
2	**Microprocessor 8085 Memory and IO Interfacing.** Various Interfacing techniques, Memory Organization & Interfacing, Introduction to 8255, Interfacing of LEDs, 7 Segment display, ADC / DAC, Stepper motor & keys/keyboard with 8255.	08
3	**Introduction to Microcontroller 8051.** Introduction,Comparison between Microprocessor and Microcontroller, Architecture of 8051, Pin details, Programming Model, Memory Organization- Data and Program Memory, Internal RAM Organization-Special Function Registers, I/O ports, Counters and Timers, Addressing modes, Instruction set, Assembly Language Programming.	08
4	**Microcontroller 8051 Memory and I/O Interfacing** Programming I/O ports, External Memory Interfacing. Interfacing of LED.	06

Text Books:
1 Microprocessor Architecture, Programming and Applications with the 8085. Ramesh Gaonkar, Willey Eastern Ltd.
2 The 8051 Microcontrollers and Embedded Systems – Muhammed Ali Mazidi – Pearson Education.
3 Fundamentals of Microprocessor and Microcontroller.- B.Ram, Dhanpat Rai and Sons

Reference Books: 1. Microprocessors and Interfacing – D.Hall, Tata Mc Graw Hill. 2. The 8051 Microcontrollers Architecture, Programming & Applications – Kenneth J. Ayala
Online Resources: Microprocessors and Microcontrollers, NPTEL course IIT Kharagpur

Course code: ETC21PCP253	**Course name:** Microprocessors and Microcontrollers Lab	
Course category: PCC		
Credits:1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Digital system Design		
Course Objectives:		
1. To write and execute Programs for 8085 Microprocessor.		
2. To understand interfacing circuits with 8085.		
3. To write and execute Programs for 8051 microcontroller using IDE.		
4. To study 8051 interfacing circuits.		
Course Outcomes: At the end of the course, the students will be able to		
CO1: Demonstrate 8085 programs on kits.		
CO2: Design interfacing circuits with 8085.		
CO3: Execute 8051 programs using IDE.		
CO4: Demonstrate interfacing circuits with 8051.		

Contents –

Sr. No.	List of Practicals	Lab hours
1	Study of 8085 Microprocessor kit.	02
2	Write Program for data transfer operations.	02
3	Write Program for arithmetic/logical operations.	02
4	Write Program for string operations.	02
5	Study of different interfacing cards.	02
6	Study of 8255.	02
7	Introduction to 8051 simulator.	02
8	Write Program for Arithmetic operations using 8051.	02
9	Study of Logical operations using 8051.	02
10	Write Program for Data transfer operations using 8051.	02
11	Write Program for Bit manipulation operations using 8051.	02
12	Study of interfacing circuits with 8051.	02

Course code: ETC21VSP254 **Course name:** Basics of Data Analytics and Visualization **Course category:** VSEC		
Credits: 2	**Teaching scheme:** P-4	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic Mathematical knowledge.		
Course Objectives:		
1. To study basic excel operations..		
2. To understand the basic statistical concepts.		
3. To study data visualization.		
4. To study data preprocessing techniques.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1:. Demonstrate the excel operations.		
CO2:.Analyze the data using statistical methods.		
CO3: Implement data visualization techniques.		
CO4: Implement data preprocessing techniques.		

Sr. No.	List of Experiments	Lab hours
1	To study various operations in excel	04
2	To study pivot tables in excel	04
3	To study pivot charts in excel	04
4	To study Measure of Central tendency, Variance, standard Deviation, Range, Inter- Quartile range, Covariance, Correlation, Kurtosis and skewness	04
5	To study hypothesis testing	04
6	To study matplotlib library, plot function, parameters of plot function and subplot	04
7	To study scatterplot, barplot, and stacked barplot	04
8	To study pie charts and histogram	04
9	To study EDA and outlier detection	04
10	To study various imputation and encoding techniques	04

Contents –

Sr. No	Content
1	**Excel Basics** Text to Columns, Concatenate Function, Absolute Cell References, Data Validation, Time and Date Calculations, Conditional Formatting, Exploring Styles and Clearing Formatting, Using Conditional Formatting to Hide Cells. Using the If function. Pivot Tables: Creating a Pivot Table, Specifying PivotTable Data, Changing a PivotTables Calculation, Filtering and Sorting a PivotTable, Grouping Items, Updating a PivotTable, Formatting a PivotTable. PivotChart: Creating a Simple Chart, Charting Non-Adjacent Cells, Creating a Chart Using the Chart Wizard, Modifying Charts, Moving and Sizing of an Embedded Chart.
2	**Descriptive and Inferential statistics** Descriptive Statistics: Measure of Central tendency, Variance, standard Deviation, Range, Inter- Quartile range, Covariance, Correlation, Kurtosis and skewness. Inferential statistics: Central limit theorem, Interval estimates, Hypothesis testing, t-test, Chi-squared test.
3	**Data Visualization** Different data visualization tools, Introduction to Matplotlib: Scatterplot, bar plot, stacked bar plot, pi-chart, Histogram.
4	**Data Preprocessing** Exploratory Data Analysis, Outlier detection, handling missing data, cleaning missing data, encoding of data.

Text Books:

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning", Springer Publication.
2. Massimiliano Bonamente, "Statistics and Analysis of Scientific Data**",** Springer publication.

Reference Books:

1. Engineering Statistics: An Introduction by Edward B. Magrab, Springer International Publishing
2. Hands-On Data Preprocessing in Python, by Roy Jafari, Packt Publishing

Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21HSL255 **Course category:** EEMC	**Course name:** Entrepreneurship Development	
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Knowledge of planning		
Course Outcomes: At the completion of the course, students should be able to:		
1. To develop skills related to various functional areas of management (Marketing Management, Financial Management, Operations Management, Personnel Management etc.)		
2. To develop skills related to Project Planning and Business Plan development.		
3. To determine and compare various skills of successful entrepreneurs, business organizations and business laws.		
4. To examine essentials to avoid failure in Entrepreneurship.		

Contents –

Unit	Content	Teaching hours
1	Introduction : Entrepreneurship Development, Evolution of Entrepreneurship, Meaning, Definition, and Concept of Enterprise, Concepts of Entrepreneurship, Role of Entrepreneurship in Economic Development, Factors Affecting Entrepreneurship, Entrepreneurial Development models and Theories, Entrepreneurial Trait Tests; Business Opportunity Identification.	08
2	Entrepreneur : Major types of Entrepreneurship – Techno Entrepreneurship, Women Entrepreneurship, Social Entrepreneurship, Intrapreneurship (Corporate entrepreneurship), Rural Entrepreneurship, Family Business etc. The entrepreneurial decision process, Entrepreneurial Environment – Political, Legal, Technological, Natural, Economic, Socio – Cultural etc.	07
3	Project Planning, Skills for Successful Entrepreneurs & Business Organizations and Business Laws: Project report; Project appraisal; Setting up an Industrial unit – procedure and formalities in setting up an Industrial unit; Business Plan Development, Communication Skills, Creativity and Problem-solving, Innovation, Negotiation Skills, Risk management. Types of Business Organizations –Sole, Proprietorship, Joint Hindu Family Business, Partnership, Limited Liability Partnership (LLP), Corporate Governance, Franchising, Business Laws in India to Start Business.	08
4	Concepts of Entrepreneurship Failure : Issues of Entrepreneurial failure, Reasons of Entrepreneurial Failure, Essentials to Avoid Failure in Entrepreneurship. Case Study of Failure in Entrepreneurship.	07

Text Books:

1. Dynamics of Entrepreneurship Development – Vasant Desai.
2. Entrepreneurship Development and small business management – Poornima M. Charantimath
3. Dynamics of Entrepreneurship Development – Vasant Desai.
1. Innovation and Entrepreneurship – Peter F. Drucker
2. Kathleen R Allen, Launching New Ventures, An Entrepreneurial Approach, Cengage Learning, 2016.
3. Vijay Sathe, Corporate Entrepreneurship, Cambridge, 2009.

Course code: MGM21VEL101	**Course name:** Environment Studies	**Course category:** VEC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–30, ESE–20
Duration of ESE: 01 Hour		
Pre-requisites: Basic Science		
Course Objectives:		
1. To study the environment and ecosystems.		
2. To study different types of natural resources		
3. To study concept of biodiversity and its conservation		
4. To study the concept of causes, effects and control of different types of environmental pollution		
5. To study population growth and its impact on environment		
Course Outcomes: At the completion of the course, students should be able to:		
1. Describe environment and ecosystem		
2. Explain environmental impacts of human activities on natural resource		
3. Identify the importance of conservation of biodiversity.		
4. Describe the problems of environmental pollution, its impact on human and ecosystem and control measures		
5. Identify the impact of increased population on environment		

Contents –

Unit	Content	Teaching hours
1	**Ecosystem and the Environment** a. Definition, Scope and importance of Environmental studies, Need for Public awareness. b. Concepts of an Ecosystem, Structure and functions of an Ecosystem. c. Producers, Consumers and Decomposers in an Ecosystem	06
2	**Natural Resources** a. Renewable and non-renewable resources, Role of individuals in conservation of natural resources for sustainable lifestyles. b. Use and over exploitation of Forest resources, Deforestation, Timber extraction, Mining, Dams and their effects on forest and tribal people c. Use and over exploitation of surface and ground water resources, Floods, Drought, Conflicts over water, Dams- benefits and problems.	06
3	**Biodiversity and its Conservation** a. Definition, Genetic, Species and Ecosystem diversity, Bio-geographical classification of India. b. Value of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and option values.	06
4	**Environmental pollution** a. Definition, Causes, effects and control measures of Air pollution. Water pollution and Soil pollution.	06

	b. Causes, effects and control measures of Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards	
5	**Population issues and the Environment** a. Population growth, Variation among nations, Population explosion- Family welfare programmes, Environment and Human health, Human rights, Value education, HIV/AIDS. b. Woman and Child welfare, Role of information technology in environment and human health, Case studies	06

Text Books:

1 Bharucha Erach (ed) Text Book of Environmental Studies., University Press (India) Pvt. Ltd

2. Bharucha Erach, 2003. The Biodiversity of India, Mapin Publishing Pvt. Ltd, Ahmedabad – 380013

3. Kaushik, Anubha & Kaushik, C.P. 2006. Perspectives in Environmental Studies, New Age International (P) Ltd. Publisher, New Delhi

4. Deswal, S. and Deswal, A. 2005. A Basic Course in Environmental Studies. Dhanpat Rai & Co ltd., Delhi.

Reference Books:

1. IndiaSantra S.C, (ed), Environmental Science, New Central Agency Pvt Ltd. Kolkata, India.

2. Botbin, D., and Keller, E.1995. Environmental Science. John Wiley and Sons, USA.

3. Cunningham, W.P. and Saigo, B.W. 1997. Environment Science. McGraw-Hill, USA.

4. Lal, R. and Stewart, B.A. 1992. Advances in Science: Soil Restoration Springer Verlag, New York.

Semester – V

Course code: ETC21PCL301	**Course name:** Computer Networks	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Computer Fundamentals		
Course Objectives:		
1. To study data network types and protocol suites.		
2. To study data link layer of protocol suite		
3. To Study Network Layer		
4. Study Client server communication		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Define data network and describe layers of protocol models.		
CO2: Summarize the working of data link layers.		
CO3: Explain the different Network layers.		
CO4: Describe the working of protocols for Application layer.		

Contents –

Unit	Content	Teaching hours
1	Data Communication, Networks, Topology, Categories of Networks, OSI & TCP/IP Protocol suites Guided media, Unguided media Data Link Layer Design Issues: Framing, Error control, Flow control, practical data link protocols	07
2	Network Layer & Design Issues: Routing & congestion control, IP addressing ARP, OSPF & BGP, IPV6 Transport Addressing, Establishing & releasing a connection Transport protocol for Internet TCP	08
3	Application Layer: DHCP, DNS, TELNET, FTP, SMTP, HTTP, WWW, Introduction to Network security, Privacy, Digital Signature	07
4	A simple client-server implementation, A simple web server implementation, Networking simulation.	08

Text Books: 1. ANDREW S. TANENBAUM, Computer Networks, 4th Edition, Prentice-Hall of India, New Delhi, 2000.
Reference Books: 1. BEHROUZ A. FOROUZAN, Data Communications and Networking, 2nd Edition, Tata McGraw-Hill, New Delhi, 2003
Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PCP301	**Course name:** Computer Networks Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Computer Fundamentals

Course Objectives:

1. To study Email System
2. To Configure IP
3. To Digital Certificates
4. To design Web page using HTML

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

CO1: Define data network and describe layers of protocol models

CO2: Summarize the working of data link layers.

CO3: Explain the different Network layers.

CO4: Describe the working of protocols for Application layer.

Contents –

Unit	Content	Lab hours
1	Demonstrate TCP/IP protocol working in layered architecture	02
2	Establish a virtual lab using star topology and compare it with other topologies.	02
3	Demonstrate errors in framing and error control in data link layer.	02
4	Calculate codes of CRC and how it is executed.	02
5	Simulation of circuit switching and packet switching systems.	02
6	Configuration of IPv4 and IPv6.	02
7	Study of Network security algorithms	02
8	Study of Digital Certificate	02
9	Design of Web page using HTML/ Java script	02
10	Simulation of POP and SMTP working.	02
11	Simulation and modelling techniques	02
12	Case study of E-Mail system	02

Course Code: ETC21PCL302 **Course name:** Operating System **Course category:** PCC	
Credit: 2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40	
Duration of ESE: 02 Hours	
Pre-requisites: Basic knowledge of Computer structure	
Course Objectives:	
1.Explain the objectives, functions and structure of OS	
2.To Analyze the concept of process management and evaluate performance of process scheduling algorithms	
3. To Understand and apply the concepts of synchronization and deadlocks	
4. Evaluate performances of Memory allocation and replacement policies	
Course Outcomes: At the end of the course, the students will be able to -	
CO1. Understand the objectives, functions and structure of OS	
CO2. Analyze the concept of process management and evaluate performance of process scheduling algorithms.	
CO3. Understand and apply the concepts of synchronization and deadlocks	
CO4. Evaluate performances of Memory allocation and replacement policies.	

Contents –

Unit	Content	Teaching hours
1	**Operating system Overview** Introduction, Objectives, Functions and Evolution of Operating System Operating system structures: Layered, Monolithic and Microkernel, Linux Kernel, Shell and System Calls	07
2	**Process and Process Scheduling** Concept of a Process, Process States, Process Description, Process Control Block. Uni processor Scheduling-Types: Preemptive and Non-preemptive scheduling algorithms (FCFS, SJF, SRTN, Priority, RR) Threads: Definition and Types, Concept of Multithreading	08
3	**Process Synchronization and Deadlocks** Concurrency: Principles of Concurrency, Inter-Process Communication, Process Synchronization. Mutual Exclusion: Requirements, Hardware Support (TSL), Operating System Support (Semaphores), Producer and Consumer Problem. Principles of Deadlock: Conditions and Resource, Allocation Graphs, Deadlock Prevention, Deadlock Avoidance: Bankers Algorithm, Deadlock Detection and Recovery, Dining Philosophers Problem	08
4	**Memory Management** Memory Management Requirements, Memory Partitioning: Fixed, Partitioning, Dynamic Partitioning, Memory Allocation Strategies: Best-Fit, First Fit, Worst Fit, Paging and Segmentation, TLB Virtual Memory: Demand Paging, Page Replacement Strategies: FIFO, Optimal, LRU, Thrashing	07

Text Books: 1. William Stallings, Operating System: Internals and Design Principles, Prentice Hall,
2. Abraham Silberschatz, Peter Baer Galvin and Greg Gagne, Operating System Concepts, John Wiley &Sons, Inc., 9thEdition, 2016, ISBN 978-81-265-5427-0.
Reference Books: 1. Achyut Godbole and Atul Kahate, Operating Systems, McGraw Hill Education, 3rdEdition
2. Andrew Tannenbaum, Operating System Design and Implementation, Pearson, 3rdEdition
3. Maurice J. Bach, "Design of UNIX Operating System", PHI
4.Sumitabha Das, "UNIX: Concepts and Applications", McGraw Hill, 4thEdition
1. **Online Resources:** 1. Analog Circuits, NPTEL course by IIT, Bombay.
2. https://www.classcentral.com/course/swayam-introduction-to-operating-systems-6559

Course code: ETC21PCP302	**Course name:** Operating System Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Basic knowledge of Computer structure.

Course Objectives:

1 To gain practical experience with designing and implementing concepts of operating systems.
2 Understand the architecture of Linux OS.
3 Understand necessary skills for developing and debugging programs in Linux environment
4 Understand implementing simple operating system mechanisms

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

CO1: Demonstrate basic Operating system Commands.
CO2: Demonstrate various process scheduling algorithms and evaluate their performance.
CO3: Demonstrate and analyze concepts of synchronization and deadlock.
CO4: Demonstrate various Memory Management techniques and evaluate their performance.

Contents –

Unit	Content	Lab hours
1	Operating system Overview: Basics of Unix Structure	02
2	Installation of Ubuntu and Virtual Box	02
3	Unix Basic Commands	02
4	Write a Shell program to a. Display Hello world b. check the given number is even or odd, c. Check leap year	02
5	Process Scheduling: Write a C program for implementation of Priority scheduling algorithms	02
6	Process Scheduling: Write a C program for implementation of Round Robin scheduling algorithms	02
7	Process Synchronization: Write a C program for implementation of FCFS and SJF scheduling algorithms	02
8	Process Synchronization: Write a C program to implement banker's algorithm for deadlock avoidance	02
9	Memory Management: Write a C-program to implement the producer – consumer problem using semaphores	02
10	Memory Management: Write a c program to implement IPC using shared memory	02
11	CASE STUDY	02

Course code: ETC21PCL303	**Course name:** Database Management System	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Database Preliminaries		
Course Objectives:		
1. To introduce database Management system.		
2. To study Relational database model.		
3. To study SQL		
4. To study schema refinement and Transaction management		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Define basic terms of DBMS system		
CO2: Create a RDBMS model.		
CO3: Use SQL for querying Relational database.		
CO4: Solve ordinary differential equations analytically and numerically and apply these methods to solve engineering problems.		

Contents –

Unit	Content	Teaching hours
1	INTRODUCTION: Introduction and applications of DBMS, Purpose of database, Data Independence, Database System architecture- Levels, Mappings, Database users. DATABASE DESIGN PROCESS: ER Diagrams - Entities, Attributes, Relationships, Constraints, Primary key, foreign key, Generalization, Specialization, Aggregation.	08
2	THE RELATIONAL MODEL: Introduction to the relational model, Integrity constraints over relations, defining, enforcing integrity constraints, Querying relational data, Logical database design: E-R to relational. RELATIONAL ALGEBRA AND CALCULUS: Relational algebra operators, Tuple and domain relational calculus.	07
3	SQL**:** Basics of SQL, DDL, DML, DCL, structure – creation, alteration, constraints –, unique, not null, check, IN operator, Functions - aggregate functions, Built-in functions – numeric, date, string functions, set operations. Use of group by, having, order by, join and its types, Exist, Any, All, view and its types. Transaction control commands – Commit, Rollback, Save point	08
4	SCHEMA NORMAL FORMS: Normalization, functional dependencies and properties. Normal forms: 1NF, 2NF, 3NF, properties of decompositions, TRANSACTIONS MANAGEMENT: Transaction concept, transaction state, ACID properties, Serializability.	07

Text Books:

1.Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2005), Database System Concepts, 5thedition, McGraw-Hill, New Delhi, India.

Reference Books: 1. Elmasri Navate, Fundamentals of Database Systems, Pearson Education, India

Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PCP303	**Course name:** Database Management System Lab	
Course category: PCC		
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW: 30, PR: 20
Pre-requisites: Database Fundamentals		
Course Objectives:		
1. To study ER diagrams and converting it to tabular form		
2. To use DML commands		
3. To use aggregate function of SQL		
4. To study multiple queries		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Create E-R diagrams and conversions		
CO2: Create tables using DML commands		
CO3: To query tables using aggregate functions.		
CO4: To query tables with multiple functions.		

Contents –

Unit	List Of Practicals	Teaching hours
1	Conceptual Designing using ER Diagrams (Identifying entities, attributes, keys and relationships between entities, cardinalities, generalization, specialization etc.)	02
2	Converting ER Model to Relational Model (Represent entities and relationships in Tabular form, Represent attributes as columns, identifying keys)	02
3	Creation of Tables using SQL- Overview of using SQL tool, Data types in SQL, Creating Tables (along with Primary and Foreign keys), Altering Tables and Dropping Tables	02
4	Practicing DML commands- Insert, Select, Update, Delete	02
5	Practicing Queries using ANY, ALL, IN, EXISTS, NOT EXISTS, UNION, INTERSECT, CONSTRAINTS etc.	02
6	Practice Queries using COUNT, SUM, AVG, MAX, MIN, GROUP BY, HAVING, VIEWS Creation and Dropping	02
7	Practicing on Triggers - creation of trigger, Insertion using trigger, Deletion using trigger, Updating using trigger	02
8	Cursors- Declaring Cursor, Opening Cursor, Fetching the data, closing the cursor.	02
9	Practicing queries and Joins (Inner, Outer).	02

Text Books: 1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2005), Database System Concepts, 5thedition, McGraw-Hill, New Delhi, India.
Reference Books: 1. Elmasri Navate, Fundamentals of Database Systems, Pearson Education, India
Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PCL304	**Course name:** Analog Circuits	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basic knowledge of Electronic Devices and Circuits		
Course Objectives:		
1. Study operational amplifier fundamentals.		
2. Study various applications of op amp.		
3. Study oscillators using op amp.		
4. Study active filters and PLL.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Describe the performance parameters of Op Amp.		
CO2: Analyze the linear and nonlinear applications of Op Amp.		
CO3: Design LC and RC oscillators using Op Amp		
CO4: Apply the concepts of filters and PLL for communication applications.		

Contents –

Unit	Content	Teaching hours
1	**OP-AMP fundamentals** Block diagram of OP-AMP, Differential Amplifier configurations. Feedback topologies: Voltage series and voltage shunt feedback amplifier, op amp parameters, concept of virtual short and ground, ideal and practical characteristics of op amp	07
2	**Linear and Nonlinear Applications of op amp** Inverting and non-inverting amplifier, voltage follower, integrator, differentiator, instrumentation amplifiers, V-I and I-V converter Introduction to comparator, characteristics and applications of comparator, Schmitt trigger, voltage limiters, Need of precision rectifiers, Half wave and Full wave precision rectifiers, peak detectors, log and antilog amplifier	08
3	**Oscillators using op amp** Principle of Oscillators, Barkhausen criterion Sinusoidal oscillator types: RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitts, Clapp) Non-sinusoidal oscillators: square wave generator, triangular wave generator	07
4	**Active Filters and PLL** Active filters: Low pass, high pass, band pass and band stop filters PLL: block diagram of PLL, PLL Characteristics, Application of PLL	08

Text Books:

1. Ramakant A. Gaikwad, “Op Amps and Linear Integrated Circuits”, Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, “Linear Integrated Circuits”, Tata McGraw Hill, India 2008.
3. Bali, “Linear Integrated Circuits”, McGraw Hill 2008.

Reference Books:

1. Sergio Franco, “Design with Operational Amplifiers and Analog Integrated Circuits”, Tata McGraw Hill
2. Gray, Hurst, Lewise, Meyer, “Analysis & Design of Analog Integrated Circuits”, Wiley publications on Education

Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PCP304	**Course name:** Analog Circuits Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic knowledge of Electronic Devices and Circuits		
Course Objectives:		
1. Study operational amplifier fundamentals.		
2. Study various applications of op amp.		
3. Study oscillators using op amp.		
4. Study active filters and PLL		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Describe the performance parameters of Op Amp.		
CO2: Analyze the linear and nonlinear applications of Op Amp.		
CO3: Design LC and RC oscillators using Op Amp		
CO4: Apply the concepts of filters and PLL for communication applications.		

Contents –

Unit	Content	Lab hours
1	To study op amp parameters	02
2	To study inverting amplifier using op amp	02
3	To study non-inverting amplifier using op amp	02
4	To study integrator using op amp	02
5	To study differentiator using op amp	02
6	To study comparator using op amp	02
7	To study square wave generator using op amp.	02
8	To study triangular wave generator using op amp.	02
9	To study active filters using op amp	02
10	To Study PLL	02

Course code: ETC21PEL305 **Course name:** Embedded System Design **Course category:** PEC **Credits:**3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40
Pre-requisites: Basic knowledge of electronic circuits, Digital circuits, Microprocessors & Microcontrollers
Duration of ESE: 02 Hours
Course Objectives:
1. To acquire the knowledge of embedded system.
2. To understand interfacing Aspects of embedded system
3. To understand microcontroller basics.
4. To understand RTOS concepts.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Explain the embedded system concepts and its features.
CO2: Describe different communication interfaces.
CO3: Explain hardware and software of microcontroller 8051.
CO4: Explain concepts of RTOS.
CO5: Explain the different ISRs.

Contents –

Unit	Content	Teaching hours
1	**Introduction to Embedded Systems** Embedded system definition, comparison between General computing system and Embedded system, Categories of Embedded Systems, Overview of Embedded System Architecture, characteristics of Embedded Systems, Design metrics, Recent trends in Embedded Systems, Applications of embedded systems	09
2	**Communication Interfaces & Microcontroller Basics** Need for Communication Interfaces, Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, 10 CAN, USB (v2.0), Bluetooth, Zig-Bee, Wireless sensor network.	09
3	**Introduction to Renesas Processor** Evolution of Renesas Microcontrollers, Architecture of Renesas Microcontrollers, Introduction to the RX Family and RA Family, Development Tools and Environments	09
4	**Hardware and Software Programming of Renesas Processors** Setting Up the Development Environment, Programming Basics with Renesas Microcontrollers, Interfacing Digital I/O, Timers and Counters, Analog Interfacing, Communication Protocols, Low Power Modes and Energy Efficiency	09
5	**Introduction to RTOS** Comparison of RTOS and Traditional OS, Need of RTOS for embedded system, Functions of RTOS , Architecture of RTOS, Kernel- Tasks and task Schedulers, ISRs, Semaphores, Mutex, Mail Boxes, Message Queues, Event registers, Timers, Memory Management, Priority Inversion Problem, Task Communication	09

Text Books.
1. **“**Embedded System Design – A unified hardware and software introduction”: F. Vahid and Givargis
2. “Embedded and Real time system” by Dr.K.V.K.Prasad
3. "Embedded Systems: An Introduction Using the Renesas RX62N Microcontroller" by James M. Conrad and Alexander G. Dean
Reference Books:
1. An Embedded Software Primer- David E. Simon
2. Introduction to Embedded systems by Shibu K.V., McGraw Hill Publication.
3. Official Renesas RA Family Beginner's Guide (Online resource).
Online Resources: 1. NPTEL / SWAYAM lectures.on Embedded systems

Course code: ETC21PEL306	**Course name:** Basics of IOT	**Course category:** PEC
Credits: 3	**Teaching scheme:** L-3	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Prerequisites: Sensors, Processor, Microcontroller.		
Course Objectives: The course enables students to		
1. Learn basics of Internet of things and protocols.		
2. It introduces the application areas.		
3. Learn about the middleware for Internet of Things.		
4. To learn the concepts of Web of Thing		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the basics of Internet of things and protocols		
CO2: Explain about the middleware for Internet of Things.		
CO3: Understand IOT architecture		
CO4: Understand various engineering Application of IOT		

Contents –

Unit	Content	Teaching hours
1	**IOT** - What is IoT and why is it important? Elements of an IoT ecosystem, Technology drivers, Business drivers, Trends and implications, Overview of Governance, Privacy and Security Issues.	09
2	**IOT PROTOCOLS -** Protocol Standardization for IoT – Efforts – M2M and WSN Protocols – SCADA and RFID Protocols – Issues with IoT Standardization – Unified Data Standards – Protocols – IEEE802.15.4–BACNet Protocol– Modbus – KNX – Zigbee– Network layer – APS layer – Security	09
3	**IOT ARCHITECTURE - IoT Open source architecture (OIC)**- OIC Architecture & Design principles- IoT Devices and deployment models- IoTivity : An Open source IoT stack - Overview- IoTivity stack architecture- Resource model and Abstraction.	09
4	**WEB OF THINGS** - Web of Things versus Internet of Things – Two Pillars of the Web – Architecture Standardization for WoT– Platform Middleware for WoT – Unified Multitier WoT Architecture – WoT Portals and Business Intelligence.	09
5	**IOT APPLICATIONS -** IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications. Study of existing IoT platforms, GSM Applications**.**	09

Text Books:

1. Honbo Zhou, “The Internet of Things in the Cloud: A Middleware Perspective”, CRC Press,2012.

2. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), "Architecting the Internet ofThings", Springer, 2011

3. David Easley and Jon Kleinberg, "Networks, Crowds, and Markets: Reasoning About a Highly Connected World", Cambridge University Press, 2010.

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on-Approach)",1st Edition, VPT, 2014

2. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1st Edition, Apress Publications, 2013

3.CunoPfister, Getting Started with the Internet of Things, O"Reilly Media, 2011, ISBN: 978-1- 4493-9357-1

Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PEL307	**Course name:** Python for AIML	**Course category:** PEC
Credits: 3	**Teaching scheme:** L-3	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basics of Computer Programming		
Course Objectives:		
1. To study the importance of python programming.		
2. To understand the basic constructs of Python programming.		
3. To study error handling and basics of object-oriented programming.		
4. To learn different components of GUI programming and database connectivity.		
5. To study insights of data using different libraries.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain the need and use of python programming.		
CO2: Implement the basic constructs of programming such as data, operations, conditions, loops, etc. and structural programming using functions, modules and packages in Python.		
CO3: Apply the OOPS concept and the error handling mechanism.		
CO4: Develop GUI applications and to connect to the database to move the data to/from the application.		
CO5: Use concept of Numpy and Pandas for data science.		

Contents –

Unit	Content	Teaching hours
1	**Introduction to Python** What Is Python, History and Applications of Python, Features of Python, Execution of Python Programs, Indentation, Comments in Python, Variables in Python, Keywords in Python, Output and Input statements.	09
2	**Datatypes, Operators and Control Statements in Python** Datatypes in Python: Integers, Floats, Strings, Operators in Python: Arithmetic, Assignment, Unary minus, Comparison (Relational), Logical / Boolean, Bitwise, Membership, Identity. Strings, Control Statements: if, if-else, if-elif-else, for, while break, continue, pass.	09
3	**Data Structures, Functions and Modules in Python** Functions: Arguments: Positional, Keyword, Default, Variable Length Arguments, Recursive Functions, Anonymous Functions. Modules: Structural Programming, creating modules, import and from import statements. Python Packages: Packages, PIP, Installing packages via PIP. Data structures: Lists, Tuples, Sets and Dictionaries (Properties and operations), List comprehension.	09
4	**Object Oriented Programming and Database Connectivity in Python** OOP: Introduction, Features of OOP, Classes and Objects, Methods, Attributes, Inheritance, Encapsulation, Polymorphism, Self Variable, Operator and Method overloading, Method overriding and data hiding. Exception Handling: Errors and its types, Exceptions and its types, Use of Try, Except, Else and Finally statements, Catch and Raise Exceptions, Assert statement, User defined Exceptions. Database connectivity in Python – Installing MYSQL connector, accessing	09

	connector module, using connect, cursor, execute & close functions, reading single & multiple results of query execution, executing different types of statements, executing transactions, understanding exceptions in database connectivity.	
5	**Introduction to Data Science and Libraries in Python** Introduction to Data Science and Machine Learning, Supervised and unsupervised learning. Numpy: Create Arrays, Multidimensional Arrays, Indexing, Array Mathematics, Array Operations. Pandas: Pandas Series object, Series indexing, Series Operation, Pandas Data Frames object, Data import from csv, excel, json, HTML, Operations on dataframe using pandas. Introduction to Data Visualization, Matplotlib, and different plots. Libraries: Datetime in Python, Turtle graphics.	09

Text Books:	1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
	2. Learning Python, Mark Lutz, Orielly
	3. Think Python, Allen Downey, Green Tea Press
	4. Core Python Programming, Dr R Nageswara Rao, Dreamtech Press
Reference Books:	1. Martin C. Brown, Python: The Complete Reference, McGraw Hill Education
	2. Hemant Kumar Mehta, Mastering Python Scientific Computing, Packt Publishing Limited
Online Resources:	1. Python for Data Science https://archive.nptel.ac.in/courses/106/106/106106212/#Programming, Data
	2. Structures and Algorithms using Python by Prof. Madhavan Mukund, NPTEL course, Chennai Mathematical Institute. https://nptel.ac.in/courses/106106145

Course code: ETC21PEP305	**Course name:** Embedded System Design Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic knowledge of Electronic Devices and Circuits		
Course Objectives:		
Students will demonstrate knowledge of programming and design using advanced microprocessors and controllers.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Demonstrate fundamental programming concepts of microcontrollers.		
CO2: Generate delay using Timer/Counter of the Microcontroller.		
CO3: To interface simple peripheral devices to a Microcontroller.		

Contents –

Unit	Content	Lab hours
1	Addition and subtraction of two 8/16-bit numbers (Using Registers & Memory)	02
2	Multiplication and division of two 8-bit numbers	02
3	Transfer block of data from one memory locations to another memory locations and exchange two blocks of data bytes	02
4	Find the largest and smallest number in a given array of numbers	02
5	Arrange numbers in Ascending order and descending order	02
6	C- Program to store the data in the accumulator	02
7	C- program to load three numbers into Accumulator and send them to port.	02
8	Program to demonstrate time delay and Serial transfer of data	02
9	Interfacing programs on Renesas processor	02

Course code: ETC21PEP306	**Course name:** Basics of IOT Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Prerequisites: IOT and microcontroller fundamentals		
Course Objectives:		
1The course enables students to understand the basics of the Internet of things and protocols.		
2. It introduces some of the application areas where Internet of Things can be applied		
3. Students will learn about the middleware for Internet of Things. To understand the concepts of Web of Thing		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the basics of Internet of things and protocols		
CO2: Understand about the middleware for Internet of Things.		
CO3: Understand IOT architecture		
CO4: Understand various engineering Application of IOT		

Contents –

Unit	Content	Lab hours
1	Characteristics of the IOT, Communications in IoT, Arduino in IoT	02
2	Features of the Arduino, Arduino IDE, (Integrated Development Environment), Installation of Arduino Software (IDE).	02
3	Controlling the Light Emitting Diode (LED) with a push button.	02
4	Interfacing the RGB LED with the Arduino	02
5	Controlling the LED blink rate with the potentiometer interfacing with Arduino	02
6	Detection of the light using photo resistor	02
7	Interfacing temperature sensor LM35 with Arduino	02
8	Interfacing Servo Motor with the Arduino.	02
9	Interfacing of the Active Buzzer with Arduino.	02
10	Interfacing the Relay with Arduino.	02
11	Building Intrusion Detection System with Arduino and Ultrasonic Sensor	02
12	Directional Control of the DC motor using Arduino.	02

Course code: ETC21PEP307	**Course name:** Python for AIML Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Basics of Computer Programming

Course Objectives:

1. To study the importance of python programming.
2. To understand the basic constructs of Python programming
3. To study error handling and basics of object-oriented programming.
4. To learn different components of GUI programming and database connectivity.
5. To study insights of data using different libraries.

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

CO1: Explain the need and use of python programming.

CO2: Implement the basic constructs of programming such as data, operations, conditions, loops, etc. and structural programming using functions, modules and packages in Python.

CO3: Apply the OOPS concept and the error handling mechanism.

CO4: Develop GUI applications and connect to the database to move the data to/from the application

CO5: Use concept of Numpy and Pandas for data science

Contents –

Unit	Content	Lab hours
1	To study variables and operators in Python	02
2	To study strings in Python	02
3	To study conditional statements in Python	02
4	To study loops in Python	02
5	To study lists and tuples in Python	02
6	To study sets and dictionary in Python	02
7	To study functions in Python	02
8	To study Object Oriented Programming in Python.	02
9	To study exception handling in Python.	02
10	To study database connectivity in Python	02
11	To study numpy library	02
12	To study pandas library	02

Semester – VI

Course Code: ETC21PCL351 **Course name**: Information Theory and Coding **Course category:** PCC
Credit:2 **Teaching scheme:** L-2 **Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours
Pre-requisites: Basic knowledge of Probability theory
Course Objectives:
1.To study the fundamental concepts of information theory
2.To understand code words for the messages using various source coding
3.To study error control coding
4.To learn cyclic codes
Course Outcomes: At the end of the course, the students will be able to -
CO1: Explain the fundamental concepts of information theory
CO2: Construct code words for the messages using various source coding.
CO3: Use linear block codes for detection and correction of errors.
CO4: Explain cyclic codes.

Contents –

Unit	Content	Teaching hours
1	**Unit –1: Information Theory and channel capacity:** Information Theory, Entropy and its properties, entropy of extended sources, Joint and conditional entropies, Mutual Information and its properties, Information rate. Channel, Types of channels & models, Channel capacity, Capacities of different channels	07
2	**Unit-2: Source coding:** Source coding theorem, Data compaction and Prefix coding, Kraft McMillan inequality, Shannon Fano coding, Huffman coding, LZW coding, Arithmetic coding, RLE, JPEG standards, Speech coding	08
3	**Unit 3: Linear block codes:** Error control coding, need of error control and its types. Linear Block Codes: Encoder, Matrix description of Linear block codes, Generation of LBC. LBC Decoder: Parity check matrix, Syndrome, error detection and correction, syndrome decoder	07
4	**Unit 4: Cyclic codes:** Cyclic Codes, Polynomials, Generation of Cyclic codes: non-systematic and systematic forms, matrix description of cyclic codes, Syndrome polynomial, decoding of cyclic codes. Circuit implementation of cyclic codes, Cyclic Redundancy Check**.**	08

Text Books:
1. Ranjan Bose, “Information Theory coding and Cryptography”, McGraw-Hill Publication.
2. R. Avudaiammal, Information Coding Techniques” Second Edition. Tata McGraw- Hill Publication.
3. C Moreira, P G Farrell, “Essentials of Error-Control Coding”, Wiley Student Edition
4. Simon Haykin, “Communication Systems”, John Wiley & Sons, Fourth Edition.

Reference Books:
1. K Sayood, “Introduction to Data Compression” 3/e, Elsevier 2006
2. Fred Halsall, “Multimedia Communications: Applications, Networks, Protocols and Standards”, Perason Education Asia, 2002
3.S Gravano, “Introduction to Error Control Codes”, Oxford University Press 2007 Python Machine Learning, Second Edition, Sebastian Raschka Vahid Mirjalili, PACKT,2017 4. Todd Moon, “Error Correction Coding: Mathematical Methods and Algorithms”, Wiley Publication
Online Resources:
1.Information Theory and Coding, NPTEL course by IIT, Bombay. https://nptel.ac.in/courses/117/101/117101053/
2.Coding Theory, NPTEL course by IIT, Madras. https://nptel.ac.in/courses/117/106/117106031/

Course code: ETC21PCP351	**Course name:** Information Theory and Coding Lab	
Course category: PCC		
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic knowledge of Probability theory		

Course Objectives:
1. To demonstrate various entropies and information.
2. To Apply source coding techniques
3. To Construct codes using different coding techniques.
4. Understand various coding schemes for text, speech and audio.
Course Outcomes: At the end of the course, the students will be able to -
CO1: Illustrate various entropies and information**.**
CO2: Perform different source coding techniques
CO3: Construct codes using different coding techniques
CO4: Implement various coding schemes for text, speech and audio.

Contents –

Unit	Content	Teaching hours
1	Pre-Requisite 1: Introduction to Scilab	02
2	Pre-Requisite 2: Introduction to Scilab Commands	02
3	Determination of Probability	02
4	Simulation of tossing a coin	02
5	Determination of entropy of a given source	02
6	Find and plot probability through large no. of trials	02
7	Determination of various entropies and mutual information ofa given channel (Noise free channel)	02
8	Determination of various entropies and mutual information of a given channel (Binary symmetric channel)	02
9	Coding & decoding of Linear block codes	02
10	Coding & decoding of cyclic codes	02

Course code: ETC21PCL352	**Course name:** Digital Signal Processing	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basics of analog and digital signals, linear algebra		
Course Objectives:		
1. To study the LTI system in z-domain and estimate stability of system.		
2.To study the discrete time signal in frequency-domain and estimate the parameters of signal		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Analyze LTI system in z-domain and estimate stability of system.		
CO2: Analyze discrete time signal in frequency-domain and estimate the parameters of signal.		
CO3: Design and realize transfer function of IIR filter and FIR filter.		

Contents –

Unit	Content	Teaching hours
1	**Digital Signal Processing and Z Transform -** Introduction to DSP, Block Diagram of DSP Advantages, Disadvantages and Application. Need for transform, relation between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Inverse Z transform, Power series method, partial fraction expansion method	08
2	**Discrete Fourier Transform** DTFT, Definition DFT, Properties of DFT, circular convolution, linear convolution, FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm	07
3	**IIR Filter Design.** Concept of analog filter design (required for digital filter design), Design of IIR filters from analog filters, IIR filter design by impulse invariance method, Characteristics of Butterworth filters, Butterworth filter design, IIR filter realization using direct form.	08
4	**FIR Filter Design** Ideal filter requirements, Gibbs phenomenon, windowing techniques, , Design of linear phase FIR filter using windows. FIR filters realization using direct form.	07

Text Books:

1.S. Salivahanan, C. Gnanpriya, ―Digital Signal processing‖, McGraw Hill

2. Dr. Shaila Apte, ―Digital Signal Processing, Wiley India Publication, second edition

3. Nagoor Koni, Digital Signal Processing ,CBS Publishers& Distributors

Reference Books:

1. S. K. Mitra, Digital Signal Processing, Tata McGraw Hill Publication 2001

2. John G. Proakis, Dimitris G. Manolakis**,** ―Digital Signal Processing: Principles, algorithms and applications‖ Fourth edition, Pearson Prentice Hall

3. Emmanuel C. Ifeachor, Barrie W. Jervis, Digital Signal Processing, A Practical Approach, Pearson Education

Online Resources: 1. NPTEL / SWAYAM lectures. Indian Journal of Signal and Image processing by GBS Publisher & Distributors, Delhi.

Course code: ETC21PCP352	**Course name:** Digital Signal Processing Lab	**Course category:** PCC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Basics of analog and digital signals, linear algebra

Course Objectives:

1. To study the LTI system in z-domain and estimate stability of system.
2. To study the discrete time signal in frequency-domain and estimate the parameters of signal

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

CO1: Analyze LTI system in z-domain and estimate stability of system.

CO2: Analyze discrete time signal in frequency-domain and estimate the parameters of signal

CO3: Design and realize transfer function of IIR filter and FIR filter

Contents –

Unit	Content	Teaching hours
1	Pre-requisite 1: Introduction to MATLAB/Scilab	02
2	Pre-requisite 2: To learn logical programming aspect of MATLAB/Scilab	02
3	Generation of standard signals.	02
4	To Find Z transform, plot Pole- Zero map.	02
5	To find inverse Z transform of given signals	02
6	To find the impulse response	02
7	Computation of linear convolution using DFT	02
8	To learn significance of DFT and FFT mathematical tool used in signal processing	02
9	To design IIR Butterworth filter to filter out noise from noisy signal	02
10	Design FIR filter.	02

Course code: ETC21PCL353	**Course name:** Computer Architecture	**Course category:** PCC
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basic knowledge of Computers		
Course Objectives:		
1. To learn how computers work.		
2. To know basic principles of computer work.		
3. To analyze the performance of computers.		
4. To know how computers are designed and built.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Learn how computers work.		
CO2: Know basic principles of computer work.		
CO3: Analyze the performance of computers.		
CO4: Know how computers are designed and built.		

Contents –

Unit	Content	Teaching hours
1	**Unit-I** Basics of Computers Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queues, Subroutines.	07
2	**Unit-II** Processor organization Processor organization, Information representation, number formats, ALU design Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit.	08
3	**Unit-III** Memory organization Memory organization, device characteristics, RAMS, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.	08
4	**Unit-IV** System organization System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces, Parallel processing Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network.	07

Text Books:	1. V.Carl Hammacher, "Computer Organisation", Fifth Edition
	2. A.S.Tanenbum, "Structured Computer Organisation", PHI, Third edition
	3. Kai Hwang, Faye A. Briggs, "Computer Architecture and Parallel Processing" McGraw Hill International Edition
	4. Kai Hwang, "Advanced Computer Architecture", Tata McGraw hill Edition
Reference Books:	1. V. Rajaraman, L Sivaram Murthy, "Parallel Computers", PHI
	2. William Stallings, "Computer Organization and Architecture, Designing for Performance" 6th Ed. PHI
	3. Harrold Stone "High Performance Computer Architecture"
	4. Richard Y. Kain "Advanced Computer Architecture"
Online Resources:	1. Introduction to Computer Architecture, NPTEL course by IIT, Bombay

Course code: ETC21PEL354 **Course name:** System Design using Verilog **Course category:** PEC **Credits:** 3 **Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours
Pre-Requisites: Basic knowledge of Digital Electronics
Course Objectives:
1. To acquire the knowledge of IC Technology
2. To study the Hardware Description language
3. To learn combinational circuits VLSI Design
4. To learn sequential logic circuits VLSI Design
5. To study the Fault Tolerance and Testability
Course Outcomes: At the end of the course, the students will be able to -
CO1: Understand the concepts of IC design technology and design PLDs.
CO2: Describe the Verilog language.
CO3: Implement the combinational circuit using Verilog.
CO4: Implement the sequential circuit using Verilog.
CO5: Explain the Fault Tolerance and Testability

Contents –

Unit	Content	Teaching hours
1	**Unit I: IC Design Technology** Design metrics, System design technology, Fixed function IC technology, Full custom ASIC, Semicustom ASIC, FPGA Architecture, PLD Technology, Implementation of logic in FPGA	09
2	**Unit II: Introduction to Verilog:** Moore's law, VLSI Design flow, Simulation and Synthesis, Basics of Verilog, Verilog Operators, Data Types Modelling styles: Behavioral modelling, Dataflow modelling, Structural modelling, Test bench, Types of Assignments, Continuous Assignment, Procedural Assignments, Always blocking, initial blocking, Blocking and Non-Blocking Assignments, Tasks and Functions	09
3	**Unit III: Synthesis of Combinational Logic Circuit using VLSI** Noise Margin, Power Dissipation: static and dynamic, propagation delay, Wait and case statement, Multiple always blocking, Combinational building blocks: Adder circuits, multiplexers, Demultiplexers, decoders, encoders ,.	09
4	**UNIT IV: Sequential Logic Circuit VLSI Design** Flip flops, Static and Dynamic Latches and Registers, Timing issues, Synchronous and Asynchronous design: Shift registers and counters, State Machine: Basic Finite State Machines (FSM) Structures, Mealy and Moore Type FSM.	09
5	**UNIT V: Fault Tolerance and Testability** Types of faults, stuck-Open and Stuck-short faults, stuck at 1& 0 fault, Fault coverage, Need of Design for testability, Testability, Design-for -testability, controllability.	09

Text Books: 1. Stephen Brown, Zvonko Vranesic, Fundamental of digital logic design with Verilog.
2. Douglas Pueknell & Kamran Eshraghian, Basic VLSI Design, Third Edition, PHI.
3. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", Second Edition, Prentice Hall of India, 2003.
4.Digital Principles and Design by Donald D Givone, McGraw Hill, 2002.
5.Digital System Designs and Practices: Using Verilog HDL and FPGAs, Ming-Bo Lin, 2007, Wiley India Pvt Ltd .
6.Verilog HDL, Palnitkar, Samir, 2nd Edition ,2003, Pearson Education.
Reference Books:
1. Jon Bhasker, VHDL PRIMER, Third Edition, PHI.
2. Xilinx FPGA /CPLD Data Book.
3. FPGA Based system Design, Wayne Wolf, Pearson Education.
4. Verilog Degital System Design , Zainalabedin Navab, 2nd Edition, 2008,TMH .
5. VLSI design, Debaprasad Das, 2nd Edition, 2015, Oxford University Press.
Online Resources: 1. NPTEL / SWAYAM lectures/ Udemy: https://www.udemy.com/course/system-design-using-verilog/
2.Artix-A7, ZED Board, Nexgen kits www.digilentinc.com
3. VLSI Design using Verilog and Hardware course www.udemy.com

Course code: ETC21PEL355	**Course name:** Hardware and Communication Protocols in IOT
Course category: PEC	
Credits: 3	**Teaching scheme:** L-3 **Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours	
Pre-requisites: Basics of WSN and IoT.	
Course Objectives:	
1.Identify the performance of IoT.	
2.To study different protocols of IoT.	
3.To understand different characteristics of IoT	
4.To learn different technologies of IoT	
5.To study different parameters of IoT	
Course Outcomes: At the end of the course, the students will be able to -	
CO1: Explain what is IoT	
CO2: Explain architecture and design of IoT.	
CO3: Describe the objects connected in IoT.	
CO4: Understand the underlying Technologies	
CO5: Understand the platforms in IoT	

Contents –

Unit	Content	Teaching hours
1	**INTRODUCTION TO INTERNET OF THINGS:-** Internet of Things Definitions and Frameworks: IoT Definitions, IoT Architecture, General Observations, ITU-T Views, Working Definition, IoT Frameworks, Basic Nodal Capabilities, Physical Design of IoT: IoT Protocols, Logical Design of IoT: Functional block, communication Model, Communication API's, IoT Enabling Technologies: WSN, cloud computing, Big data Analytics, communication Protocols, Embedded systems	09
2	**IoT NETWORK ARCHITECTURE AND PROTOCOLS:-** The one M2M IoT Standardized Architecture, The IoT World Forum (IoTWF) Standardized Architecture, A Simplified IoT Architecture, IoT protocol stack, The Core IoT Functional Stack,IoT Protocols: Bluetooth Low Energy (BLE), Message Queue Telemetry Transport (MQTT), Extensible Messaging and Presence Protocol (XMPP), Data Distribution Service (DDS), Advanced Message Queuing Protocol (AMQP).	09
3	**SMART OBJECTS: THE "THINGS" IN IoT:-** Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects: Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and 802.15.4e, IEEE 1901.2a, LoRaWAN, ZigBee, RFID	09
4	**IoT PLATFORMS:-** What is an IoT Device, Exemplary Devices: Raspberry Pi, Other IoT Devices: ESP8266 , ARDUINO.Raspberry Pi: Models of Raspberry pi, R Pi 3 hardware, GPIO	09

	pins, operating system for R pi3, Basic of Linux commands, configuring R pi3, Interfacing of Digital and Analog sensors.	
5	**IoT PHYSICAL SERVERS AND CLOUD OFFEREINGS:-** Introduction to cloud storage models and communication API's, WAMP-AutoBahn for IoT, Python web application framework, Designing a RESTful web API, AMAZON web services for IoT, SkyNet IoT messaging platform, IoT case studies: Home Automation, Cities, Environment.	09

Text Books: 1. Internet of Things: A Hands-On Approach Arshdeep Bahga, Vijay Madisetti VPT – Paperback 2015 978- 0996025515 628/- 2.
2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things David Hanes, Gonzalo Salgueiro, Patrick Grossetete Cisco Press – Paperback – 16 Aug 2017 978-1- 58714-456- 1 599.
Reference Books: 1. Smart Internet of things projects Agus Kurniawan Packt - Sep 2016 978-1- 78646-651-8 2 The Internet of Things Key Olivier Willy Publication 2nd Edition 978
Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PEL356	**Course name:** Machine Learning	**Course category:** PEC
Credits: 3	**Teaching scheme:** L-3	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basics of AI and Python Programming		
Course Objectives:		
1. To study different techniques used in AI.		
2. To understand the statistics of data and various tests.		
3. To visualize the data using different plots such Histogram, Scatterplot, Boxplot etc.		
4. To study various data preprocessing methods and EDA tools.		
5. To implement supervised and unsupervised learning.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand basic principle behind machine learning.		
CO2: Explain the statistical concepts used in machine learning.		
CO3: Implement data visualization techniques for representing the data.		
CO4: Demonstrate the handling outliers, missing values and encoding.		
CO5: Apply supervised and unsupervised algorithms in machine learning.		

Contents –

Unit	Content	Teaching hours
1	**Introduction to AIML** What is Machine Learning, Data Science vs Machine Learning vs Deep learning vs Artificial Intelligence, Supervised and Unsupervised Machine learning, workflow in Machine Learning, Tools used in Machine learning, Real time applications of machine learning.	07
2	**Descriptive and Inferential statistics** Descriptive Statistics: Measure of Central tendency, Mean, Median and Mode, Variance, standard Deviation, Range, Inter- Quartile range, Covariance, Correlation, Kurtosis and skewness. Inferential statistics: Hypothesis testing, process of hypothesis testing, z-test, t-test, Chi-squared test.	10
3	**Data Visualization and Preprocessing** Data Visualization: Different data visualization tools, Introduction to Matplotlib: Scatterplot, bar plot, stacked bar plot, pi-chart, Histogram. Data Preprocessing: Exploratory Data Analysis, Outlier detection, handling missing data, cleaning missing data, encoding of data.	10
4	**Supervised Learning** Linear Regression, Need of Linear regression, Ordinary least squares, MAE, RMSE Regularization Techniques (LASSO), Ridge, Polynomial Regression Usage Logistic Regression: Model building, cost function, Accuracy score, Precision, Recall and F score, ROC-AUC score. Algorithms: Random Forest, Decision Trees, Bagging and Boosting Methods, Support Vector Machines, KNN, Naïve Bayes.	10
5	**Unsupervised Learning** Clustering: K-Means, K Nearest Neighbours, Association Rule Learning. Dimensionality Reduction: PCA. Case Study (Clustering/Anomaly/Fraud Detection). Machine Learning Applications across Industries.	08

Text Books:	1.Machine Learning, Tom Mitchell, First Edition, McGraw Hill, 1997
	2.Introduction to Machine Learning, 2nd Edition, by EthemAlpaydin
Reference Books:	1. Business Analytics,U Dinesh Kumar,Wiley India,2018
	2. Machine learning using Python,FirstEdition,by U Dinesh Kumar Manaranjan Pradhan,Wiley,2018
	3. Python Machine Learning, Second Edition, Sebastian RaschkaVahid Mirjalili,PACKT,2017
Online Resources:	1. Introduction to Machine Learning, By Prof. Balaraman Ravindran, IIT Madras https://onlinecourses.nptel.ac.in/noc20_cs29/preview
	2. Machine Learning, ML, By Prof. Carl Gustaf Jansson, KTH, The Royal Institute of Technology https://nptel.ac.in/courses/106106145

Course code: ETC21PEP354	**Course name:** System Design using Verilog Lab	
Course category: PEC		
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR-20
Pre-requisites: Basic knowledge of Digital Electronics		
Course Objectives:		
1. To study Verilog language		
2. To study combinational circuits VLSI Design		
3. To study sequential logic circuits VLSI Design		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Demonstrate verilog programming.		
CO2: Implement the combinational circuits and sequential logic circuits with verilog		
CO3: Demonstrate PMOS, NMOS with Microwind		

Sr.No.	List of Experiment	Lab hours
1	Introduction to VLSI lab (Xilinx, ISE Microwind tool, VHDL Verilog code)	02
2	Write Verilog code of all logic Gates: (AND, OR, NOT, NAND, NOR, XOR, XNOR) and implement	02
3	Design and implementation of Adder (Half-Adder, Full Adder by HA) using Verilog code	02
4	Design and implementation of Subtractor (Half Subtractor, Full Subtractor) using Verilog code	02
5	Design and simulate of 8:1 MUX using Verilog code	02
6	Design and simulation of 3 : 8 Decoder using Verilog code	02
7	Write Verilog code for SR & D Flip-Flop and simulate	02
8	Write Verilog code for JK & T Flip-Flop and simulate	02
9	Design and implementation of Decade Counter using Verilog code	02
10	Write test bench for full adder in Verilog.	02
11	Layout Design of PMOS, NMOS using Microwind	02

Course code: ETC21PEP355 **Course name:** Hardware and Communication Protocols in IOT Lab
Course category: PEC
Credits: 1 **Teaching scheme:** P-2 **Evaluation scheme:** TW–30, PR–20
Prerequisites: Basics of WSN and IoT
Course Objectives:
1. To know IoT
2. To Distinguish between different network protocols.
3. To understand IoT design issues
Course Outcomes: At the end of the course, the students will be able to -
CO1: Illustrate IoT requirements.
CO2: Illustrate TCP IP layered architecture.
CO3. Create strong foundation of concepts of IoT.

Contents –

Sr. No.	List of Experiment	Lab hours
1	Pre-Requisite: Configuration of Arduino IDE for ESP 8266	02
2	Pre-Requisite: Study of Embedded C programming for Arduino IDE	02
3	To interface ESP 8266 with LEDs and write a program for LED blinking.	02
4	To Create A Simple ESP8266 NodeMCU Web Server In Arduino IDE.	02
5	To interface ESP 8266 with Ultrasonic sensor and write a program for distance calculation.	02
6	Study of different operating systems for Raspberry-Pi. Understanding the process of OS installation on Raspberry-Pi	02
7	To interface Raspberry pi 3 B+ with LEDs and write a program for LED blinking.	02
8	To interface Raspberry pi 3 B+ with Ultrasonic sensor and write a program for distance calculation.	02
9	To interface Raspberry pi 3 B+ with DHT11 and write a program.	02
10	Introduction to MQTT and sending sensor data to cloud using Raspberry-Pi/ Arduino.	02
11	To interface Raspberry pi 3 B+ with LCD and write a program.	02
12	Development of IoT Application in real time.	02

Course code: ETC21PEP356	**Course name:** Machine Learning Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Basics of AI and Python Programming

Course Objectives:

1. To study the tools used for machine learning.
2. To visualize the data using different plots such Histogram, Scatterplot, Boxplot etc.
3. To learn pandas and numpy libraries.
4. To study linear and logistic regression.
5. To study supervised and unsupervised machine learning algorithms.

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

CO1: Explain different tools used for Machine Learning.

CO2: Visualize data using Matplotlib.

CO3: Demonstrate various dataframe operations.

CO4: Implement Linear and logistic regression techniques on real time datasets.

CO5: Apply supervised and unsupervised techniques to calculate accuracy of data.

Contents –

Sr. No.	List of Experiment	Lab hours
1	Introduction and Installation of Anaconda Environment and Jupyter Notebook	02
2	To measure and display Central tendencies of a dataset using Python	02
3	To study Matplotlib library for data visualization	02
4	Introduction to Pandas and Load/ Write data from/to CSV and EXCEL files	02
5	To study various Pandas data manipulation commands	02
6	To study different imputation and encoding techniques for data preprocessing	02
7	To study Linear Regression and Regularization	02
8	To study Classification model and its evaluation metric	02
9	To study Ensemble algorithms used in supervised learning	02
10	To study Boosting techniques used in supervised learning	02
11	To study Clustering and its applications	02

Course code: ETC21PEL357	**Course name:** Cloud Computing	**Course category:** PEC
Credits: 3	**Teaching scheme:** L-3	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basic knowledge of computer networking.		
Course Objectives:		
1. Learn the cloud computing fundamentals.		
2. Learn cloud architecture & infrastructure.		
3. Learn the implementation of cloud computing for enterprise.		
4. Learn the design issues and compare various cloud service providers		
5. Learn the security concerns related to cloud computing.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Understand the fundamentals of cloud computing.		
CO2: Understand architecture of cloud computing.		
CO3: Understanding of different layers of cloud computing.		
CO4: Gain knowledge of cloud storage system design issues.		
CO5: Understand the various cloud security and privacy mechanisms.		

Contents –

Unit	Content	Teaching hours
1	**Unit 1: Cloud Fundamentals** Basic structure of Cloud Computing, working models - deployment, and service models, cloud computing - benefits, risks, limitations, components, types of cloud environment, cloud computing characteristics, service providers, public cloud, private cloud, hybrid cloud, community cloud model.	09
2	**Unit 2: Cloud Computing Architecture** Cloud computing infrastructure - hypervisor, Cloud computing technologies - virtualization, SOA, grid computing, and utility computing. SaaS, PaaS, IaaS - characteristics, benefits, and issues. Cloud Interoperability and Standards, Cloud computing client server technology, Peer to Peer Computing, Distributed Computing, Grid Computing, Autonomic and Parallel computing architecture.	09
3	**Unit 3: Defining the Clouds for Enterprise** Cloud computing enterprise applications, challenges & operations. Hardware Virtualization - characteristics, reference model, types, advantages, Scaling a Cloud Infrastructure - Capacity Planning, Cloud Scalability, Fault Tolerance, Disaster Recovery - Disaster Recovery Planning, Disasters in the Cloud, Disaster Management.	09
4	**Unit 4: Cloud Platforms** Service Oriented Architecture (SOA), Cloud Platform and Management, Service Level Agreements (SLAs), Computation Storage, Enterprise Cloud Platforms - AWS, Google Cloud, Microsoft Azure.	09

5	**Unit 5: Cloud Security** Cloud computing security - importance, protecting data mechanism, security concerns, and threats. IAM, Public Key Infrastructure (PKI), Encryption - Symmetric vs. Asymmetric, Single Sign On (SSO), Direct I/O Access Architecture, Multipath Resource Access Architecture, Jurisdictional issues raised by data location.	09

Text Books:

1. Mastering Cloud Computing by Rajkumar Buyya, Christian Vecchiola, S. Thamarai Selvi from TMH2013.
2. George Reese Cloud Application Architectures, First Edition, O Reilly " Media 2009.
3. Cloud Computing and SOA Convergence in Your Enterprise: A Step-by-Step Guide by David S. Linthicum from Pearson 2010.
4. Cloud Computing 2nd Edition by Dr. Kumar Saurabh from Wiley India2012.
5. Cloud Computing – web-based Applications that change the way you work and collaborate Online – Michael Miller, Pearson Education.

Reference Books:

1. Cloud Computing Bible, Barrie Sosinsky, Wiley-India, 2010
2. Cloud Computing: Principles and Paradigms, Editors: Rajkumar Buyya, James Broberg, Andrzej M. Goscinski, Wile, 2011
3. Cloud Computing: Principles, Systems and Applications, Editors: Nikos Antonopoulos, Lee Gillam, Springer, 2012
4. Cloud Security: A Comprehensive Guide to Secure Cloud Computing, Ronald L. Krutz, Russell Dean Vines, Wiley-India, 2010

Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PEL358	**Course name:** Automotive Electronics	**Course category:** PEC
Credits: 3	**Teaching scheme:** L-3	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hour		
Pre-requisites: Knowledge of automobile systems.		

Course Objectives:

1. To understand electronic systems in Automotive.
2. To study the powertrain and chassis control in Automotive.
3. To study the use and controls of batteries in Automotive.
4. To understand various automotive controllers.

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

CO1: Explain the use of electronic systems in Automotive.

CO2: Illustrate the powertrain and chassis control in Automotive.

CO3: Elaborate the use and controls of batteries in Automotive.

CO4: Explain various automotive controllers.

Contents –

Unit	Content	Teaching hours
1	**Introduction** Introduction to Electronic systems in Automotive – Sensors and Actuators for body electronics, powertrain and chassis systems.	09
2	**Body electronics domain** Automotive alarms, Lighting, Central locking and electric windows, Climatic Control, Driver information, Parking, CAN Protocol.	09
3	**Powertrain and chassis control domain** Engine management, Transmission control, ABS, ESP, Traction Control, Active Suspension, passive safety, Adaptive Cruise Control, etc. Hardware implementation example of simple automotive systems using Sensors, Controller, Actuators etc.	09
4	**Battery** Types and maintenance, Alternators in vehicles, Starting motor systems, Electrical circuits and wiring in vehicles, vehicle network and communication buses – Digital engine control systems.	09
5	**Automotive controllers** Introduction to automotive controllers, On-Board Diagnostics (OBD). Introduction to electric vehicles.	09

Text Books:

1. Bosch,"Automotive Electrics and Automotive Electronics. System and components ,Networking and Hybrid drive", Fifth edition, Springer view 2014
2. NajamuzZaman , " Automotive Electronics Design Fundamental'' first edition, Springer 2015.
3. Hillier's, "Fundamentals of Motor Vehicle Technology on Chassis and Body Electronics", Fifth Edition, Nelson Thrones, 2007.

Reference Books:

1. William B. Ribbens, "Understanding Automotive Electronics" Sixth Edition, Elsevier Newnes, 2002.

Online Resources: NPTEL / SWAYAM lectures.

Course code: ETC21PEL359	**Course name:** Robotics and Automation	**Course category:** PEC
Credits: 3	T**eaching scheme:** L-3	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Basic knowledge of Robotics and Automation		
Course Objectives:		
1. Learn basics of robotics component.		
2. Learn various end effectors and sensors.		
3. Learn PLC		
4. Learn PLC and its ladder logic programming.		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Explain the fundamental Robotics		
CO2: Implement the use of end effectors and sensors in different application.		
CO3: Explain operation PLC.		
CO4: Design simple Ladder Logic.		

Contents –

Unit	Content	Teaching hours
1	**Introduction:** Robot Anatomy-Definition, law of robotics, History and Terminology of Robotics-Accuracy and repeatability of Robotics-Simple problems- Specifications of Robot-Speed of Robot-Robot joints and Links-Robot classifications -Architecture of robotic Systems-Robot Drive systems- Hydraulic, Pneumatic and Electric system.	09
2	**End Effectors and Robot Controls:** Mechanical Grippers-Slider crank mechanism, Screw type, Rotary actuators, cam Type-Magnetic grippers -Vacuum grippers -Air operated Grippers-Gripper force Analysis-Gripper Design-Simple problems-Robot controls-Point to point control, Continuous path control, Intelligent robot-Control system for robot joint-Control actions-Feedback devices-Encoder, Resolver, LVDT-Motion Interpolations-Adaptive control.	09
3	**Robot Transformations and Sensors:** Robot Kinematics- Types – 2D & 3D Transformation-Scaling, Rotation, Translation-Homogeneous coordinates, multiple Transformation Simple problems. Sensors in robot – Touch sensors -Tactile sensor – Proximity and range sensors – Robotic vision Sensor-Force sensor -Light sensors, Pressure sensors. Programming of robot	09
4	**Programmable Logic Controllers (PLCs):** Evolutions of PLCs– Sequential and Programmable Controllers, Architecture, Communication Networks for PLC, Comparative study of Industrial PLCs.	09
5	**PLC Programming: PLC Programming**- Ladder logic, Functional block, Sequential Function Chart, Structured Text, and Instruction list. Communication architectures and open SCADA protocols.	09

Text Books:

1. Mikell P Groover & Nicholas Godrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, Industrial Robotics, Technology Programming and Applications, McGraw Hill, 2nd Edition.
2. J John Craig, "Introduction to Robotics, Pearson Education, 2018, 4th Edition. R22 M.Tech.
3. F.D. Petruzella- Programmable Logic Controllers, Tata Mc-Graw Hill, Third Edition, 2010.
4. Michael P. Lukas- Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 1986.
5. Clarke. G, Reynders. D, and Wright. E, Practical Modern SCADA Protocols: DNP3, 60870.5 and Related Systems, Newnes, 1st Edition, 2004. Robotics & Artificial Intelligence

Reference Books:

1. Klafter. R.D, Chmielewski. T.A. and Noggin's., "Robot Engineering: An Integrated Approach", Prentice Hall of India Pvt. Ltd., 2009
2. S.R. Deb, Robotics Technology and flexible automation, Tata McGraw-Hill Education., 2009
3. Hughes, T. - Programmable Logic Controllers, ISA Press, 2000.
4. McMillan, G.K. - Process/Industrial Instrument and Controls Handbook, McGrawHill, New York, 1999.

Online Resources: 1. NPTEL / SWAYAM lectures.

Course code: ETC21PEP357	**Course name:** Cloud Computing Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20
Pre-requisites: Basic knowledge of computer networking.		
Course Objectives:		
1 To inculcate the concepts of cloud computing.		
2 To familiarize the concepts of cloud computing and services.		
3 To explain cloud platform and types of cloud.		
4 To explain resource management in cloud computing.		
Course Outcomes: At the end of the course, the students will be able to -		
1 Understand the fundamental principles of cloud computing.		
2 Create virtual machines and virtual templates.		
3 Create Cloud platform using Virtual machine.		
4 Identify suitable business models of cloud computing.		

Contents –

Sr. No.	List of Experiment	Lab hours
1	To introduce yourself to cloud computing.	02
2	To study Virtualization and Hypervisor.	02
3	To create a Linux (Ubuntu) virtual machine using VMware. (Write the important steps only).	02
4	To install a ‘C’ compiler in the Linux ubuntu based virtual machine and execute a sample C program.	02
5	To study AWS S3 and get the data on S3.	02
6	To study the Identity and Access Management (IAM) roles.	02
7	To study the AWS EC2 instance.	02
8	To study Service Level Agreements (SLAs).	02

Course code: ETC21PEP358 **Course name:** Automotive Electronics Lab **Course category:** PEC **Credits:** 1 **Teaching scheme:** P-2 **Evaluation scheme:** TW–30, PR–20
Pre-requisites: Knowledge of automobile systems.
Course Objectives:
1. To understand electronic systems in Automotive.
2. To study the powertrain and chassis control in Automotive.
3. To study the use and controls of batteries in Automotive.
4. To understand various automotive controllers.
Course Outcomes: At the end of the course, the students will be able to –
CO1: Interface sensors with microcontrollers
CO2: Know the importance of Signal conditioning circuits
CO3: Demonstrate concept of PWM control
CO4: Build prototype of automotive electronic system

Contents –

Sr. No.	List of Experiment	Lab hours
1	To study construction and working various sensors used in Automotive Electronics	02
2	To study architecture and IDE of generic microcontroller development board.	02
3	Interface Various temperature (LM35, RTD etc.) with microcontroller	02
4	Interface pressure sensor with microcontroller	02
5	Interface speed sensor with microcontroller	02
6	Demonstrate PWM control of DC motors and LEDs	02
7	Demonstrate amplification of Signal	02
8	Demonstrate filtering of Signal	02
9	Demonstrate ADC conversion of Signal	02
10	To study CAN bus communication between microcontrollers	02
11	Project development: design, construction, and testing of an automotive electronic system	02

Course code: ETC21PEP359	**Course name:** Robotics and Automation Lab	**Course category:** PEC
Credits: 1	**Teaching scheme:** P-2	**Evaluation scheme:** TW–30, PR–20

Pre-requisites: Basic knowledge of Electronic Robotics and sensors.

Course Objectives:

1 Understand the basic component of robotics.

2 Understand hardware and programming of robotics

3 Understand basic of PLC.

4 Draw and implement the PLC ladder logic.

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

CO1: Explain the basics of robotics component.

CO2: Demonstrate hardware and programming of robotics.

CO3: Use PLC trainer kit.

CO4: Verify the operation of PLC programming by ladder logic.

Contents –

Sr. No.	List of Experiment	Lab hours
1	Study of robotics and its type.	02
2	Study of robotics and its component.	02
3	Study of Ysakawa hardware robot and its programming.	02
4	Study of TATA robot hardware and its programming.	02
5	Study of ABB robot hardware and its programming.	02
6	Study of PLC Kit.	02
7	Study of Ladder logic.	02
8	Design Logic gates be ladder logic.	02
9	Study of Counter and timer using PLC.	02

Course code: ETC21VSL360		**Course category:** VSEC
Course name: Computer Hardware and Networking		
Credits: 2	**Teaching scheme:** L-2	**Evaluation scheme:** CA–60, ESE–40
Duration of ESE: 02 Hours		
Pre-requisites: Computer Fundamentals		
Course Objectives:		
1. To study Computer architecture.		
2. To study ports and interfacing with computers		
3. To Study computer network terminologies		
4. Study Client server model		
Course Outcomes: At the end of the course, the students will be able to -		
CO1: Define computer architecture		
CO2: Perform computer interfacing		
CO3: Describe network terminologies		
CO4: Implement a client server model		

Contents –

Unit	Content	Teaching hours
1	Computer Fundamentals History and Generations of Computer. Architecture of the Computer. Different parts of a computer. System Software and Application Software. Different type of mother boards, Serial and Parallel ports. SMPS Features, Functions. Types of SMPS with block diagram	07
2	Basics of BIOS - ROM BIOS organization and services - BIOS for Windows, Function of a BIOS, Dot-Matrix Printer - Printer sub-assemblies - block diagram, Types of Printers - Printer Problems and Troubleshooting Techniques. Definition and types of Operating Systems. Functions & Features of OS. Introduction to RAM, ROM, Cache Memory.	08
3	Data Communication, Networks, Topology, Categories of Networks, OSI & TCP/IP Protocol suites Guided media, Unguided media.	07
4	Configuring IP address, A simple client-server implementation, A simple web server implementation	08

Text Books:
1. ANDREW S. TANENBAUM, Computer Networks, 4th Edition, Prentice-Hall of India, New Delhi, 2000.

Reference Books:
1. BEHROUZ A. FOROUZAN, Data Communications and Networking, 2nd Edition, Tata McGraw-Hill, New Delhi, 2003

Online Resources: NPTEL / SWAYAM lectures.