SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY

An Autonomous Institution | Approved by AICTE | Affiliated to Anna University
Accredited by NAAC with A++ Grade, Kuniamuthur, Coimbatore - 641008

83rd Rank

DEPARTMENT OF MECHATRONICS ENGINEERING

(Accredited by NBA)

AUTONOMOUS CURRICULUM AND SYLLABI

2024-2028 BATCH

REGULATIONS 2022

SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution | Approved by AICTE | Affiliated to Anna University | Accredited by NAAC with A++ Grade
Kuniamuthur, Coimbatore – 641008
Phone : (0422)-2678001 (7 Lines) | Email : info@skcet.ac.in | Website : www.skcet.ac.in

Curriculum & Syllabi

Regulation 2022

2024-2028 Batch

DEPARTMENT OF MECHATRONICS ENGINEERING

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DEPARTMENT OF MECHATRONICS ENGINEERING

(Batch 2024-2028)

VISION OF THE INSTITUTION

- To Produce Globally Competitive Engineers with High Ethical Values and Social Responsibilities

MISSION OF THE INSTITUTION

- To impart the highest quality state-of-the-art technical education by providing impetus to innovation, research, and development and empowering students with entrepreneurship skills
- To instill ethical values, imbibe a sense of social responsibility, and strive for societal well-being
- To identify the needs of society and offer sustainable solutions through outreach programs

DEPARTMENT OF MECHATRONICS ENGINEERING

VISION OF THE DEPARTMENT

- To provide world class education in the fields of Robotics and Automation to make Mechatronics Engineering the most preferred program among engineering aspirants

MISSION OF THE DEPARTMENT

To impart knowledge and skill to the students participating in the program by providing

M1: Expert Faculty to teach, inspire, mentor and motivate
M2: Excellent Infrastructure with facilities to learn Mechatronics, research and experiment
M3: Motivation towards self-learning, social responsibility and entrepreneurship
M4: Exposure to the latest technologies through industry-institute interaction
M5: Environment to develop their innovative thoughts, moral values, communication and multidisciplinary skills

I. PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)	
PEO 1	Apply knowledge of mathematics, science and engineering to solve contemporary engineering problems in the field of automation.
PEO 2	Design, analyze, fabricate and test smart products.
PEO 3	Exhibit the skills of simulation and experimentation using advanced engineering tools of industrial standards.
PEO 4	Communicate and develop strong interpersonal abilities to prepare them for placement and higher studies.
PEO 5	Be self-motivated towards lifelong learning and entrepreneurship.

II. PROGRAMME OUTCOMES (POs)	
PO 1	**Engineering knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop the solution of complex engineering problems
PO 2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/ develop systems/ components/ processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions (WK8)
PO 5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7)

PO 7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws (WK9)
PO 8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams
PO 9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO 10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments
PO 11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change (WK8)

Knowledge and Attitude Profile (WK)

WK1	A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences
WK2	Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline
WK3	A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline
WK4	Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline much is at the forefront of the discipline
WK5	Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area
WK6	Knowledge of engineering practice (technology) in the practice areas in the engineering discipline
WK7	Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development
WK8	Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues

WK9	Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes

III.	**PROGRAMME SPECIFIC OUTCOMES (PSOs)**
PSO 1	Design, simulate and create automation systems for various applications.
PSO 2	Apply the Knowledge of Robotics for addressing Societal, health and Safety Issues.

IV. MAPPING OF PEOs WITH POs

PEO	**POs**										
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11
1	3	2	3	1	2	3	2	3	3	3	2
2	3	3	2	2	3	2	1	2	2	2	3
3	3	3	3	2	1	3	2	2	3	1	3
4	3	2	3	1	2	3	2	2	3	3	3
5	3	3	3	1	2	3	2	2	3	1	3
	1- low, 2 - medium, 3 - high, '-' - no correlation										

V. MAPPING OF PEOs WITH PSOs

	PSO 1	**PSO 2**
PEO 1	3	3
PEO 2	3	3
PEO 3	3	3
PEO 4	2	2
PEO 5	2	2

AUTONOMOUS CURRICULUM AND SYLLABI

Regulations 2022

B.E. Mechatronics Engineering Curriculum 2024-2028 Batch						
Semester - I						
S.no	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
	Theory (Internal 40 Marks & External 60 Marks)					
1	23MT101	Production Technology	3/0/0	3	3	4,8,9
2	23MT102	Sensors, Measurements, and Instrumentation	3/0/0	3	3	4,8,10
3	23MA101	Mathematics I	3 / 1 / 0	4	4	4,8,17
Theory with Practical (Internal 50 Marks & External 50 Marks)						
4	23IT101	Application Development Practices	1/0/4	5	3	4,9
5	23CS101	Problem Solving using C++	1/0/4	5	3	4, 9
Practical (Internal 60 Marks & External 40 Marks)						
6	23EN101	Oral and Written Communication Skills	2/0/2	4	3	4, 8, 9 ,16
7	23MT103	Production Technology Laboratory	0/0/2	2	1	4,8,9
8	23MT202	Computer Aided Drawing Laboratory for Mechatronics	0/0/2	2	1	4,8,9
Indian Knowledge System - Blended Learning (Internal 100 Marks)						
9	23TA101	Heritage of Tamils / தமிழர் மரபு	3 Weeks		1	2, 7, 9, 12, 15, 16
Mandatory Course						
10	23MC101	Induction Programme	3 Weeks		0	4,8,9,10,11,16
		Total	**28**	**22**		

Semester – II						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23MT201	Applied Mechanics	3/0/0	3	3	4,8,9
2	23EC202	Digital System Design	3/0/0	3	3	4,8,10
3	23MA205	Differential Equations and Transform Techniques	3 / 1 / 0	4	4	4,8,17

4	23AS101	Applied Science	4/0/0	4	4	4,7,9,12,13,14
Theory with Practical (Internal 50 Marks & External 50 Marks)						
5	23CD201	Database Management Systems	1/0/4	5	3	4,8,9
6	23IT211	Introduction to Python Programming	1/0/4	5	3	4,8,9,12
Practical (Internal 60 Marks & External 40 Marks)						
7	23AS102	Applied Science Laboratory	0/0/4	4	2	4,7,9,12,13,14
8	23EC204	Digital System Design Laboratory	0/0/2	2	1	4,8,10
Indian Knowledge System - Blended Learning (Internal 100 Marks)						
9	23TA201	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	3 Weeks		1	2,7,9,11,12,15,17
Mandatory Course (Internal 100 Marks)						
10	23MC102	Mandatory Course – II (EVS)	3 Weeks		0	4,8,9,11,13,14,15
			Total	**30**	**24**	

Semester – III						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23GE301	Universal Human Values	3/0/0	3	3	3, 4, 10, 16
2	23MT302	Basics of Mechatronics Systems	3 / 0 / 0	3	3	4,8,9
3	23EC301	Signals and Systems	3 / 1 / 0	4	4	4,8,9
Theory with Practical (Internal 50 Marks & External 50 Marks)						
4	23MT305	Microcontrollers and Embedded systems	3/0/2	5	4	4,8,9
5	23MT301	Theory of Machines	3/0/2	5	4	4,8,9
6	23CSC01	Data Structures	3/0/2	5	4	4,9
Practical (Internal 60 Marks & External 40 Marks)						
7	23MT304	Idea Lab for Mechatronics	0/0/2	2	1	4, 9, 11, 12
			Total	**27**	**23**	
Certification/Online Course						
Certification/Spoken Tutorial/Coursera/NPTEL Courses- Minimum one Course						

Semester - IV						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23MT401	Machine Design	3 / 0 / 0	3	3	4,8,9
Theory with Practical (Internal 50 Marks & External 50 Marks)						
2	23MT406	Robotic System Engineering	3/0/2	5	4	4,8,9
3	23MT407	Electrical Actuators and Drives	3/0/2	5	4	4,8,9
4	23MT408	Control Theory	3/0/2	5	4	4,8,9
5	23MT409	Fluid and Thermal Engineering Systems	3 / 0 /2	5	4	4,8,9
6	23CY203	Programming in Java	1 / 0 / 4	5	4	4,9
Spoken Language (Internal 100 Marks)						
7	23SLC01	Multilingual Practices	0/0/2	2	1	4, 5, 10
Mandatory Course (Internal 100 Marks)						
8	23MCC11	Disaster Management and Preparedness	1 / 0 / 0	1	0	4,8,9,11,13,14,15
			Total	**31**	**23**	
Certification/Online Course						
Certification/Spoken Tutorial/Coursera/NPTEL Courses- Minimum one Course						

Semester – V						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23MT501	Autotronics and Vehicle Intelligence	3/0/0	3	3	4,8,9
2	23MTXXX	Professional Elective-I	3/0/0	3	3	-
3	23XXXXX	Open / Emerging / Industrial Elective- I	3/0/0	3	3	-
4	23MTXXX	Professional Elective-II	3/0/0	3	3	-
Theory with Practical (Internal 50 Marks & External 50 Marks)						
5	23MT503	Hydraulics and Pneumatics System	3/0/2	5	4	4,8,9
6	23MT506	Programming in Embedded C++	3/0/2	5	4	4,8,9

Project (Internal 100 Marks)						
7	23MT507	Prototype lab	0/0/2	2	1	8, 9, 11, 12
			Total	**24**	**21**	
Semester - VI						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23MT602	Industrial Management and Professional Ethics	3/0/0	3	3	4,8,9
2	23MT603	Computer Networks and Cyber Security	3/0/0	3	3	4,8,9,16
3	23MTXXX	Professional Elective – III	3/0/0	3	3	-
4	23XXXXX	Open / Emerging / Industrial Elective- II	3/0/0	3	3	-
Theory with Practical (Internal 50 Marks & External 50 Marks)						
5	23MT601	Computer Integrated Manufacturing	3/0/2	5	4	4,8,9
6	23MT604	Industrial Automation	3/0/2	5	4	4,8,9
Mandatory Course-Blended Learning (Internal 100 Marks)						
7	23MC1XX	Mandatory Course – IV			0	4, 5, 10
			Total	**22**	**20**	

Semester – VII						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	**SDG Mapping**
Theory (Internal 40 Marks & External 60 Marks)						
1	23XXXXX	Professional Elective – IV	3/0/0	3	3	-
2	23MTXXX	Professional Elective – V	3/0/0	3	3	-
3	23MTXXX	Professional Elective – VI	3/0/0	3	3	-
4	23XXXXX	Open / Emerging / Industrial Elective- III	3/0/0	3	3	-
5	23XXXXX	Open / Emerging / Industrial Elective- IV	3/0/0	3	3	-
Project (Internal 60 Marks & External 40 Marks)						
6	23MT704	Project – I	0/0/6	6	3	4,8,9,17

Internship (Internal 100 Marks)						
7	23EES01	Employability Enhancement Skills	-	-	2	4,8,9,17
				Total	**23**	**20**

Semester - VIII						
S. No.	**Course Code**	**Courses**	**L/T/P**	**Total Hours**	**Credits**	
Project (Internal 60 Marks & External 40 Marks)						
1	23MT801	Project - II	0/0/24	**24**	**12**	4,8,9,17
					Total Credits	**165**

SCHEME OF CREDIT DISTRIBUTION – SUMMARY

Sl. No.	Stream	Credits/Semester								C	%
		I	II	III	IV	V	VI	VII	VIII		
1	**Humanities & Social Sciences Including Management (HSMC)**	4	1	3	-	-	3	-	-	**11**	**6.67**
2	**Basic Sciences (BSC)**	4	10	-	-	-	-	-	-	**14**	**8.48**
3	**Engineering Sciences (ESC)**	6	6	8	4	-	-	-	-	**24**	**14.54**
4	**Professional Core (PCC)**	8	7	12	19	11	11	-	-	**68**	**41.21**
5	**Professional Electives (PEC)**	-	-	-	-	6	3	9	-	**18**	**10.91**
6	**Open / Emerging / Industrial Elective (OEC)**	-	-	-	-	3	3	6		**12**	**7.27**
7	**Project Work (PROJ)**	-	-	-	-	1	-	5	12	**18**	**10.91**
8.	**Mandatory Course (MC) / Spoken Hindi**	-	-	-	-	-	-	-	-	**0**	**0.00**
Total		**22**	**24**	**23**	**23**	**21**	**20**	**20**	**12**	**165**	**100**

STRUCTURE FOR UNDERGRADUATE ENGINEERING PROGRAM			
S. No.	**Course Work - Subject Area**	**AICTE Suggested Credits**	**SKCET Credits (MCT)**
1.	Humanities and Social Sciences (HS), including Management;	12*	11
2.	Basic Sciences (BS) including Mathematics, Physics, Chemistry, Biology;	21*	14
3.	Engineering Sciences (ES), including Materials, Workshop, Drawing, Basics of Electrical / Electronics/ Mechanical/ Computer Engineering /Instrumentation	-	28
4.	Professional Subjects-Core (PC), relevant to the chosen specialization/branch; (May be split into Hard (no choice) and Soft (with choice), if required	101*	64
5.	Professional Subjects – Electives (PE), relevant to the chosen specialization/ branch	6*	18
6.	Open Subjects- Electives (OE), from other technical and/or emerging subject areas	6*	12
7.	Project Work, Seminar and/or Internship in Industry or elsewhere.	17*	18
8.	Mandatory Courses (MC)	Non-credit	0
Total		**163***	**165**
**Minor Variations is allowed as per need of the respective disciplines*			

HUMANITIES & SOCIAL SCIENCES INCLUDING MANAGEMENT (11 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	23EN101	Oral and Written Communication Skills	2/0/2	4	3	4, 8, 9 ,16
2.	23TA101	Heritage of Tamils / தமிழர் மரபு	3 Weeks		1	2, 7, 9, 12, 15, 16
3.	23TA201	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	3 Weeks		1	2,7,9,11,12,15 ,17
4.	23GE301	Universal Human Values	3/0/0	3	3	3, 4, 10, 16
5.	23MT602	Industrial Management and Professional Ethics	3/0/0	3	3	4,8,9

BASIC SCIENCE COURSES (14 Credits)						
SL. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23MA101	Mathematics I	3 / 1 / 0	4	4	4,8,17
2.	23MA205	Differential Equations and Transform Techniques	3 / 1 / 0	4	4	4,8,17
3.	23AS101	Applied Science	4/0/0	4	4	4,7,9,12,13, 14
4.	23AS102	Applied Science Laboratory	0/0/4	4	2	4,7,9,12,13, 14

ENGINEERING SCIENCE COURSES (24 Credits)						
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23IT101	Application Development Practices	1/0/4	5	3	4,9
2.	23CS101	Problem Solving using C++	1/0/4	5	3	4, 9
3.	23CD201	Database Management Systems	1/0/4	5	3	4,8,9
4.	23IT211	Introduction to Python Programming	1/0/4	5	3	4,8,9,12
5.	23EC301	Signals and Systems	3/1/0	4	4	4,8,9
6.	23CSC01	Data Structures	3/0/2	5	4	4,9
7.	23CY203	Programming in Java	1/0/4	5	4	4,9

PROFESSIONAL CORE COURSES (68 Credits)						
S. No.	Course Code	Course Title	L/T/P	Contact hrs./Wk.	C	SDG Mapping
1.	23MT101	Production Technology	3/0/0	3	3	4,8,9
2.	23MT102	Sensors, Measurements, and Instrumentation	3/0/0	3	3	4,8,10
3.	23MT103	Production Technology Laboratory	0/0/2	2	1	4,8,9
4.	23MT202	Computer Aided Drawing Laboratory for Mechatronics	0/0/2	2	1	4,8,9
5.	23MT201	Applied Mechanics	3/0/0	3	3	4,8,9

6.	23EC204	Digital System Design Laboratory	0/0/2	2	1	4,8,10
7.	23MT302	Basics of Mechatronics Systems	3/0/0	3	3	4,8,9
8.	23MT305	Microcontrollers and Embedded systems	3/0/2	5	4	4,8,9
9.	23MT301	Theory of Machines	3/0/2	5	4	4,8,9
10.	23MT304	Idea Lab for Mechatronics	0/0/2	2	1	4, 9, 11, 12
11.	23MT401	Machine Design	3/0/0	3	3	4,8,9
12.	23MT409	Fluid and Thermal Engineering Systems	3/0/2	5	4	4,8,9
13.	23MT406	Robotic System Engineering	3/0/2	5	4	4,8,9
14.	23MT407	Electrical Actuators and Drives	3/0/2	5	4	4,8,9
15.	23MT408	Control Theory	3/0/2	5	4	4,8,9
16.	23MT501	Autotronics and Vehicle Intelligence	3/0/0	3	3	4,8,9
17.	23MT503	Hydraulics and Pneumatics System	3/0/2	5	4	4,8,9
18.	23MT506	Programming in Embedded C++	3/0/2	5	4	4,8,9
19.	23MT602	Industrial Management and Professional Ethics	3/0/0	3	3	4,8,9
20.	23MT603	Computer Networks and Cyber Security	3/0/0	3	3	4,8,9,16
21.	23MT601	Computer Integrated Manufacturing	3/0/2	5	4	4,8,9
22.	23MT604	Industrial Automation	3/0/2	5	4	4,8,9

PROFESSIONAL ELECTIVE COURSES (18 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
ELECTIVE STREAM I – APPLIED ROBOTICS						
1.	23MT901	Mobile Robotics	3/0/0	3	3	9,11
2.	23MT902	Agricultural Robotics and Automation	3/0/0	3	3	2,8,9,12,13
3.	23MT903	Bio mechatronics	3/0/0	3	3	3,9

4.	23MT904	Robot Operating System	3/0/0	3	3	4,9
5.	23MT905	Micro Robotics	3/0/0	3	3	3,6,9
6.	23MT906	Humanoids	3/0/0	3	3	4,8,10
7.	23MT937	Introduction to Marine and Aerial Robotics	3/0/0	3	3	9,13,14,15
8.	23MT938	Robot Motion Planning	3/0/0	3	3	9,11
9.	23MT939	Robot Control	3/0/0	3	3	9,4
ELECTIVE STREAM II - DESIGN AND MANUFACTURING						
1.	23MT907	Product Design and Manufacturing	3/0/0	3	3	9,12
2.	23MT908	Robots and System in Smart Manufacturing	3/0/0	3	3	9,8
3.	23MT909	CNC Machines and Part Programming	3/0/0	3	3	9,12
4.	23MT910	Additive Manufacturing Processes	3/0/0	3	3	9,12,13
5.	23MT911	Robotic Welding Technology	3/0/0	3	3	8,9
6.	23MT912	Digital Manufacturing	3/0/0	3	3	9,12
7.	23MT940	Micro and Nano Manufacturing	3/0/0	3	3	3,6,9
8.	23MT941	Industrial Metrology	3/0/0	3	3	9,12
9.	23MT942	Microelectromechanical Systems	3/0/0	3	3	3,9,13
ELECTIVE STREAM III - SMART MOBILITY SYSTEMS						
1.	23MT913	Advanced Driver Assistance Systems	3/0/0	3	3	3,9
2.	23MT914	Vehicle Ergonomics	3/0/0	3	3	3,10,12
3.	23MT915	Autonomous Underwater Vehicles	3/0/0	3	3	9,13,14
4.	23MT916	Electric and Hybrid Vehicles	3/0/0	3	3	7,9,11,13
5.	23MT917	Automobile Engineering	3/0/0	3	3	4,9,12
6.	23MT918	Battery Management System	3/0/0	3	3	7,12,13
7.	23MT943	Connected Vehicles	3/0/0	3	3	3,9,11
8.	23MT944	Safety, Ethics and Regulations for Driverless Cars	3/0/0	3	3	3,10,16
9.	23MT945	Foundations of Autonomous Vehicles	3/0/0	3	3	4,9,11
ELECTIVE STREAM IV – INTELLIGENCE SYSTEMS						
1.	23MT919	Introduction to Machine Learning	3/0/0	3	3	4,9,17
2.	23MT920	AI for Perception Planning and Control	3/0/0	3	3	3,9,11
3.	23MT921	Condition Monitoring and Fault Diagnostics	3/0/0	3	3	9,12,13
4.	23MT922	Intelligent Control System	3/0/0	3	3	7,9,12
5.	23MT923	Haptics	3/0/0	3	3	4,3,10
6.	23MT924	Computer Vision and Deep Learning	3/0/0	3	3	3,9,11
7.	23MT946	Reinforcement Learning for Robotics	3/0/0	3	3	4,9,13
8.	23MT947	Virtual Reality and its Applications	3/0/0	3	3	3,4,10
9.	23MT948	Augmented and Mixed Reality	3/0/0	3	3	4,9,11
ELECTIVE STREAM V – AUTOMATION						

1.	23MT925	Embedded System for Automation	3/0/0	3	3	9,7,12
2.	23MT926	Robotic Process Automation	3/0/0	3	3	8,9,12
3.	23MT927	Industrial Networking	3/0/0	3	3	9,11
4.	23MT928	Virtual Instrumentation and its Applications	3/0/0	3	3	4,9,12
5.	23MT929	Digital Twin and Industry 5.0	3/0/0	3	3	9,12,13,
6.	23MT930	Internet of Things for Mechatronics	3/0/0	3	3	6,9,11
7.	23MT949	AI and Machine Learning in Automation Testing	3/0/0	3	3	9,12
8.	23MT950	Planning and Decision Making in Robotics	3/0/0	3	3	3,9,11
9.	23MT951	Automation in Production Systems and Management	3/0/0	3	3	8,9,12
ELECTIVE STREAM VI – AVIONICS AND DRONE TECHNOLOGY						
1.	23MT931	Avionics	3/0/0	3	3	9,11,13
2.	23MT932	Drone Technologies	3/0/0	3	3	2,3,9,13
3.	23MT933	Navigation and Communication System	3/0/0	3	3	9,11,17
4.	23MT934	Unmanned Aerial Vehicles	3/0/0	3	3	9,11,13
5.	23MT935	Aircraft Stability and Control	3/0/0	3	3	4,9,11
6.	23MT936	Aircraft Mechatronics	3/0/0	3	3	7,9,12
7.	23MT952	Introduction to Aircraft Control System	3/0/0	3	3	3,9
8.	23MT953	Introduction to Airplane Performance	3/0/0	3	3	9,13
9.	23MT954	Introduction to Aircraft design	3/0/0	3	3	7,9,13

INDIAN KNOWLEDGE SYSTEM (02 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	23TA101	Heritage of Tamils / தமிழர் மரபு	3 Weeks		1	2, 7, 9, 12, 15, 16
2.	23TA201	Tamils and Technology / தமிழரும் தொழில்நுட்பமும்	3 Weeks		1	2,7,9,11,12,15, 17

OPEN/ EMERGING/ INDUSTRY (9 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
OPEN ELECTIVES (OE): Offered to other departments						
1.	23MT001	Basics of Robotics	3/0/0	3	3	2,3,9,13

2.	23MT002	Basics of Automation Systems	3/0/0	3	3	9,11,17
3.	23MT003	Smart Sensors for IoT	3/0/0	3	3	9,11,13
4.	23MT004	Basics of Unmanned Aerial Vehicles	3/0/0	3	3	4,9,11
5.	23MT005	Fundamentals of Arduino and Raspberry Pi	3/0/0	3	3	7,9,12
EMERGING ELECTIVES (EE): Offered to MCT						
1.	23MT006	Collaborative Robotics	3/0/0	3	3	9,11,17
2.	23MT007	Design Thinking and Entrepreneur Development	3/0/0	3	3	9,11,13
3.	23MT008	Brain Computer Interface	3/0/0	3	3	9,11,17
4.	23MT009	Social Robotics	3/0/0	3	3	9,11,13
5.	23MT010	Cognitive Robotics	3/0/0	3	3	4,9,11
6.	23MT011	Data Analytics for Robotics and Automation	3/0/0	3	3	9,11,17
7.	23MT012	Ethical Hacking	3/0/0	3	3	9,11,13
8.	23MT013	Communication Networks in IoT	3/0/0	3	3	4,9,11
9.	23MT014	Vision Guided Robots	3/0/0	3	3	9,11,17

PROJECT WORK (16 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	23MT507	Prototype lab	0/0/2	2	1	8, 9, 11, 12
2.	23MT704	Project – I	0/0/6	6	3	4,8,9,17
3.	23MT801	Project - II	0/0/24	24	12	4,8,9,17

PROFESSIONAL ELECTIVE COURSES: VERTICAL					
Vertical I	**Vertical II**	**Vertical III**	**Vertical IV**	**Vertical V**	**Vertical VI**
APPLIED ROBOTICS	**DESIGN AND MANUFACTURING**	**SMART MOBILITY SYSTEMS**	**INTELLIGENCE SYSTEMS**	**AUTOMATION**	**AVIONICS AND DRONE TECHNOLOGY**
23MT901- Mobile Robotics	23MT907- Product Design and Manufacturing	23MT913- Advanced Driver Assistance Systems	23MT919 - Introduction to Machine Learning	23MT925- Embedded System for Automation	23MT931-Avionics
23MT902- Agricultural Robotics and Automation	23MT908- Robots and System in Smart Manufacturing	23MT914- Vehicle Ergonomics	23MT920- AI for Perception Planning and Control	23MT926- Robotic Process Automation	23MT932-Drone Technologies
23MT903- Bio-Mechatronics	23MT909- CNC Machines and Part Programming	23MT915- Autonomous Underwater Vehicles	23MT921- Condition Monitoring and Fault Diagnostics	23MT927- Industrial Networking	23MT933-Navigation and Communication System
23MT904- Robot Operating System	23MT910-Additive Manufacturing Processes	23MT916-Electric and Hybrid Vehicles	23MT922- Intelligent Control System	23MT928-Virtual Instrumentation and its Applications	23MT934- Unmanned Aerial Vehicles
23MT905- Micro Robotics	23MT911-Robotic Welding Technology	23MT917-Auto-mobile Engineering	23MT923- Haptics	23MT929-Digital Twin and Industry 5.0	23MT935- Aircraft Stability and Control

23MT906- Humanoids	23MT912- Digital Manufacturing	23MT918-Battery Management System	23MT924- Computer Vision and Deep Learning	23MT930- Internet of Things for Mechatronics	23MT936-Aircraft Mechatronics
23MT937 - Introduction to Marine and Aerial Robotics	23MT940 - Micro and Nano Manufacturing	23MT943 - Connected Vehicles	23MT946- Reinforcement Learning for Robotics	23MT949 - AI and Machine Learning in Automation Testing	23MT952 - Introduction to Aircraft Control System
23MT938 - Robot Motion Planning	23MT941 - Industrial Metrology	23MT944- Safety, Ethics and Regulations for Driverless Cars	23MT947 - Virtual Reality and its Applications	23MT950 - Planning and Decision Making in Robotics	23MT953 - Introduction to Airplane Performance
23MT939 - Robot Control	23MT942 - Micro Electro Mechanical Systems	23MT945 - Foundations of Autonomous Vehicles	23MT948 - Augmented and Mixed Reality	23MT951 - Automation in Production Systems and Management	23MT954 - Introduction to Aircraft design

INTERNSHIP (2 Credits)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	23EES01	Employability Enhancement Skills	-		2	4,8,9,17

VALUE ADDED COURSES (Based on student's interest)							
S. No	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**	**Sem**
1.	23VA600	Real time data acquisition using LabVIEW- VI solutions, Bengaluru	0/0/2	2	1	9,4	III/IV
2.	23VA601	CAD modeling and analysis software (CREO, catia, Fusion360, Ansys, NX CAD) - CAD Solutions, Coimbatore	0/0/2	2	1	9,12	III/IV
3.	23VA602	Autonomous Mobile Robots - Goat Robotics and Anya Robotics, Coimbatore	0/0/2	2	1	8,9	IV/V
4.	23VA603	Industry 4.0 - Maxbyte Technologies, Coimbatore	0/0/2	2	2	9,11	IV/V
5.	23VA604	Embedded and Microcontroller Programming - RoboRam Education	0/0/2	2	2	4,9	IV/V
6.	23VA605	Fusion 360 - ICT Academy, Coimbatore	0/0/2	2	1	9,12	VI/VII
7.	23VA606	Electric Vehicle, Industry 4.0, Data Analytics, Industrial Automation, Robotics and Automation, IoT using smart devices Lean Six Sigma – Yellow, Green and black) - TVS Training & Services Limited	0/0/2	2	2	7,9,11,12	VI/VII
8.	23VA607	Mastering Embedded Systems: Unleash the Power of Controller Boards-IIT BOMBAY e-YANTRA	0/0/2	2	1	4,9	VI/VII
9.	23VA608	AI and Deep learning - DeepVision Tech AI	0/0/2	2	1	3,4,9,13	VI/VII

MANDATORY COURSES (Non-Credits) (Courses conducted either by internal faculty or through MOOCs)						
SL. No.	**Course Code**	**Course Title**	**L/T/P**	**Contact hrs./Wk.**	**C**	**SDG Mapping**
1.	23MC101	Induction Programme	3 weeks		0	3,4,10
2.	23MC102	Environmental Sciences	3 weeks		0	4,8,9,11,13, 14,15
3.	23MC103	Soft Skills	3 weeks		0	4,8,9
4.	23MC104	Management Organizational Behavior	3 weeks		0	4,5,10
5.	23MC105	General Aptitude	3 weeks		0	3,4,10
6.	23MC106	Life Skills and Ethics	3 weeks		0	4,8,9,11,13, 14,15
7.	23MC107	Stress Management	3 weeks		0	4,8,9
8.	23MC108	Constitution of India	3 weeks		0	4,5,10
9.	23MC109	Essence of Indian Traditional Knowledge	3 weeks		0	3,4,10
10.	23MC110	Biology	3 weeks		0	4,8,9,11,13, 14,15
11.	23MCC11	Disaster Management and Preparedness”	1		0	4,8,9,11,13, 14,15

L: Lecture **T:** Tutorial **P:** Practical **C:** Credit **O:** Outside Class hours **Cat.:** Category

HSMC : Humanities and Social Sciences including Management
BSC : Basic Science Courses
ESC : Engineering Science Courses
PCC : Professional Core Courses
PEC : Professional Elective Courses
OEC : Open and Emerging Elective Courses
PRJ : Project Work
INT : Internship
MC : Mandatory Course

Definition of Credit:

L – Lecture	1 Hr. Lecture (L) per week	1 credit
T – Tutorial	1 Hr. Tutorial (T) per week	1 credit
P - Practical/Practice (Project and Industry based Courses)	1 Hr. Practical (P) per week	0.5 credit

SEMESTER-I

23MT101	PRODUCTION TECHNOLOGY	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To understand the various methods of manufacturing processes.
2. To develop the knowledge on machines and related tools for manufacturing various components.
3. To impart the knowledge of relative advantages of advanced manufacturing processes over conventional techniques.

MODULE I MATERIALS AND MANUFACTURING PROCESSES 15

Introduction to Materials: Steel-Types- Cast Iron- Types- Casting: Sand casting, Die casting, Investment casting. Forging- Rolling- Extrusion - Sheet metal Process: Blanking, Punching and Bending. Welding – Electric arc welding-Resistance Welding-Submerged arc welding, Tungsten inert gas welding-Powder metallurgy process.

MODULE II MACHINE TOOLS 15

Machine tools: Lathe machine –Types and Operations - Construction of Engine lathe – Construction of horizontal milling machine – Keyway and gear milling – Construction of Shaping machine–Construction of radial drilling machine - Construction of cylindrical grinding and Surface grinding machine

MODULE III ADVANCED MANUFACTURING PROCESSES 15

Classification of advanced manufacturing processes – Construction, Working Principle and Applications of: Ultrasonic Machining, Electrical Discharge Machining, Laser Beam Machining, Plasma Arc Machining, Electro chemical Machining-Introduction to Additive Manufacturing.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Identify the most appropriate manufacturing process for a given material and product.	[R]
CO2	Understand basic manufacturing operations, including their capabilities, limitations.	[U]
CO3	Explain the construction of Lathe, Milling, Drilling and grinding machine	[U]
CO4	Infer the significance of unconventional machining processes	[AP]
CO5	Choose the process parameters for different manufacturing processes	[AP]

TEXTBOOKS

1. R.K. Rajput, “A Text book of Manufacturing Technology (Manufacturing Processes)”, Lakshmi Publications (P) Ltd., New Delhi, 2019.
2. Pandey P.C. and Shan H.S., “Modern Machining Processes”, Tata McGraw-Hill, New Delhi, 2017.

3. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I and II, Media Promoters and Publishers Pvt., Ltd., Mumbai, 2014.

REFERENCE BOOKS

1. R.S. Khurmi & J.K. Gupta, “A Text book of Workshop Technology: Manufacturing Processes”, Nirja Publishers & Printers Pvt. Ltd., Uttarakhand, 2021.
2. V.K.Jain, “Advanced Machining Processes”, Allied Publishers Pvt. Ltd., Bengaluru, 2016.

WEB RESOURCES

1. https://nptel.ac.in/courses/112105126
2. https://www.edx.org/course/fundamentals-manufacturing-processes-mitx-2-008x
3. https://onlinecourses.nptel.ac.in/noc22_me119/preview

23MT102	SENSORS, MEASUREMENTS AND INSTRUMENTATION	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To observe the basic concept conventional transducers and its characteristics.
2. To understand various sensors and transducers for measuring mechanical quantities.
3. To familiarize the basics of Virtual Instruments.

MODULE I CLASSIFICATION OF SENSORS 15

Introduction - Hall effect sensors, Tactile, Proximity, Capacitive, Inductive, Fiber optic, Thermal, Chemical, Inertial Rotary, Magnetic, Nano Sensor, Smart Sensors, Measurement of vehicle speed with radar sensors.

MODULE II MEASUREMENT SYSTEMS 15

Basic block diagram-Terminologies - Performance characteristics – Errors - Calibration and Standards- Transducer vs sensors-Resistive transducer: Potentiometer, strain gauge-inductive transducer: LVDT-Capactive transducer-Self generating transducer: Piezoelectric transducer.

MODULE III FORM MEASUREMENTS 15

Optical Flat – Thread Gauge - Gear Measurements – Optical Projector, Angular Velocity Measurement: Stroboscopic methods – Encoders and Resolvers - Vibrometer and Accelerometer – Densitometers, Laser Interferometer, Data Display and Recording Systems-Introduction to Virtual Instrumentation using LabVIEW- Comparison with traditional Instrument, Components of DAQ.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Explain the various types of sensors.	[U]
CO2	Examine the basics of measurement systems and errors	[R]
CO3	Choose different types of sensors and transducers for various applications	[AP]
CO4	Discuss the methodologies for measuring various physical and mechanical parameters	[U]
CO5	Illustrate the basic concepts of Virtual Instrumentation	[U]

TEXTBOOKS

1. John P. Bentley, “Principles of Measurement Systems”, Pearson Education, 6th Edition, 2018.
2. Samir Mekid, “Metrology and Instrumentation Practical Applications for Engineering and Manufacturing”, 1st Edition 2022.

3. A K.Sawhney, “A course in Electrical and Electronic Measurements and Instrumentation”, Dhanpat rai & co, 2015.

REFERENCE BOOKS

1. Murthy D. V. S, “Transducers and Instrumentation”, Prentice Hall, 2nd Edition, 2018.
2. S. Sumathi and P. Surekha, “LabVIEW based Advanced Instrumentation Systems” Springer-Verlag Berlin Heidelberg, 2015.

WEB RESOURCES

1. https://www.sciencedirect.com/science/article/pii/B9780123819604000127
2. https://www.sciencedirect.com/science/article/pii/B9780123819604000139
3. https://www.sciencedirect.com/topics/engineering/sensor-fusion

23MA101	MATHEMATICS I	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. To use logical notation to define the fundamental data types and structures used in computer algorithms and systems..
2. To use the concepts of graph theory in practical situations.
3. To acquire thorough knowledge of fundamental notions of proof's and its application in Cryptography.
4. To analyse data pertaining to discrete and continuous random variables to interpret the results.
5. To impart the knowledge of counting principles, to think critically and apply it in real world problems.

MODULE I LOGICAL PROOFS & FUNCTIONS 20

Proofs: Definitions - Proof by cases - Proof by contradiction - Logical formulas - Propositions - Truth table - Logical operators - Tautologies and Contradictions – Contrapositive - Equivalences and implications - Predicates - Free and bound variables – Quantifiers - Universe of discourse - **Sets:** Basic sets - Operations on Sets – Law on Sets (without proof) - Cartesian product of sets. **Relations:** Types of relations and their properties - Relational matrix and graph of a relation - Equivalence relations - Partial ordering relation - Graphical representation of relations - Binary relation - **Functions:** Classifications of functions – Induction - Ordinary induction and Strong induction - Recursive data types - Definition of recursive and structural induction.

MODULE II NUMBER THEORY & GRAPH THEORY 20

Number Theory: Divisibility - Greatest common divisor - Euclid's algorithm - Prime numbers - Fundamental theorem of arithmetic - Modular arithmetic - Multiplicative inverses and cancelling - Relatively prime - Euler's theorem. **Graph Theory:** Vertices and Degrees - Types of graphs - Handshaking theorem - Adjacency matrices - Walks and paths - Directed acyclic graphs and scheduling – Isomorphism - Connectivity - Trees - Spanning trees - Minimum weight spanning trees - Prims algorithm - Kruskal algorithm.

MODULE III COUNTING & PROBABILITY 20

Sums and Asymptotics - Sums of Powers - Harmonic Numbers - Asymptotic Notation -The Division Rule - Counting Subsets - Sequences with Repetitions - The Pigeonhole Principle - Events and Probability Spaces - Set Theory and Probability - The Four-Step Method for Conditional Probability - The Law of Total Probability - Baye's theorem – Independence - Mutual Independence - Pairwise Independence - Random Variables - Distribution Functions - Bernoulli Distributions - Uniform Distributions - Binomial Distributions - Great Expectations - Conditional Expectation - Linearity of Expectation - Infinite Sums - Expectations of Products

TOTAL PERIODS: 60

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall the basic concepts of logical laws, structures and probability.	[R]
CO2	Understand the concepts of proof techniques, structures and random variables.	[U]
CO3	Apply the logical and foundational structures of mathematics with an emphasis on writing proofs.	[AP]
CO4	Apply the concepts of graph and number theory in cryptography.	[AP]
CO5	Apply the probability concepts in transition from real problem to a probabilistic model.	[AP]

TEXTBOOKS

1. Tremblay J.P and Manohar R, “Discrete Mathematical Structures with applications to Computer Science”, Tata McGraw–Hill Pub. Co. Ltd, New Delhi, 30th Reprint, 2011.
2. Koshy. T, “Elementary Number Theory with Applications”, Elsevier Publications, New Delhi, Second Edition, 2007.
3. Eric Lehman, F. Thomson Leighton and Albert R. Meyer, “Mathematics for Computer Science”, 14thEdition, MIT Open courseware, 2018.

REFERENCE BOOKS

1. Bernard Kolman, Robert C. Busby, Sharan Cutler Ross, “Discrete Mathematical Structures”, sixth edition, Pearson Education Pvt Ltd., New Delhi, 2017
2. Kenneth H. Rosen, “Discrete Mathematics and its Applications”, Eighth Edition, Tata McGraw – Hill Pub. Co. Ltd., New Delhi, Eighth Edition, 2021.
3. Thomas Koshy, “Discrete Mathematics with Applications”, Elsevier Publications, 2004
4. P. Grimaldi, “Discrete and Combinatorial Mathematics: An Applied Introduction”, Fifth Edition, Pearson Education Asia, New Delhi, Fifth Edition, 2019.

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc23_cs109/preview
2. https://onlinecourses.nptel.ac.in/noc23_cs120/preview
3. https://onlinecourses.nptel.ac.in/noc23_ma77/preview
4. https://onlinecourses.nptel.ac.in/noc23_ma72/preview

23IT101	APPLICATION DEVELOPMENT PRACTICES	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1. To discuss the essence of agile development methods.
2. To understand and apply Scrum framework.
3. To set up and create a GitHub repository.
4. To impart the knowledge of web application development platforms.
5. To create interactive websites using HTML, CSS.
6. To recognize the user experience design methodologies like Java script for responsive web design.

MODULE I SOFTWARE DEVELOPMENT AND BASIC LINUX PROGRAMMING 5

History of traditional software development model, SDLC, Waterfall Model, Agile Software Development - Agile Manifesto and Principles, Agile Values, Characteristics, Agile methods and practices, Agile Vs Waterfall Model, Introduction to Scrum, Roles and Responsibilities, Practices and Artifacts, User Story, Review Meetings, Product backlog, Sprint backlog, Iteration planning, User story definition, Characteristics and content of user stories, Acceptance tests and Verifying stories, Project velocity, Burn down chart, Sprint Scrum Team, Extreme Programming (XP) – Principles, Lean Software Development – Principles, Kanban, Introduction to Git - Getting a Git Repository, Recording Changes to the Repository, Viewing the Commit History, Undoing Things, Working with Remotes, Tagging, Git Aliases, Git Branching, Branches in a Nutshell, Basic Branching and Merging, Branch Management, Remote Branches, Rebasing. Introduction to GitHub – Introduction, Set up Git, Create a repository, GitHub Flow, Contribution to Projects, Communicating on GitHub. Linux Basic Commands, Linux File Permissions, Basic System Administration, Process Management, Archival. Linux Shell Script - Shell Basics, Writing first script, Conditional statements, Loops, Command line arguments, Functions & file manipulations, Background processes, Scheduling processes -At, batch & Cron -Networking.

MODULE II HTML 5

HTML Basics - Understand the structure of an HTML page, New Semantic Elements in HTML 5, Learn to apply physical/logical character effects, Learn to manage document spacing. Tables - Understand the structure of an HTML table, Learn to control table format like cell spanning, cell spacing, border. List - Numbered List, Bulleted List, Working with Links, Understand the working of hyperlinks in web pages, Learn to create hyperlinks in web pages, Add hyperlinks to list items and table contents. Image Handling - Understand the role of images in web pages, Learn to add images to web pages, Learn to use images as hyperlinks. Frames - Understand the need for frames in web pages, Learn to create and work with frames. HTML Forms for User Input - Understand the role of forms in web pages, Understand various HTML elements used in forms, Single line text field, Text area, Check box, Radio buttons, Password fields, Pull-down menus, File selector dialog box. New Form Elements - Understand the new HTML form elements such as date, number, range, email, search and data list, Understand audio, video, article tags.

MODULE III FRONT END DEVELOPMENT 5

Introduction to Cascading Style Sheets - What CSS can do, CSS Syntax, Types of CSS. Working with Text and Fonts - Text Formatting, Text Effects, Fonts. CSS Selectors - Type Selector, Universal Selector, ID Selector, Class selector. Colors and Borders – Background, Multiple Background, Colors RGB and RGBA, HSL and HSLA, Borders, Rounded Corners, Applying Shadows in border, Implementing CSS3 in the "Real World" – Modernizr, HTML5 Shims, SASS, and Other CSS Preprocessors, CSS Grid Systems, CSS Frameworks. Introduction to Bootstrap – Introduction, Getting Started with Bootstrap, Bootstrap Basics, Bootstrap grid system, Bootstrap Components, Page Header, Breadcrumb, Button Groups, Dropdown, Nav & Navbars. JavaScript Essentials - Var, Let and Const keyword, Arrow functions, default arguments, Template Strings, String methods, Object de-structuring, Create, apply, prototype, bind method, Spread and Rest operator, Typescript Fundamentals, Types & type assertions, Creating custom object types, function types, Typescript OOPS - Classes, Interfaces, Constructor, Decorator & Spread Operator, Difference == & === , Asynchronous Programming in ES6, Promise Constructor, Promise with Chain, Promise Race.

TOTAL PERIODS(Theory): 15

LIST OF EXPERIMENTS

1. Study of Basic Linux Commands.
2. Implementation of Shell Programming.
3. Design a web page using HTML basic tags.
4. Develop web site with suitable contents and links.
5. Design web pages using lists and tables.
6. Build a web client-side Login, Registration form and Dashboard with drop down menus.
7. Develop a HTML form and validation using HTML5 features.
8. Create a website using HTML: To embed an image map in a web page, To fix the hot spots., Show all the related information when the hot spots are clicked.
9. Apply style specification in HTML page using CSS.
10. Develop dynamic web application using HTML, CSS and JavaScript.

TOTAL PERIODS(Lab): 60

TOTAL PERIODS:75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Relate the concepts of agile software engineering and its advantages in software development.	[R]
CO2	Demonstrate the roles and responsibilities of Scrum, Lean Software Development and how to setup the GitHub repository.	[U]
CO3	Analyze the working model and develop static, dynamic websites.	[AN]
CO4	Utilize the knowledge of HTML, CSS and Bootstrap using forms to build modern interactive web applications.	[AP]
CO5	Develop dynamic web pages using HTML5 with validation using Java Script objects and by applying different event handling mechanisms.	[AP]

TEXT BOOKS

1. Roman Pichler, “Agile Product Management with Scrum Creating Products that Customers Love”, Pearson Education, 1st Edition, 2010.

2. Jeff Sutherland, “Scrum the Art of Doing Twice the Work in Half the Time”, Random House Publisher,1st Edition, 2015.
3. Scott Chacon, Ben Straub, “Pro GIT”, CreateSpace Independent Publishing Platform, 2017.
4. Richard Blum, Christine Bresnahan, “Linux Command Line and Shell Scripting BIBLE”, Wiley India Pvt. Limited, 2020.
5. Jennifer Niederst Robbins., “Learning Web Design, A beginner's guide to HTML, CSS, JavaScript, and Web Graphics”, O'Reilly Media, 5th Edition, 2018.
6. Jennifer Smith and the AGI Creative Team, “Web Design with HTML and CSS”, Wiley Publisher,1st Edition, 2011.
7. Stephen Blumenthal, “JavaScript: JavaScript for Beginners - Learn JavaScript Programming with ease”,1st Edition, 2017.

REFERENCE BOOKS

1. Robert C. Martin, “Agile Software Development, Principles, Patterns and Practices”, Prentice Hall, 2nd Edition, 2014.
2. Mike Cohn, “User Stories Applied: For Agile Software”, Addison Wesley,2nd Edition, 2016.
3. Thomas a Powell, “HTML & CSS: The Complete Reference”, 5th Edition, Tata McGraw Hill Education Private Limited, 2010.
4. Russ Ferguson, “Beginning JavaScript: The Ultimate Guide to Modern JavaScript Development”, Apress Publishers, 3rd Edition, 2019.
5. Deitel, Deitel, Goldberg, “Internet and World Wide Web – How to program”, 5th Edition, Prentice Hall Publishers, 2012

WEB RESOURCES

1. https://www.coursera.org/specializations/agile-development
2. https://www.edx.org/learn/agile
3. https://nptel.ac.in/courses/106/105/106105182/
4. https://developer.mozilla.org/en-US/docs/Web/HTML
5. https://developer.mozilla.org/en-US/docs/Web/CSS
6. https://developer.mozilla.org/en-US/docs/Web/JavaScript

ONLINE RESOURCES

1. http://www.agilenutshell.com/
2. https://www.atlassian.com/agile/scrum
3. https://www.youtube.com/user/AgileMikeCohn
4. https://www.coursera.org/learn/html-css-javascript-for-web-developers
5. https://online-learning.harvard.edu/subject/javascript

23CS101	PROBLEM SOLVING USING C++	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1. To master fundamental programming concepts and methodologies essential for developing robust C++ programs.
2. To acquire a deep understanding of control structures and functions in C++
3. To explore basic object-oriented programming principles and apply them effectively in problem-solving.
4. To introduce file streams and operations for persistent data storage.
5. To gain familiarity with the generic programming paradigm

MODULE I C++ PROGRAMMING FUNDAMENTALS 5

C vs C++, Basic of OOPS, the main () function, Header files, Basic Input and Output (I/O) using cin and cout, Variable, Constant. **Operators:** Arithmetic Operators, Assignment Operators, Relational Operators, Logical Operators, Bitwise Operators, Other Operators, Operator Precedence. Control Statements: if, if...else and Nested if...else, switch case, break and continue, Loops - for loop, while loop, do while loop, goto. **Arrays and Strings:** 1D array, 2D array, Strings, String functions. **Function:** Basics, call by value, call by reference & return by reference, Inline function, overloading Functions, inline Functions, Recursive Functions. **Pointers:** Pointer, Dynamic Memory Allocation.

MODULE II OBJECT ORIENTED CONCEPTS 5

Classes and Objects, public, private, protected. **Constructors and destructors**: Overloaded Constructor, Copy Constructor, Shallow Copying Deep Copying. **Overloading:** this' Pointer, structs vs Classes, Friends of a class, Operator Overloading, Inheritance, Overloading vs Overriding, Polymorphism, Virtual Functions, Pure Virtual Functions and Abstract Classes.

MODULE III WEB DEVELOPMENT FOUNDATIONS 5

Abstract Classes as Interfaces- Abstract Methods, Exception Handling Methodologies- try catch block, Multiple catch block, Nested try-catch, Inbuilt Exception- Custom Exception, File Handling-Files Operations, Streams and I/O, Buffering and Serialization, STL- Vector, List, Set, Pair, Lambda Functions- Generic Programming, Lambda Expression.

TOTAL PERIODS (Theory): 15

LIST OF EXPERIMENTS

1. Practice of C Programming using Branching and Iterative constructs.
2. Programs using arrays and strings.
3. Programs using Functions.
4. Programs using Structures and Pointers.
5. Programs using classes and objects.
6. Programs using constructor and destructor.
7. Programs using method overloading, operator overloading and polymorphism

concepts.

8. Programs using friend class.
9. Programs using virtual functions and abstract class.
10. Programs using inheritance concepts.
11. Programs using exception handling concept.
12. Programs using Files.
13. Mini project

TOTAL PERIODS (Lab): 60
TOTAL PERIODS: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Demonstrate fundamental concepts and methodologies to design and develop programs for specific problem scenarios.	[U]
CO2	Create programs to address real-time challenges using pointers and objects in C++	[AP]
CO3	Utilize constructors, destructors, and overloading techniques to solve real-world problems effectively.	[AP]
CO4	Develop C++ programs incorporating interfaces, exception handling, and file processing.	[AP]
CO5	Apply file streams, I/O operations, and lambda expressions in C++ programming.	[AP]

TEXTBOOKS

1. E Balagurusamy,"Object Oriented Programming With C++", 4th Edition, Tata McGraw-Hill Education, 2008.
2. YashavantP. Kanetkar, "Let us C++", BPB Publications, 2020.
3. M. Sprankle, "Problem Solving and Programming Concepts", 9th Edition, Pearson Education, New Delhi, 2011.

REFERENCE BOOKS

1. Herbert Schildt, "The Complete Reference C++", 4th edition, MH, 2017.
2. John Hubbard, "Schaum's Outline of Programming with C++", MH, 2016.

WEB RESOURCES

1. https://www.geeksforgeeks.org/c-plus-plus/
2. http://web.stanford.edu/class/cs106l/https://www.programiz.com/python-programming
3. https://nptel.ac.in/courses/106101208

23EN101	ORAL AND WRITTEN COMMUNICATION SKILLS	L	T	P	C
		2	0	2	3

COURSE OBJECTIVES

1. To empower students to comprehend different aspects of communication using LSRW skills.
2. To equip students with the skills to create impactful job search and perform confidently in group discussions and interviews.
3. To enrich students to carry out day-to-day communication at the workplace and facilitate efficient interpersonal communication.

MODULE I READING 15

Reading: Reading techniques -Skimming and scanning - Cloze reading - Reading and understanding technical articles - Reading for detailed comprehension: Email and letters - Reading advertisements - Table completion: Interpreting charts and graphs - Verbal reasoning - Comprehending reviews - Reading and responding to instant messages.

MODULE II WRITING 15

Writing: Formal letters (Sales letter, calling for quotations, seeking clarification, placing an order, complaint letter, inviting, accepting and declining letters) - Emails - Minutes of meeting - Professional report writing - Proposal writing - Resume / job application letter - Case study.

MODULE III LISTENING AND SPEAKING 15

Listening: Situational listening - Listening about an experience - Listening about short extracts - Listening an interview: Conversational speaking - Speaking: Engaging in interactive conversations - Decipher the picture given and answer the question posed along with it - Decipher the mind map given and speak about it - Listen to the questions posed and answer them appropriately.

Lab Components 15

1. Conversational listening [R]
2. Speaking – Pictography [AP]
3. Listening about an experience [U]
4. Listening to short extracts [U]
5. Writing - Resume Writing, Job application letter [AP]
6. Mock interview [AP

TOTAL PERIODS: 60

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Remember and develop LSRW skills through guided activities.	[R]
CO2	Understand and collaborate better with colleagues, building stronger professional and personal relationships.	[U]
CO3	Apply communication skills in a corporate environment.	[AP]
CO4	Apply technical writing skills to write letters, emails and prepare technical documents.	[AP]
CO5	Analyze and communicate effectively in personal and professional situations.	[AN]

TEXTBOOKS

1. Jay Sullivan, “Simply Said: Communicating Better at Work and Beyond”, Wiley Publication, 2018.
2. Alred J Gerald, Brusaw T Charles,.Oliu E Walter, “Handbook of Technical Writing”, Bedford/St. Martin’s Boston publication,New York, 2012.
3. Liz Hamp-Lyons and Ben Heasly, “Study Writing :A Course in Written English for Academic Purposes”, Updated Edition, Cambridge University Press, 2006.
4. Dr.Praveen Sam and K N Shoba - A Course in Technical English by Cambridge University press, 2020.

REFERENCE BOOKS

1. Rutherfoord J Andrea, “ Basic Communication Skills for Technology”, Upper Saddle River, N.J. : Prentice Hall, 2001.
2. SinghHardeep (Author), Kothari (Author), “Written & Oral Technical Communication Skills For Engineers/Scientists” - LAMBERT Publications, 2019.

WEB RESOURCES

1. http://www.academiccourses.com/Courses/English/Business-English
2. https://www.liveworksheets.com/worksheets/en/English_as_a_Second_Language_(ESL)/Technical_English
3. https://www.coursera.org/specializations/business-english

23MT103	PRODUCTION TECHNOLOGY LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To perform the different manufacturing processes.
2. To expose hands-on training to the students by various exercises using lathe and shaping machines
3. To expose hands-on training to the students by various exercises using Milling and drilling machines
4. To expose hands-on training to the students by various exercises using grinding machines
5. To impart the knowledge of relative advantages of advanced manufacturing processes over conventional techniques

LIST OF EXPERIMENTS

1. Preparation of Butt joint and T- joint by Shielded metal arc welding.
2. Preparation of Green Sand Mould using Foundry operation
3. Fabrication of Tray and Cone by Sheet Metal Working operation.
4. Perform Drilling, reaming and tapping operations on a mild steel flat work piece
5. Step Turning and Taper Turning Operation using a Lathe.
6. Internal and External Thread Cutting using a Lathe.
7. Machining of Hexagon shape from round rod using Milling Machine.
8. Machining square from round rod using Shaper
9. Perform plain surface grinding on the work piece using Surface Grinder.
10. 3D Printing of a Key chain (Basic Shapes).

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Develop simple metal joints, sand mold, surfaces using welding, foundry and sheet metal operations.	[AP]
CO2	Practice various operations on a given component using Lathe and drilling machine.	[AP]
CO3	Construct flat surface on the given component using milling and shaper machines.	[AP]
CO4	Examine the surface finish in the given components using grinding machines.	[AP]
CO5	Produce products using 3D printer.	[AP]

TEXT BOOKS

1. Hajra Choudhury, “Elements of Workshop Technology”, Vol. I & II, Media Promotors Pvt. Ltd., Mumbai, 2014.
2. R.S.Khurmi & J.K.Gupta , “A Text book of Workshop Technology : Manufacturing Processes”, Nirja Publishers & Printers Pvt. Ltd, Uttarakhand , 2021
3. Kalpakjian and Schmid, “Manufacturing Processes for Engineering materials”, (5th Edition) - Pearson India, Uttar Pradesh, 2014.

REFERENCE BOOKS

1. V.K.Jain ,"Advanced Machining Processes", Allied Publishers Pvt. Ltd., Bengaluru, 2016
2. K. Rajput, "A Text book of Manufacturing Technology (Manufacturing Processes)", Lakshmi Publications (P) Ltd., New Delhi, 2019.

WEB RESOURCES

1. http://msvs-dei.vlabs.ac.in/msvs-dei/SheetMetal.php
2. http://vlabs.iitkgp.ac.in/psac/newlabs2020/vlabiitkgpAM/#

23MT202	COMPUTER AIDED DRAWING LABORATORY FOR MECHATRONICS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To develop the visual science in the form of technical graphics.
2. To develop an understanding of Isometric to Orthographic Views and vice versa.
3. To develop projections of lines, planes, solids, and sections of solids.
4. To develop 3D models for flange coupling, rack and pinion and plummer block.
5. To develop 3D models for universal coupling, screw jack and machine vice.

LIST OF EXPERIMENTS

Software used in Lab: 2D modelling software (AutoCAD)

1. Creation of simple component using Drawing and Modifying commands
2. Drawing front, top and side views of isometric drawings.
3. Drawing front and top views for a prism and a pyramid.
4. Drawing front and top views of Plane surfaces (Hexagon, Pentagon and circle) inclined to HP

Software used in Lab: 3D modelling Software (SolidWorks/ Creo)

5. Two shafts have to be connected for power transmission. Draw the part and assembly drawing of the any one of the components, which can solve this problem. (3D modelling of a Flange Coupling).
6. Name a component that can be used to convert rotary motion to linear motion. Draw the part and assembly of that component. (3D modelling of Rack and Pinion).
7. 3D modelling of Plummer block.
8. 3D modelling of Universal coupling
9. 3D modelling of Screw jack.
10. 3D modelling of Machine vice.

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Illustrate the dimensioning system in complex object.	[AP]
CO2	Apply the different techniques of engineering drawing.	[AP]
CO3	Examine their visualization skills for developing new products.	[AP]
CO4	Develop projections of lines, planes, solids, isometric projections and sections of solids using software.	[AP]
CO5	Simulate 3D models for machine elements.	[AP]

TEXT BOOKS

1. Venugopal. K, Prabu Raja. V, “Engineering Graphics” New Age International Publishers, 15th Edition, 2021.
2. Shah. M. B and Rana. B. C, “Engineering Drawing”, Pearson Education, 6th edition, 2018.
3. Natarajan. K. V, “A textbook of Engineering Graphics”, Dhanalakshmi Publishers, 5th Edition, 2018.

REFERENCE BOOKS

1. Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.
2. Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Stores, Bangalore, 2018.

WEB RESOURCES

1. http://nptel.ac.in/courses/112104172/
2. http://home.iitk.ac.in/~mohite/TA101.html

22TA101	HERITAGE OF TAMILS	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES

1. To know various concepts of Tamil Language families.
2. To know about the essentialities of Heritage.
3. To understand the Aram concepts of Tamils and the cultural influence.

MODULE I LANGUAGE AND LITERATURE: 5

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

MODULE II HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE 5

Hero stone to modern sculpture - bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils. Folk And Martial Arts: Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.

MODULE III THINAI CONCEPT OF TAMILS 5

Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas. Contribution of Tamils to Indian national movement and indian culture: Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books.

TOTAL PERIODS: 15

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Know about the language families in India, impact of religions and the contribution of Bharathiyar and Bharathidhasan.	[U]
CO2	Observe the growth of sculpture, making of musical instruments and the role of temples in socio and economic lives.	[U]
CO3	Understand the significance of folklore and martial arts.	[U]

CO4	Learn the sangam literature, sangam age and overseas conquest of Cholas.	[U]
CO5	Understand the contribution of Tamils to Indian Freedom Struggle, role of Siddha medicine and print history of Tamil Books..	[U]

TEXT-CUM-REFERENCE BOOKS:

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

23MC101	INDUCTION PROGRAMME	L	T	P	C
		1	0	0	0

COURSE OBJECTIVES

1. To have broad understanding of society and relationships.
2. To nurture the character and fulfil one's responsibility as an engineer, a citizen and a human being
3. To incorporate meta skills and values

MODULE I PHYSICAL ACTIVITY **5**

Research over the past years has shown Yoga to have stress-relieving powers on students, paving the way for improved academic performance with the practice of asanas, meditation and breathing exercises. To prove these words Yoga classes has been planned in this module.

Creative Arts (students can select any one of their choice)

Cultural development supports students to understand, feel comfortable with, value and appreciate the potential enrichment of cultural diversity. They should challenge discrimination, whether based on cultural or racial difference. Students should experience cultural traditions embedded in arts, crafts, language, literature, theatre, song, music, dance, sport, Science, technology and travel. Students should develop an appreciation of beauty both in experiencing artistic expression and by exploring their own creative powers. To inculcate those skills they are given a chance to exhibit their talents through painting, sculpture, pottery, music, dance, craft making and so on.

MODULE II UNIVERSAL HUMAN VALUES **5**

Moral development involves supporting students to make considered choices around their behaviour and the values that provide a framework for how they choose to live. Moral development is also learning about society's values, understanding the reasons for them, how they are derived and change; and how disagreements are resolved. Students must consider the consequences of personal and societal decisions on the wider community – local and global- and on the environment and future generations. To acquire this the students are exposed to training to enhance their soft skills.

Literary And Proficiency Modules: Social development helps students to work effectively together, developing the inter-personal skills required to relate positively with their peers and people of all ages. Students must also understand how to participate productively in a diverse and plural society and learn about, and how to effectively engage with societal institutions and processes. They should understand that a person may have different roles and responsibilities within society. To reach this the following aspects are given in the form of Reading, writing, speaking – debate, role play etc. Communication and computer skills

MODULE III LECTURES BY EMINENT PEOPLE **5**

Teaching with Lectures. ... It is essential to see lectures as a means of helping students learn to think about the key concepts of a particular subject, rather than primarily as a means of

transferring knowledge from instructor to student. During the induction period students will attend to Guest lectures by subject experts

Visit To Local Areas: Traveling is in fact a way of learning to learn. You are out of your comfort zone and so you must learn to be able to adapt to a new learning environment in a very short time. It also helps in your overall learning as well. In the induction period students will be taken to different places near college to learn new things. Eg.Meditation centre/orphanage/Hospital

Familiarization To Department/Branch Innovation: HoD's of different branches will present about their department followed by department visit to view various facilities available at their department, new innovations from students and faculties etc.

TOTAL PERIODS: 15

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Explore academic interest and activities	[AP]
CO2	Work for excellence	[AP]
CO3	Promote bonding and give a broader view of life and character	[AP]

SEMESTER II

23MT201	APPLIED MECHANICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To get insight about the Law of Mechanics, resultant of Forces and equilibrium.
2. To comprehend the concept of centroid, center of gravity and moment of inertia of composite areas.
3. To understand the mechanical properties of material, the concept of moment and couple and bending behavior of beam for various types of loads.

MODULE I STATICS OF PARTICLES AND DISTRIBUTED FORCES 15

System of forces- Resolution and resultant of coplanar concurrent forces-Free body diagram -Equilibrium of a particle in two dimensions– Centroid and Centre of gravity of common shapes: Rectangle, triangle, circle, and semicircle by using standard formula - Parallel axis and perpendicular axis theorems - Area moment of inertia: T section, I section, Angle Section - Polar moment of Inertia - Laws of Friction - Ladder Friction.

MODULE II SIMPLE STRESSES, SHEAR AND BENDING MOMENT DIAGRAM 15

Stress: Tension, compression and shear- Strain: Linear, volumetric and shear - Hooke's Law, Elastic constants and their relations - Factor of safety - Poisson's ratio - Analysis of bars of uniform section and composite sections - Moment of a force - couple - Types of loads and support - Shear force and bending moment diagrams for cantilever, simply supported and overhanging beam with point and uniformly distributed loads.

MODULE III TORSION OF SHAFTS AND DEFLECTION OF BEAM 15

Theory of simple bending and its equation – Bending stress in symmetrical sections – Torsion equation - Torsion in solid and hollow circular shafts - Evaluation of slope and deflection by Double integration and Macaulay's method for cantilever and simply supported beams – Column - Euler Equation.

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Describe the effect of forces and find the centroid, center of gravity and moment of inertia.	[R]
CO2	Determine the stress and strain induced in uniform and composite sections.	[U]
CO3	Examine the concept of friction, moment and couple in solving shear force and bending moment diagram	[AP]
CO4	Calculate the bending stress in symmetrical sections and torque produced in circular shafts and hollow shaft	[AP]
CO5	Calculate the slope, deflection and buckling load of the column	[AP]

TEXT BOOKS

1. N. Kottiswaran, “Engineering Mechanics Statics and Dynamics”, Sri Balaji Publications, 2017.
2. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd, 2016.
3. S.S. Rattan, “Strength of Materials”, Mc Graw Hill Publication, 2016.

REFERENCE BOOKS

1. F.P. Beer and Jr. E. Johnston, “Vector Mechanics for Engineers statics and Dynamics”, Tata McGraw Hill Publishing Company, NewDelhi, 11th edition, 2017.
2. R.C.Hibbeler, "Mechanics of Materials", Pearson, 10th edition, 2022.

WEB RESOURCES

1. https://www.udemy.com/course/applied-mechanics-for-engineering-students/
2. https://www.coursera.org/learn/engineering-mechanics-statics
3. https://archive.nptel.ac.in/courses/112/106/112106286/

23EC202	DIGITAL SYSTEM DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To introduce the principles of Canonical forms to minimize the logic expression
2. To enable the students to understand the operation of various combinational and sequential logic circuits.
3. To allow students to analyze synchronous sequential circuits.
4. To enable the students to construct PLD's and their roles in digital systems
5. To enable the students to write verilog code for combinational logical circuits.

MODULE I CANONICAL FORMS AND MINIMIZATION 15

Minterms, Maxterms, Complements, Implementation using universal logic gates, Minimizing functions using Karnaugh maps – 2,3 & 4 Variables, Minimization using Quine McClusky method – 4 Variables.

MODULE II COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS 15

Adders and Subtractors, Multiplexer, Demultiplexer, Encoders, Decoders, Two Bit Magnitude comparator, Carry Look-ahead adder, Code converters, – Binary to Gray, BCD to Excess-3 Parity generator and Checker. **Sequential logic circuits:** Latches and flip flops, Realization of one flip flop using other flip flops, Asynchronous Up counter and Synchronous counters, Shift registers –SISO,SIPO,PISO,PIPO, Application of Shift registers. Case Study: DTMF Decoder

MODULE III SYNCHRONOUS SEQUENTIAL LOGIC 15

Analysis of Synchronous Sequential Circuits, Sequence generator, State transition diagrams and state transition tables. PLD's - PLA, PAL, Modelling basic combinational circuits using Verilog**.**

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Demonstrate knowledge on canonical forms and their realization using logic gates	[U]
CO2	Applying K- Map and Tabulation method to minimize the Boolean functions.	[AP]
CO3	Understand various combinational logic and sequential logic circuits and their implementation	[AP]
CO4	Apply synchronous sequential logic for reducing state reduction.	[AP]
CO5	Understanding Programmable logic devices and applying for logical function implementation.	[AP]

CO6 Apply verilog code for realization of combinational logical circuits. [AP]

TEXTBOOKS

1. M. Morris Mano, Michael D.Ciletti., "Digital Design",6th Edition, Pearson education, 2018.
2. Donald D. Givone, "Digital principles and Design", 2004, McGraw Hill Education India Private Ltd., 29th Reprint, 2018.

REFERENCE BOOKS

1. Samir Palnitkar,"Verilog HDL: A Guide to Digital Design and Synthesis" Prentice Hall, Second Edition, 2018
2. J. F. Wakerly, "Digital Design - principles and practices", 4th Edition, Pearson Education, 2008.
3. Thomas L. Floyd, Digital Fundamentals, 10th Edition, Pearson Education, New Delhi, 2017

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc25_cs25/preview
2. https://www.tutorialspoint.com/digital_circuits/digital_circuits_useful_resources.htm
3. http://www.technologystudent.com/elec1/dig1.htm
4. https://www.electronics-tutorials.com/basics/digital-basics.htm

23MA205	DIFFERENTIAL EQUATIONS AND TRANSFORM TECHNIQUES (EEE/ECE/MCT)	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. To know the fundamental techniques for solving Differential Equations.
2. To use Fourier series to represent periodical physical phenomena in engineering analysis.
3. To study Fourier Transform and concepts of infinite Fourier Sine and Cosine transform.
4. To learn the theory and applications of Laplace Transform.
5. To learn Z-Transform and solve difference equations using Z-transform.

MODULE I DIFFERENTIAL EQUATIONS 20

Solution of second order linear ordinary differential equations with constant coefficients– Solution by variation of parameters – Linear differential equations with variable coefficients: Euler–Cauchy and Legendre's equation – Solving PDE by Lagrange's linear equations – Linear homogeneous partial differential equations of second order with constant coefficients.

MODULE II FOURIER ANALYSIS 20

Fourier series – Dirichlet's conditions – General Fourier Series – Half range sine series – Half range cosine series – Applications of Fourier Series: One Dimensional Wave Equation – Fourier Transform – Complex form of Fourier Transform – Fourier transform pair – Fourier sine and cosine transform – Parseval's identity in Fourier Transform.

MODULE III DISCRETE AND INTEGRAL TRANSFORM 20

Laplace transform: Condition for existence – Properties (excluding proof) – Inverse Laplace transform – Partial fraction method – Convolution theorem – Solving Initial value problems by using Laplace Transform techniques. Z-transform: Properties of Z-transform (excluding proof) – Inverse Z-transform – Convolution theorem – Partial fraction method –Solution of difference equations using Z-transform techniques.

TOTAL PERIODS: 60

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall the concepts to solve second-order ordinary differential equations and partial differential equations	[R]
CO2	Interpret Fourier series solutions to the problems in engineering field.	[U]
CO3	Apply Fourier transform techniques to evaluate integrals and analyze continuous-time signals and systems.	[AP]
CO4	Apply Laplace transform techniques to solve differential equations and analyze linear systems.	[AP]
CO5	Apply Z transform techniques to analyze and solve discrete-time systems.	[AP]

TEXTBOOKS

1. Kreyszig. E, “Advanced Engineering Mathematics”, 10th edition, John Wiley and Sons (Asia) Limited, Singapore 2014.
2. Grewal. B.S, “Higher Engineering Mathematics”, 44th edition, Khanna Publications, Delhi, 2017.
3. N.P.Bali ,”A Text book of Engineering Mathematics” ,13th edition, Laxmi Publications Ltd, 2017.

REFERENCE BOOKS

1. Veerarajan. T, “Transforms and Partial differential equations”, 3rd edition, Tata McGraw-Hill Publishing Company Ltd., reprint, 2016
2. Glyn James, “Advanced Modern Engineering Mathematics”, Pearson Education, 4th edition, 2016.
3. Ray Wylie C and Barett L C, “Advanced Engineering Mathematics” Tata Mc Graw Hill Education Pvt Ltd, 6th edition, New Delhi, 2022.

WEB RESOURCES

1. https://archive.nptel.ac.in/courses/111/106/111106046/
2. https://archive.nptel.ac.in/courses/111/106/111106139/
3. https://www.youtube.com/watch?v=XfmbrUBrs5Q
4. https://archive.nptel.ac.in/courses/111/106/111106100/
5. https://archive.nptel.ac.in/courses/108/106/108106151/

23AS101	APPLIED SCIENCE	L	T	P	C
		4	0	0	4

COURSE OBJECTIVES

1. To learn the fundamental concepts of physics and apply this knowledge to both scientific and engineering problems.
2. To make the students enrich basic knowledge in various fields such as electrostatics and magnetism.
3. To understand the principles and applications of electrochemistry and polymer science, and explore the knowledge of various energy sources and storage devices.
4. To understand the concepts of photo-physical and photochemical processes in spectroscopy.

MODULE I ELECTROSTATICS 15

Charges and their conservation; Coulomb's law - superposition principle. Electric field – electric field due to a point charge, electric field lines; electric dipole, electric field intensity due to a dipole - behaviour of a dipole in a uniform electric field. Electric potential - potential difference - electric potential due to a point charge and dipole - equipotential surfaces – electrical potential energy of a system of two point charges. Electric flux-Gauss's law and its applications. Electrostatic induction-capacitor and capacitance – dielectrics- electric polarisation – parallel plate capacitor with and without dielectric – applications of capacitor – energy stored in a capacitor - Capacitors in series and in parallel – Van de Graff generator.

MODULE II MAGNETISM, ELECTROMAGNETIC INDUCTION & ALTERNATING CURRENT 15

Magnetism: Definitions of fundamental terms – Magnetic field around a current carrying conductor – Direction of magnetic field and current – Biot-Savart law and its application: Magnetic field due to Line charge – Ampere's law and its application: magnetic field due to a solenoid. Electromagnetic induction - Faraday's law - induced emf and current - Lenz's law. Self-induction - Mutual induction - self-inductance of a long solenoid - mutual inductance of two long solenoids. Methods of inducing emf - (i) by changing magnetic induction (ii) by changing area enclosed by the coil and (iii) by changing the orientation of the coil. AC generator - (Single phase, three phase). Eddy current - applications - transformer - Alternating current - AC circuit with resistance - AC circuit with inductor - AC circuit with capacitor - LCR series circuit - Resonance and Q - factor - power in AC circuits.

MODULE III ELECTROCHEMISTRY, POLYMERS & SPECTROSCOPY 15

Electrochemistry-Introduction-Cells and its types-emf series-Nernst equation and its applications. Reference electrodes-standard hydrogen electrode, saturated calomel electrode, glass electrode-pH-measurement. Discussion of energy storage-Lead acid, Nickel cadmium and Lithium-ion batteries-Energy Sources-Fuel cells (H_2-O_2). Polymers-

Classifications-addition and condensation polymerization-free radical mechanism. Spectroscopy-Introduction, Beer Lambert's law, principle, instrumentation, and applications of electronic spectroscopy (UV-visible), Vibrational and rotational spectroscopy (IR) and atomic spectrum-Flame emission spectroscopy (FES).

TOTAL PERIODS: 45

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand the principles of electrostatics and problems relating to electric field and electric potential.	[U]
CO2	Realize the nature of magnets, properties and the magnetic effect of electric current.	[U]
CO3	Describe the nature of electromagnetic wave and its propagation through different media and interfaces involved in different situations.	[AP]
CO4	Understand the principle and working of reference electrodes, energy storage devices and polymer products in engineering fields.	[U]
CO5	Interpret the principle and working of analytical techniques.	[AP]

TEXTBOOKS

1. David Halliday, Robert Resnick, Jearl Walker "Fundamentals of Physics", 11th edition, Wiley, 2018.
2. Bhattacharya, D.K. and Poonam, T., "Engineering Physics", Oxford University Press, 2017.
3. Dara S.S, Umare S.S, "Engineering Chemistry", First revised Edition by S. Chand & Company Ltd., New Delhi 2015.
4. Jain P. C. & Monica Jain., "Engineering Chemistry", 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2020.

REFERENCE BOOKS

1. Avadhanulu M.N., Kshirshagar P.G., Arun Murthy TVS "A Text Book of Engineering Physics" S.Chand & Co Ltd, 2018.
2. S.O. Kasap, "Principles of Electronic Materials and Devices", McGraw Hill Education, 2017.
3. Perez, Nestor," Electrochemistry and Corrosion Science", Springer, 2016.
4. Fundamentals of Molecular Spectroscopy, 4 th Edition by C. N. Banwell Publishing McGraw-Hill Book Company (P) Ltd, England, 2017.

WEB RESOURCES

1. https://nptel.ac.in/courses/115101005.
2. https://onlinecourses.nptel.ac.in/noc22_ph31/preview.
3. https://archive.nptel.ac.in/courses/108/106/108106073/.
4. https://www.sciencedirect.com/book/9780750646253/battery.
5. http://www.rnlkwc.ac.in/pdf/study-material/chemistry/Spectroscopy.

6. https://ocw.mit.edu/courses/chemistry.

23CD201	DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1. To introduce fundamental concepts of Data Base Management Systems and concepts of Relational Data Models.
2. To explain Relational algebra, Relational calculus and Normalization.
3. To implement different relational model constraints and SQL queries.
4. To manage Database using transactions, concurrency and query optimization.

MODULE I INTRODUCTION 5

Introduction to DBMS, Characteristics of DBMS, DBMS vs File Systems, need for DBMS, Three Level DBMS Architecture, Data Models – Introduction, Benefits, and Phases, ER Diagrams – Symbols, Components, Relationships, Weak entities, Attributes, Cardinality, Relational Algebra, Domain Relational Calculus, Tuple Relational Calculus, Keys - primary Key, Foreign Key.

MODULE II CONSTRAINS AND SQL COMMANDS 5

DDL Commands - Create, Drop, Alter, Truncate, Rename, Normalization - 1NF, 2NF, 3NF, BCNF, 4NF- DML Commands - Select, Insert, Update, Delete, Any, All, In, Exists, Non Exists, Union, Intersection, Subqueries - nested, correlated, Joins- Inner, Outer, and Equi, Functions - SUM, COUNT, AVG, MIN, MAX, Clauses - Group By, Having By, Embedded SQL, Dynamic SQL, Transaction Concepts – Transaction model – ACID Properties – Serializability

MODULE III QUERIES AND TRANSACTIONS 5

Creation and Dropping of Views, Creation and Execution of Stored Procedures Cursors and Triggers - Opening, Fetching and Closing, Creation , Insertion, Deletion and Updating Database Applications: Payroll Processing Systems, Railway Reservation Systems, Bank Management System Introduction, Storage media and file structures, B+ Tree Hashing – static and Dynamic, Introduction to Query Processing – Issues in query optimization – Steps in query processing, Concurrency control and transactions, Lock based protocols Recovery System – Failure classification, Transactions as SQL statements

TOTAL PERIODS (Theory): 15

LIST OF EXPERIMENTS

1. Conceptual Database design using E-R DIAGRAM
2. Implementation of SQL commands DDL, DML, DCL and TCL
3. Queries to demonstrate implementation of Integrity Constraints
4. Practice of Inbuilt functions
5. Implementation of Join and Nested Queries AND Set operators
6. Implementation of virtual tables using Views
7. Practice of Procedural extensions (Procedure, Function, Cursors, Triggers)

8. Mini Project (Application Development)
   i) IT Training Group Database
   ii) Blood Donation System
   iii) Salary Management System
   iv) Traffic Light Information System

TOTAL PERIODS (Lab): 60
TOTAL PERIODS: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	To introduce fundamental concepts of Data Base Management Systems and concepts of Relational Data Models.	[U]
CO2	To explain Relational algebra, Relational calculus and Normalization.	[AP]
CO3	Write SQL commands and Subqueries with Constraints.	[AP]
CO4	Determine Appropriate transactions, views, cursors and triggers to perform the given task.	[AP]
CO5	Analyze database storage structures, query processing and recovery system.	[AP]

TEXTBOOKS

1. Abraham Silberschatz, Henry F Korth, S Sudarshan, “Data base System Concepts”, 7th Edition, McGraw hill, 2020.
2. Vijay Krishna Pallaw, “Database Management Systems”, 2nd Edition Asian Books Private Limited, 2010.

REFERENCE BOOKS

1. Herbert Schildt, “The Complete Reference C++”, 4th edition, MH, 2015.
2. John Hubbard, “Schaum's Outline of Programming with C++”, MH, 2016.
3. Mark L. Gillenson, "Fundamentals of Database Systems", 7th Edition, Wiley India Pvt. Limited, 2008.

WEB RESOURCES

1. https://www.geeksforgeeks.org/c-plus-plus/
2. http://web.stanford.edu/class/cs106l/
3. https://onlinecourses.nptel.ac.in/noc22_cs91/preview

23IT211	INTRODUCTION TO PYTHON PROGRAMMING	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1. To understand and execute Python script using types and expressions.
2. To understand the difference between expressions & statements and to understand the concept of assignment semantics.
3. To utilize high level data types such as lists and dictionaries.
4. To import and utilize a module and to perform read & write operations on files.

MODULE I DATA, EXPRESSIONS, STATEMENTS 5

Data Types, Variables and Identifiers, Operators and Expression, Conditional Branching Statements, Iterative statements Nested Loops, Break, Continue, Pass statements, Function - definition and function call, arguments, return statements, Lambda Function and Recursive Function.

MODULE II STRING, LISTS, FUNCTIONS 5

Strings – Concatenation, Append, Comparing Strings, Iterating Strings, Strings Modules and Functions, Modules – NumPy, Math, List: Operations, Nested list, Cloning, Methods, Looping, Tuple: Operations, Nested Tuple, Tuple assignments, Checking the index, Dictionary: Operations, looping over and Nested Dictionary, Built in functions and Methods.

MODULE III FILES, INHERITANCE 5

Classes and Objects, Inheritance, Polymorphism, File Handling and Exception Handling.

TOTAL PERIODS(Theory): 15

LIST OF EXPERIMENTS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method).
3. Exponentiation (power of a number).
4. Find the maximum of a list of numbers.
5. Linear search and Binary search.
6. First n prime numbers.
7. Multiply matrices.
8. Programs that take command line arguments (word count).
9. Extract the functionality of Book class in Library class.
10. File Handling

TOTAL PERIODS(Lab): 60
TOTAL PERIODS:75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Demonstrate expressions.	[U]
CO2	Build control flow and string concept in python for solving problems.	[AP]
CO3	Develop python programs using functions.	[AP]
CO4	Analyze compound data using python lists, tuples and dictionaries.	[AN]
CO5	Apply python programs using files, exception, modules and packages.	[AP]

TEXT BOOKS

1. Allen B. Downey, “Think Python: How to Think Like a Computer Scientist’’, 2nd Edition, Updated for Python 3, Shroff / O’Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/).
2. Tony Gaddis, “Starting out with Python’’, 4th Edition, Addison Wesley, Pearson, 2017.

REFERENCE BOOKS

1. Paul Deitel and Harvey Deitel, “Python for Programmers”, Pearson Education, 1st Edition, 2021.
2. G Venkatesh and Madhavan Mukund, “Computational Thinking: A Primer for Programmers and Data Scientists”,1st Edition, Notion Press, 2021.
3. John V Guttag, "Introduction to Computation and Programming Using Python: With Applications to Computational Modeling and Understanding Data”, 3rd Edition, MIT Press, 2021.

WEB RESOURCES

1. http://nptel.ac.in/courses/106106145/
2. https://www.codecademy.com/learn/learn-python
3. https://www.coursera.org/learn/python-data-analysis#syllabus

ONLINE RESOURCES

1. https://www.programiz.com/python-programming
2. https://www.fullstackpython.com/best-python-resources
3. https://www.udemy.com/course/easy-way-to-learn-python-for-beginners-2021/
4. https://stackify.com/learn-python-tutorials/

23AS102	APPLIED SCIENCE LABORATORY	L	T	P	C
		0	0	4	2

COURSE OBJECTIVES

1. To carry out experiments to understand the basic laws of magnetism.
2. To understand how objects become electrically charged and how electrical charge is transferred from one object to another.
3. To understand the principles and applications of water analysis, electrochemistry and learning electro-analytical methods.
4. To explore the knowledge of various energy sources and storage devices and to understand the concepts of photo-physical and photochemical processes in spectroscopy.

LIST OF EXPERIMENTS

1. Determination of Magnetic field along the axis of current carrying coil- Stewart and Gee method and compare with the theoretical value.
2. Determination of Planck's Constant of an LED and compare with the standard value.
3. Determination of characteristics of LCR circuit and compare with the theoretical value.
4. Determination of characteristics of an RC circuit.
5. Determine the Specific resistance of a given coil of wire using the Carey Foster bridge.
6. Determination of Hysteresis loss of a ferromagnetic material.
7. Estimation of dissolved oxygen in waste water using Winkler's method.
8. Determination of strength of strong acid by pH metry.
9. Determination of single electrode potential of Zinc and Copper by Potentiometric method.
10. To determine the strength of acids (HCl & CH_3COOH) Vs NaOH by conductometric method.
11. Determination of cathode efficiency of Nickel using electroplating process.
12. Estimation of iron content in the given solution by spectrophotometry.

TOTAL PERIODS: 36

LIFE SKILLS EXPERIMENTS

1. Determination of pressure required to shut off the fuel pump nozzle.
2. Determination of capacitance required to shut off the circuit in a circuit breaker.
3. Determination of earth, neutral and phase line in a circuit.
4. To know the presence of dissolved oxygen in given water sample using glucose by redox principle.

5. To view the colour of the different medium of given water sample using litmus paper test.

6. To detect the chlorine content in tap water using simple chemical method.

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	To determine the magnetic field around a current-carrying conductor and Planck's constant.	[An]
CO2	To determine the rate of growth or decay in a resistor-capacitor circuit and to estimate the resonance frequency and Q-factor of an LCR circuit.	[An]
CO3	To determine the relationship between the magnetic flux density and the magnetizing field strength and to find the specific resistance of the wire.	[Ap]
CO4	To determine the dissolved oxygen using Winkler's method, pH, single electrode potential using reference electrodes, Strength of acids by conductometric titration.	[Ap]
CO5	To determine the Electroplating process based on electrolytic cell, and interpret the principle and working of Spectroscopic technique.	[An]

TEXTBOOKS

1. S.L.Gupta and V Kumar "Practical Physics Volume -II", Pragati Prakashan., 2023.
2. Anoop Sing Yadav "Applied Physics Lab Manual" Vayu Education of India Publisher, 2018.
3. Method of Sampling and Test (Physical and Chemical) for Water and Wastewater, Chemical Oxygen Demand, 2012, Part-58.
4. Vogel's "Text book of Quantitative Analysis", Jeffery G H, Basset J. Menthom J, Denney R.C., 6th Edition, EBS, 2009.

REFERENCE BOOKS

1. Dr. Ruby Das and Prashant Kumar Sahu, A Textbook of Engineering Physics Practical, 2016,2nd Edition
2. S. L. Gupta and Dr. V. Kumar, "Practical physics with viva voice", Pragati Prakashan Publishers, Revised Edition, 2009.
3. American Public Health Association *et al*, Standard Methods for the Examinations of Water and Waste Water, APHA. 2017.
4. AWWA, WEF, APHA, 2017, Standard Methods for the Examination of Water and Wastewater (Method: 5210B, BOD).

WEB RESOURCES – VIRTUAL LAB LINK

1. https://vlab.amrita.edu/?sub=1&brch=192&sim=972&cnt=4
2. https://bop-iitk.vlabs.ac.in/exp/carey-foster-bridge/simulation.html

3. https://mpv-au.vlabs.ac.in/modern-physics/Determination_of_Plancks_Constant/experiment.html
4. https://ee1-nitk.vlabs.ac.in/exp/determination-of-ph/simulation.html
5. https://ee1-nitk.vlabs.ac.in/exp/determination-of-biological-oxygen/simulation.html
6. https://ee1-nitk.vlabs.ac.in/exp/determination-of-total-iron/simulation.html

23EC204	DIGITAL SYSTEM DESIGN LABORATORY	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To design, construct and debug combinational and sequential circuits based on an abstract functional specification.
2. To simulate and design Digital logic circuits using software Tools.

LIST OF EXPERIMENTS

1 Analysis and Synthesis of Arithmetic Expressions using Adders/Subtractors
2 Analysis and Synthesis of Logic Functions using 4 x 1 Multiplexers & 1 x 4 Demultiplexer
3 Analysis and Synthesis of Logic Functions using Decoders & Encoders
4 Analysis and Synthesis of Boolean Relations using two bit Digital Comparator
5 Analysis and synthesis of Code Converter (Binary to Gray and BCD to Excess-3)
6 Analysis and Synthesis of Multi-bit Sequential Circuits using Shift Registers (SISO,SIPO,PIPO)
7 Analysis and Synthesis of Multi-bit Sequential Circuits using Asynchronous Counter
8 Combinational logic circuits design using Verilog
9 Design a seven segment Electronic clock / Name display.
10 Design of an Arithmetic and Logical Unit using simulation Tool.

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Ability to design and analyze various combinational and sequential circuits.	[AP]
CO2	Analyzing and implementing the various combinational logic circuits and verifying its truth table.	[AN]
CO3	Analyzing the various sequential logic circuits and its characterization.	[AN]
CO4	Design of any Digital display using digital IC's.	[AP]
CO5	Simulation of digital circuits using simulation Tool.	[AP]

TEXT BOOKS

1. M. Morris Mano, Michael D.Ciletti., "Digital Design",4th Edition Pearson education,2018
2. C. H. Roth Jr., Larry L. Kinney "Fundamentals of Logic Design", 7th Edition, Cengage Learning, 2019

REFERENCE BOOKS

1. J. F. Wakerly, "Digital Design - principles and practices", 4th Edition, Pearson Education, 2008.
2. Thomas L. Floyd, Digital Fundamentals, 10th Edition, Pearson Education, New Delhi, 2017
3. Samir Palnitkar,"Verilog HDL: A Guide to Digital Design and Synthesis" Prentice Hall, Second Edition, 2018

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc25_cs25/preview
2. https://www.tutorialspoint.com/digital_circuits/digital_circuits_useful_resources.htm
3. http://www.technologystudent.com/elec1/dig1.htm
4. https://www.electronics-tutorials.com/basics/digital-basics.htm

23TA201	TAMILS AND TECHNOLOGY / தமிழரும் தொழில்நுட்பமும்	L	T	P	C
		1	0	0	1

COURSE OBJECTIVES

1. To know about weaving, ceramic, design and construction technologies in sangam age.
2. To know the significance of technologies such as manufacturing, agriculture and irrigation.
3. To understand the development of Scientific Tamils and Tamil Computing.

MODULE I WEAVING AND CERAMIC TECHNOLOGY 5

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW) – Graffiti on Potteries. Design and Construction Technology: Designing and Structural construction House & Designs in household materials during Sangam Age - Building materials and Hero stones of Sangam age – Details of Stage Constructions in Silappathikaram - Sculptures and Temples of Mamallapuram - Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple) - Thirumalai Nayakar Mahal - Chetti Nadu Houses, Indo - Saracenic architecture at Madras during British Period.

MODULE II MANUFACTURING TECHNOLOGY 5

Iron smelting, steel - Copper and gold - Coins as source of history - Minting of Coins – Beads making-industries Stone beads - Glass beads - Terracotta beads - Shell beads/ bone beats - Archeological evidences - Gem stone types described in Silappathikaram. Agriculture and Irrigation Technology: Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing - Knowledge of Sea - Fisheries – Pearl - Conche diving - Ancient Knowledge of Ocean - Knowledge Specific Society.

MODULE III SCIENTIFIC TAMIL & TAMIL COMPUTING 5

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

TOTAL PERIODS: 15

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Describe about the weaving industry in sangam age and ceramic technology.	[U]
CO2	Observe the design of houses, sculptures and construction of temples.	[U]
CO3	Relate the various manufacturing materials and stone types in Silappathikaram.	[U]
CO4	Understand the significance of agriculture and irrigation technology in ancient period.	[U]
CO5	Explain the growth of scientific Tamil, Tamil computing and digitization of Tamil books.	[U]

TEXTBOOKS

1. “தமிழக வரலாறு – மக்களும் பண்பாடும்” – கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்).
2. கணினித் தமிழ் – முனைவர் இல. சுந்தரம் . (விகடன் பிரசுரம்).
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)

REFERENCE BOOKS

1. “Social Life of Tamils” (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2. “Social Life of the Tamils - The Classical Period” (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.

WEB RESOURCES

1. https://archive.org/details/keeladibookenglish18092019/page/n13/mode/2up
2. https://www.tamildigitallibrary.in/admin/assets/book/TVA_BOK_0005812_Language_and_Literature.pdf
3. https://archive.org/details/lLXZ_historical-heritage-of-the-tamils-edited-by-s-v-subrahmanian-and-k-d-thirunavukk

23MC102	ENVIRONMENTAL SCIENCES	L	T	P	C
		2	0	0	0

COURSE OBJECTIVES

1. To learn the integrated themes on various natural resources.
2. To gain knowledge on the type of pollution and its control methods.
3. To have an awareness about the current environmental issues and the social problems.

MODULE I NATURAL RESOURCES 10

Introduction-Forest resources: Use and abuse, case study-Major activities in forest-Water resources-over utilization of water, dams-benefits and problems. Mineral resources-Use and exploitation, environmental effects of mining- case study–Food resources- World food problems, case study. Energy resources -Renewable and non-renewable energy sources Land resources- Soil erosion and desertification – Role of an individual in conservation of natural resources.

MODULE II ENVIRONMENTAL POLLUTIONS 10

Definition – causes, effects and control measures of: a. Air pollution-Acid rain - Green house effect-Global warming- Ozone layer depletion – case study- Bhopal gas tragedy b. Water pollution c. Solid waste management-Recycling of plastics-Pyrolysis method- causes, effects and control measures of municipal solid wastes d. Noise pollution. e. Nuclear hazards-case study-Chernobyl nuclear disaster-Role of an individual in prevention of pollution.

MODULE III SOCIAL ISSUES AND THE ENVIRONMENT 10

Sustainable development-water conservation, rain water harvesting, E-Waste Management – Environmental ethics: 12 Principles of green chemistry-Scheme of labelling of environmental friendly products (Eco mark) – Emission standards – ISO 14001 standard. HIV AIDS.

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Recall and play an important role in transferring a healthy environment for future generation.	[R]
CO2	Understand the importance of natural resources and conservation of biodiversity.	[U]
CO3	Understand and analyze the impact of engineering solutions in a global and societal context.	[U]
CO4	Apply the gained knowledge to overcome pollution problems.	[AP]
CO5	Apply the gained knowledge in various environmental issues and sustainable development.	[AP]

TEXT BOOKS

1. Anubha Kaushik and C P Kaushik “Perspectives in Environmental Studies”4th Edition, Newage International (P) Limited, Publisher Reprint 2014. New Delhi.
2. Rajagopalan, R, “Environmental Studies-From Crisis to Cure”, Oxford University Press 2015.
3. Tyler Miller, Jr., “Environmental Science”, Brooks/Cole a part of Cengage Learning, 2014.

REFERENCE BOOKS

1. William Cunningham and Mary Cunningham, “Environmental Science”, 13th Edition, McGraw Hill, 2015.
2. Gilbert M. Masters, “Introduction to Environmental Engineering and Science”, Third Edition, Pearson Education, 2014.

WEB RESOURCES

1. www.edx.org/course/subject/environmental-studies
2. www.environmentalscience.org
3. http://nptel.ac.in/courses/104103020/20

SEMESTER – III

23GE301	UNIVERSAL HUMAN VALUES (Common to all branches)	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence
2. Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
3. Strengthening of self-reflection
4. Development of commitment and courage to act
5. Helping the students to appreciate the essential complementarities between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity, which are the core aspirations of all human beings
6. Highlighting plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behaviour and mutually enriching interaction with Nature

Module 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education, Understanding Harmony in the Human Being-Harmony in Myself 10

Self-evaluation of the students -Pre-test of UHV- Purpose and motivation for the course. Self-exploration –Its content and process- A look at basic Human Aspirations. Understanding Happiness and Prosperity correctly-Understanding the needs of Self ('I') and 'Body'- Understanding the Body as an instrument of 'I'(being the doer, seer and enjoyer)- Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of I' with the Body- Social activities – Waste Management - Water Conservation-Soil Pollution - Physical Health and related activities - Lectures by eminent persons- Literary activities.

Module 2: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship, Understanding Harmony in the Nature and Existence- Whole existence as Coexistence 10

Understanding values in human relationship - Understanding the harmony in the society (society being an extension of family): - Visualizing a universal harmonious order in society - Understanding the harmony in Nature.-Understanding Existence as Coexistence of mutually Interacting units in all - pervasive space. Holistic perception of harmony at all levels of existence-Buddy program - Relationships – Homesickness - Managing peer pressure - Projects - Socially responsible engineers - Visit to local areas (orphanages, special children) - Physical Activities (games).

Module 3: Implications of the above Holistic Understanding of Harmony on Professional Ethics 10

Natural acceptance of human values- Definitiveness of Ethical Human Conduct- Basis for Humanistic Education-Humanistic Constitution and Humanistic Universal Order-Competence in professional ethics-Case studies of typical holistic technologies, management models and

eco-friendly production systems - Strategy for transition from the present state to Universal Human Order-Sum up: Self-evaluation of the students-Post test of UHV.

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Understand and take responsibilities in life and handle problems to attain sustainable solutions while keeping human relationships and human nature in mind.	[U]
CO2	Apply responsibilities towards their commitments (human values, human relationship and human society).	[AP]
CO3	Apply what they have learnt to their own self indifferent day-to-day settings in real life, at least a beginning would be made in this direction.	[AP]
CO4	Analyze ethical and unethical practices, and formulate strategies to actualize a harmonious environment wherever they work.	[A]
CO5	Understand the harmony in nature and existence, and work out mutually on fulfilling participation in nature.	[U]

TEXT BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010

REFERENCE BOOKS

1. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
2. The Story of My Experiments with Truth –by Mohandas Karamchand Gandhi
3. India Wins Freedom-Maulana Abdul Kalam Azad.

WEB RESOURCES

1. https://examupdates.in/professional-ethics-and-human-values/
2. http://hvpe1.blogspot.com/2016/06/notes-human-values-and-professional.html
3. https://www.yourmorals.org/schwartz.2006.basic%20human%20values.pdf

ONLINE RESOURCES

1. https://nptel.ac.in/courses/109/104/109104068/
2. https://medium.com/the-mission/the-12-important-life-skills-i-wish-id-learned-in-school-f4593b49445b
3. https://www.thebalancecareers.com/life-skills-list-and-examples-4147222

23MT302	BASICS OF MECHATRONICS SYSTEMS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

1. To know the basics on mechanical and mechatronics design process and concurrent designs
2. To provide exposure on performing mechatronic modelling and design
3. To reduce the product design and development cost through simulation

INTRODUCTION TO MECHANICAL AND MECHATRONICS SYSTEMS 18

Introduction: Definition of Mechanical Systems - Key elements of Mechatronics - Mechatronics Design Process - Differences between Traditional and Mechatronics designs, Types of Design - Concurrent design procedure and its concepts, Mechatronics systems for CNC machines, Introduction to PLC - Architecture - Inputs/Outputs - Selection of PLC, SCADA: Introduction, Elements, Architecture - Man-Machine Interface.

MICRO-MECHATRONIC SYSTEMS AND BOND GRAPHS 15

Micro mechatronic systems: Microsensors - Microactuators. Micro-fabrication techniques - LIGA Process: Lithography – etching - Micro-joining. Introduction to Bond Graphs and its Terminology, Mechatronics design quotient (MDQ) - MDQ Optimization - Application to food industry: Chocolate - Cookies - Natural Drinks, Case Studies: Health Monitoring of a Spacecraft System - Landmine Detection and Removal.

MODELLING AND SIMULATION AND CASE STUDIES 12

Introduction - Random Number Generation Techniques - Steps in a Simulation life cycle - Applications. Tests for Random Numbers - KS Test - Chi-square test. Verification and Validation of simulation models. Case Studies: Automotive Control Systems, UAV Quadrotor, pH control system, mobile robot, pick and place robot.

TOTAL:45 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Outline the basic mechanical and mechatronics system design and their structure	[U]
CO2	Contrast different mechatronics systems using basic concepts	[U]
CO3	Examine real time micro mechatronics concepts and bond graphs by learning case studies	[AN]
CO4	Identify the function of each process through simulation and develop products	[AP]
CO5	Analyze mechatronics concept-based products	[A]

TEXT BOOKS

1. Clarence W. de Silva, “Mechatronic Systems-Devices, design, control, operation and monitoring”, CRC Press, Taylor & Francis Group, 2019.

2. William Bolton., “Mechatronics Electronic Control Systems in Mechanical and Electrical Engineering” Seventh Edition, Pearson Education, 2019
3. R.K. Rajput., “A Textbook of Mechatronics”, S. Chand & Company Private Limited, 2007

REFERENCE BOOKS

1. Banks J., Carson J.S. and Nelson B.L. “Discrete – Event System Simulation”, Fifth Edition, Pearson Education, 2013
2. Robert H. Bishop., “The Mechatronics Handbook”, CRC Press, London, 2012
3. Devdas Shetty, Richard A. Kolk, “Mechatronics System Design”, Second Edition, Cengage Learning, 2012

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc21_me27/preview
2. https://nptel.ac.in/courses/112/103/112103174/
3. https://robotsguide.com/

23EC301	SIGNALS AND SYSTEMS	L	T	P	C
		3	1	0	4

COURSE OBJECTIVES

1. Understanding the fundamental characteristics of signals and systems
2. Understanding the characterization of LTI systems in time domain
3. Understanding time domain and frequency domain analysis of Continuous and Discrete systems
4. Imparting analytical skills to solve problems involving convolution integral and convolution sum
5. Imparting the knowledge of correlation between signals

SIGNALS AND SYSTEMS **20**

Signals (discrete / continuous) - Basic signals - Representation of signals, Signal classification, Types of signals, Operations on signals - Time reversal, Scaling, Shifting, Transformation of independent variables. Systems - Classification of systems- Static and dynamic, Linear and non - linear, Time - variant and time - invariant, Causal and non - causal, Stable and unstable, Continuous - time Linear Time Invariant (LTI) systems and Discrete - time Linear Shift Invariant (LSI) systems and its properties

ANALYSIS OF CT SYSTEMS **20**

Continuous - time Fourier transform (CTFT) - Existence, Properties, Inverse Fourier transform, Laplace Transform - Properties, Inverse Laplace transform, Region of convergence, Stability analysis, Relationship between Laplace and Fourier transform - System representation using differential equations - System Analysis using Laplace transform and Fourier transform – Input - output behaviour with periodic and aperiodic convergent inputs - Impulse response and step response - Frequency response, Convolution integral

ANALYSIS OF DT SYSTEMS **20**

Fourier series representation of discrete-time signals - Discrete Time Fourier Transform (DTFT) and its properties – z - transform, Properties, s - plane to z - plane mapping, Inverse z - transform, Region of convergence, Stability analysis, System representation using difference equations - Relationship between Z - transform and DTFT - System Analysis using Z - transform and DTFT - poles and zeros – stability - impulse response and step response - frequency response , convolution sum, Correlation between signals - Autocorrelation and Cross correlation.

TOTAL PERIODS: 60

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Acquire the knowledge of signal, system and its classifications	[U]
CO2	Analyse the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier Transform.	[AN]
CO3	Analyse the response of the LTI system using convolution integral and LSI system using convolution.	[AN]
CO4	Analyse system properties based on impulse response and Frequency Response.	[AN]
CO5	Apply Laplace transform for the analysis of continuous-time systems and Z-transform for the analysis of discrete-time signals and systems.	[AP]

TEXT BOOKS

1. Allan V. Oppenheim et al, ”Signals and Systems”, Prentice Hall of India, 2/E, 2015
2. Ramakrishna Rao P, “Signals and Systems", McGraw Hill Education, New Delhi, 2/E, 2013.
3. Simon Haykin and Barry VanVeen, “Signals and Systems”, 2007, second edition, Wiley, India.

REFERENCE BOOKS

1. J. Roberts,“Fundamentals of Signals and Systems”, Tata McGraw Hill, 2007.
2. B. P. Lathi, “Signal Processing and Linear Systems”, Oxford University Press, 1998.
3. R.F. Ziemer, W.H. Tranter and D.R. Fannin, “Signals and Systems – Continuous and Discrete”, Prentice Hall, 4/E, 1998.

WEB RESOURCES

1. http://www.nptelvideos.in/2012/12/signals-and-system.html
2. http://freevideolectures.com/Course/3177/Signals-and-Systems

23MT305	MICROCONTROLLERS AND EMBEDDED SYSTEMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To acquire knowledge of microcontroller programming in Mechatronics systems.
2. To realize the fundamentals of embedded system design with real time systems.
3. To familiarize the concepts and features of Real-time operating systems, task scheduling, and inter-task communication

MODULE I MICROCONTROLLERS 15

8-bit microcontroller – architecture - AVR: Architecture,General Purpose and Status Register, Data Memory - Structure of Assembly Language. Overview of Intel Pentium, I (i3,i5, i7) Series Processor. ARM Controller - Architecture - Functional description - ARM state instruction - Thumb state instruction - Addressing modes - Operating modes-Applications in Mechatronics systems.

MODULE II EMBEDDED SYSTEM PRODUCT DEVELOPMENT 15

Characteristics of embedded systems, Classification of embedded systems, Embedded product development cycle, Embedded System Design Challenges, Performance and Benchmarking Tools. Hardware interfacing - controlling embedded system based devices using Arduino - Arduino IDE. Debugging Techniques/ Challenges

MODULE III RTOS BASED EMBEDDED SYSTEM DESIGN 15

Introduction to basic concepts of RTOS, Task, process & threads - Task management and scheduling - Interrupt servicing - Multiprocessing and Multitasking - Inter task Communication and data exchange -Synchronization between processes: Semaphores - Memory management - Issues in real-time system design - Design of Embedded Systems – Development of IoT Applications

TOTAL PERIODS: 45

LIST OF EXPERIMENTS

1. Establishing LED blinking with practical AVR microcontroller
2. Interfacing sensors with AVR microcontroller.

3. Interfacing stepper motor with AVR Microcontroller.

4.Interfacing of serial communication using Arduino.

5. Embedded C programming for interfacing the peripherals (keypad, LCD & other simple peripherals)

6. Embedded C programming for interfacing the ADC

7. Connect and establish communication with a Bluetooth module using a microcontroller

8. Develop scheduling algorithm for Real time Applications.

9. Develop a small embedded systems project adhering to real time Applications

10. To design and implement the Smart home devices system using microcontroller.

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Compare the architecture of various microcontrollers	[U]
CO2	Develop assembly language programs for different microcontrollers	[AP]
CO3	Apply the fundamentals of embedded system design with real time systems	[AP]
CO4	Examine the concepts of RTOS and apply the knowledge for developing real-time systems	[AN]
CO5	Choose appropriate controllers and build simple embedded application	[AP]

TEXTBOOKS

1. Muhammed Ali Mazidi, Janice Gillispie Mazidi, Rolin D. McKinlay, “The 8051 Microcontroller and Embedded Systems", Pearson Education, Second Edition, 2018.
2. Raj Kamal, “Embedded systems Architecture, Programming and Design”, 2017, Third Edition, McGraw Hill Education, India..
3. Jiacun Wang, "Real-Time Embedded Systems", 2017, First Edition, Wiley Publishers, United States.

REFERENCE BOOKS

1.Michael McRoberts, " Beginning Arduino", Apress, Year: 2018

2. M. A. Mazidi, S. Naimi, S. Naimi, The AVR Microcontroller and Embedded Systems Using Assembly and C, Pearson, 2015

WEB RESOURCES

1. https://www.codingninjas.com/courses/c-plus-plus-data-structures-and-algorithms
2. https://archive.nptel.ac.in/courses/117/106/117106113/
3. https://onlinecourses.nptel.ac.in/noc22_ee12/preview
4. https://archive.nptel.ac.in/courses/108/105/108105102/
5. https://nptel.ac.in/courses/108107029/

23MT301	THEORY OF MACHINES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To develop competency in understanding the basic concepts of mechanisms.
2. To understand the analysis of kinematics, force analysis and vibration
3. To make the student conversant with friction drives and mechanism for control

CONCEPTS OF MECHANISM AND GEARS **15**

Introduction, Mechanisms, Types of Links- Types of Kinematic Pairs – Degrees of Freedom (DOF) - open and closed chain - planar robots - Kutzbach criterion - Grashof's law - Kinematic Inversions of four bar Chain- Kinematic Inversions of single slider crank chain – Velocity and Acceleration of Four bar and single slider crank Mechanisms by Relative Velocity Method: Concepts of Coriolis acceleration. Gears terminology and types - Epicyclic spur gear trains.

CAM LAYOUT AND FORCE ANALYSIS **15**

Cam - Displacement diagrams - Parabolic, Uniform and Simple harmonic motions - Layout of plate cam profiles (Inline and offset of knife edge follower only). Displacement and velocity analysis of two arm Robots - Review the concepts of static and dynamic force analysis - Static force analysis of simple front loader mechanism with two DOF- Dynamic force analysis of a compressor with single slider air compressor mechanism

VIBRATIONS AND GYROSCOPIC EFFECTS **15**

Introduction to Vibration, Types of Vibration - Terminologies - Free damped single degree of freedom vibration - Logarithmic decrement - Critical speed of shafts using Dunkerley's method - Working of block brake - Gyroscopic effects on the movement of air planes - Gyroscopic effects on the movement of ships.

TOTAL: 45 PERIODS

List of Exercises

1. Compare the characteristics of Watt and Proell governors.
2. Determination of critical speeds of the shaft and analyze it.
3. Determination of transverse frequency of beam and compare it theoretically.
4. Determination of natural frequency of given spring mass system in free longitudinal vibrations.
5. Determination of mass moment of inertia of the disc using Motorized Gyroscope.
6. Determine the mass moment of inertia of the object using compound pendulum setup experimentally. Verify the answer theoretically.
7. Determination of mass moment of inertia of flywheel axle system.
8. Determine the ultimate and yield strength of a mild steel bar using Universal Testing machine.
9. Determine the impact strength of components.
10. Determine the hardness of components.

TOTAL(LAB): 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Illustrate the nomenclature and classification of mechanisms.	[U]
CO2	Apply kinematics to determine the velocity and acceleration of linkages	[AP]
CO3	Examine the functioning of cam and force analysis of mechanisms.	[AN]
CO4	Apply the vibration principles in mechanisms	[AP]
CO5	Solve the imbalance conditions of aeroplane and ships using gyroscopic effect	[AP]

TEXTBOOKS

1. R.S.Khurmi, J.K.Gupta, “Theory of Machines” S Chand & Company Ltd, 14th Edition, 2020.
2. David H. Myszka, “Machines & Mechanisms: Applied Kinematic Analysis”, Pearson Prentice Hall, 4th Edition, 2012.
3. S.S.Rattan, “Theory of Machines”, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 5th Edition, 2019.

REFERENCE BOOKS

1. John J. Uicker, Gordon R. Pennock and Joseph E. Shigley, "Theory of Machines and Mechanisms", Oxford University Press India, 5th Edition, 2016
2. R.K. Bansal, J. S. Brar, “Textbook of Theory of Machines”, Laxmi Publication, New Delhi, 2016
3. Robert William Angus, "The Theory of Machines", Maxwell Press, 1st edition, 2022

WEB RESOURCES

1. https://ocw.metu.edu.tr/course/view.php?id=340
2. https://archive.nptel.ac.in/courses/112/106/112106270/
3. https://archive.nptel.ac.in/courses/112/104/112104114/
4. https://onlinecourses.nptel.ac.in/noc25_me46/preview
5. https://unacademy.com/course/complete-course-on-theory-of-machines-part-i-267/LOSYJP5Z
6. https://scienceeureka.com/theory-of-machines

23CSC01	DATA STRUCTURES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES:

1. To learn the basics of data structures and linked lists, and implement common sorting techniques.
2. To gain hands-on experience in implementing stacks and queues using arrays and linked lists, and apply them to solve problems like expression evaluation and priority queuing.
3. To understand the usage of binary trees, binary search trees, and searching algorithms for efficient data storage and manipulation.
4. To explore graph representations and traversal techniques, and implement advanced sorting algorithms.
5. To learn hashing techniques and work with advanced data structures

LINKED LIST & STACK **15**

Linked List: Array vs Linked list - Types of linked list - Singly, Doubly and Circular Linked list - Applications of linked list. Stack: Stack Model, Array and Linked list implementation of Stack– Applications of Stack - Infix, Prefix and Postfix expressions - infix to postfix conversion - Expression Evaluation- Balancing Parenthesis.

QUEUE AND TREES **15**

Queue: Queue Model, Array and Linked list implementation of Queue-Priority Queue - Applications of Queue. Trees: Binary Tree - Binary Search Tree - Insertion, Deletion, Traversal- Inorder, Preorder, Postorder, Level order traversal. AVL Tree.

GRAPHS AND HASHING **15**

Graphs: Weighted and Directed graphs - Adjacency matrix and list implementation - Traversal– Breadth First Search & Depth First Search. Hashing: Direct Address Table, Hash function, Collision resolution techniques, Linear Probing, quadratic probing, double hashing. Searching Techniques: Linear Search and Binary Search. Sorting Techniques: Bubble sort, Insertion Sort & Merge Sort

TOTAL (THEORY): 45 PERIODS

List of Lab Experiments:

1. Implement Singly Linked List operations (Creation, Insertion, Deletion, Traversal)
2. Implement Doubly Linked List operations (Creation, Insertion, Deletion, Traversal)
3. Implement Circular Linked List operations and explore its applications
4. Implement Stack operations using Array and Linked List
5. Evaluate Infix, Prefix, and Postfix Expressions using Stacks
6. Implement Queue operations using Array and Linked List

7. Implement Breadth-First Search (BFS) and Depth-First Search (DFS) on Graphs
8. Implement Binary Tree operations (Creation, Insertion, Deletion) and Tree Traversals
9. Implement Hashing with Collision Resolution Techniques (Linear and Quadratic Probing)
10. Implement Sorting Algorithms (Merge Sort, Quick Sort, and Counting Sort) and evaluate their time complexities

TOTAL (LAB): 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES (COs):

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

CO1	Analyze the appropriateness of using core data structures like arrays and linked lists to implement efficient algorithms.	[AN]
CO2	Utilize stacks and queues to develop solutions for real-world computational challenges.	[AP]
CO3	Apply binary trees, binary search trees (BSTs), traversal techniques, and searching algorithms to organize and retrieve data efficiently.	[AP]
CO4	Evaluate the effectiveness of various graph algorithms and advanced sorting techniques in solving computational problems.	[AN]
CO5	Design efficient solutions using hashing, searching, and sorting techniques to optimize problem-solving in real-world applications.	[AP]

TEXT BOOKS:

1. Narasimha Karumanchi, “Data Structures and Algorithms Made Easy”, 6th Edition, CareerMonk Publications, 2022.
2. Seymour Lipschutz, “Data Structures with C (SIE)”, 1st Edition, McGraw Hill Education, 2019.
3. Mark Allen Weiss, “Data Structures and Algorithm Analysis in C”, 4th Edition, Pearson, 2014.
4. Ellis Horowitz, Sartaj Sahni, and Susan Anderson-Freed, “Fundamentals of Data Structures in C/C++”, Second Edition, Silicon Press, 2008.

REFERENCE BOOKS:

1. Reema Thareja, “Data Structures Using C”, 3rd Edition, Oxford University Press, 2022.
2. Jean-Paul Tremblay and Paul G. Sorenson, “An Introduction to Data Structures with Applications”, 2nd Edition, McGraw-Hill Education, 1984.
3. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein, “Introduction to Algorithms”, 3rd Edition, MIT Press, 2009.
4. Debasis Samanta, “Classic Data Structures”, 2nd Edition, PHI Learning, 2009.

WEB REFERENCES:

1. https://www.khanacademy.org/computing/computer-science/algorithms
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-006-introduction-to-algorithms-spring-2011/
3. https://www.w3schools.com/dsa/dsa_intro.php
4. https://techdevguide.withgoogle.com/paths/data-structures-and-algorithms/

23MT304	IDEA LAB FOR MECHATRONICS	L	T	P	C
		0	0	2	1

COURSE OBJECTIVES

1. To gain all the skills pertaining to the tools and inventory associated with the IDEA Lab.
2. Learn useful mechanical and electronic fabrication processes.
3. Learn necessary skills to build useful and standalone system/ project with enclosures.
4. Learn necessary skills to 3D print the components which and electronic documentation for the system/project

List of Lab Experiments:

1. Design a prototype of an engineering component using 3D modeling software
2. Design and develop any functional component using 3D printing method.
3. Schematic and PCB layout design of a suitable circuit, fabrication and testing of the circuit.
4. Determination of required wattage for any electric equipment.
5. Familiarity and use of proximity sensors, temperature sensors, force sensors, ultrasonic sensors
6. Design and develop a water level indicator prototype using ultrasonic sensor
7. Programming for measurement of displacement using LVDT sensor using DAQ.
8. Programming for measurement of real time temperature using LM35 sensor
9. Develop a conceptual study for a fire alarming system
10. Design and implementation of a capstone project involving embedded hardware, software and machined or 3D printed enclosure

TOTAL (LAB): 15 PERIODS

COURSE OUTCOMES

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

CO1	Examine the basics of 3D modeling and printing.	[AN]
CO2	Develop PCB layout design, fabricate and test electronic circuits.	[AP]
CO3	Interpret the wattage rating of electrical equipment	[U]
CO4	Experiment with different types of sensors for real time applications	[AP]
CO5	Model a project involving hardware and software.	[AP]

TEXT BOOKS

1. AICTE's Prescribed Textbook: Workshop / Manufacturing Practices (with Lab Manual), ISBN: 978-9391505332
2. All-in-One Electronics Simplified, A.K. Maini; 2021. ISBN-13: 978-9386173393, Khanna Book Publishing Company, New Delhi.
3. 3D Printing & Design, Dr. Sabrie Soloman, ISBN: 978-9386173768, Khanna Book Publishing Company, New Delhi.

REFERENCE BOOKS

1. Practical Electronics for Inventors. 4th edition. Paul Sherz and Simon Monk. McGraw Hill.
2. Make Your Own PCBs with EAGLE: From Schematic Designs to Finished Boards. Simon Monk and Duncan Amos. McGraw Hill Education. ISBN-13 : 978-1260019193

WEB REFERENCES

1. https://fab-coep.vlabs.ac.in/List%20of%20experiments.html
2. https://www.innovationtraining.org/how-to-use-design-thinking-to-design-an-innovation-lab/
3. shttps://www.erdster.co.in/design-thinking-lab.html

SEMESTER – IV

23MT401	MACHINE DESIGN	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

1. To analyse the various machine elements subjected to the design stresses
2. To design various joints, shafts and springs
3. To understand the selection of bearings and power transmission elements.

*(Use of PSG Design Data Book is permitted)

PRINCIPLES OF MACHINE COMPONENT DESIGN **15**

Design Process and Procedure - Stresses - Static, residual - Factors of safety - Theories of failure – Stress concentration factors - Goodman, Soderberg equation-based design- Limits, Fits and Tolerances- Design of axially loaded Transverse and Parallel fillet welded joints – Design of axial loaded threaded joints.

DESIGN OF SHAFTS, COUPLINGS, BEARINGS AND SPRINGS **15**

Design of Solid and Hollow shafts based on strength – Design of flanged coupling and Bushed pin coupling - Design of Journal Bearings – selection of Deep groove ball bearings – Oil Seals (Theory only) - Design of helical and leaf springs.

DESIGN OF POWER TRANSMISSION ELEMENTS **15**

Design and selection of V belts and pulleys - Design and selection of roller chains and sprockets - Component design of spur, helical, bevel and worm gears based on wear strength. Ball screw selection (Theory only).

TOTAL : 45 PERIODS

COURSE OUTCOMES

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

CO1	Interpret the design of mechanical components based on failure modes.	[U]
CO2	Explain welded and threaded joints.	[U]
CO3	Examine the dimensions of couplings, helical and leaf springs.	[AN]
CO4	Identify deep groove ball bearings and journal bearings.	[AP]
CO5	Inspect the dimensions of various mechanical power transmission Elements.	[AN]

TEXT BOOKS

1. Bhandari V.B, “Design of Machine Elements”, 5th Edition, Tata McGraw-Hill education, 2020.
2. Joseph Edward Shigley and Richard G. Budynas, J.Keith Nisbett, “Mechanical Engineering Design”, 11th Edition, Tata McGraw-Hill education, , 2020.

REFERENCE BOOKS

1. Robert L Norton, "Machine Design - An Integrated Approach, 5th Edition,Pearson

Education", New Delhi, 2013.
2. Robert C. Juvinall and Kurt M. Marshek, “Fundamentals of Machine Component Design”, 7th Edition, Wiley, 2019.
3. C. V. Chandrashekara, N. Rajesh Mathivanan, K. Hariharan, “Recent Advances in Machine Design”, Springer Verlag, Singapore, 2024

WEB REFERENCES

1. https://archive.nptel.ac.in/courses/112/105/112105124/
2. http://www.nptelvideos.com/course.php?id=791
3. https://www.me.iitb.ac.in/~ramesh/courses/ME423/me423.htm

23MT409	FLUID AND THERMAL ENGINEERING SYSTEMS	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To understand the properties of the fluid and appreciate the complexities involved in solving the fluid flow problems
2. To apply the principles of thermodynamics to analyze energy interactions in systems, including the laws of thermodynamics, Carnot cycle, heat engines, refrigerators, and heat pumps
3. To explore the basics of heat transfer and refrigeration

FLUID MECHANICS **15**

Definitions of fluid properties (qualitative treatment only); Fluid pressure – Piezometer, U-tube manometer and U-tube differential manometer - Types of fluid flow; Continuity equation. Practical application of Bernoulli's equation in horizontal venturimeter. Laminar flow and turbulent flow (qualitative treatment only), Major energy losses due to friction in pipes. Centrifugal Pumps - Working principle, work done by the impeller on water

ENGINEERING THERMODYNAMICS **15**

Basic concepts in thermodynamics- Zeroth law of thermodynamics- First law of thermodynamics for closed system- Steady Flow Energy Equation for open system- Second law of thermodynamics – Heat engine- Carnot cycle - Carnot theorem- Refrigerator and heat pump

HEAT TRANSFER **15**

Refrigeration terminology - Vapour compression refrigeration system and its performance - NH3 - Water vapour absorption system. Heat transfer - Modes of heat transfer- Fourier's law of conduction- Newton's law of cooling-Electrical analogy of conduction and convective heat transfer through a plane and composite wall-Stefan Boltzmann law

TOTAL PERIODS: 45

List of Exercises

1. Find the coefficient of discharge for the given orifice using orifice meter
2. Find the coefficient of discharge of liquid flowing through using venturimeter
3. Calculate the coefficient of friction using the set of horizontal pipes
4. Study about Centrifugal pump working and construction
5. Conduct the performance test on 4 stroke twin cylinder diesel engine with electric dynamometer.
6. Conduct the performance test on single stage air compressor
7. Study about vapour compression refrigeration system
8. Study about air conditioner types
9. Perform the heat conduction experiment for a composite wall with two or more different materials.

10. Compare the effectiveness of Parallel flow and counter flow heat exchangers .

TOTAL PERIODS (LAB): 30

TOTAL PERIODS: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Outline the basic properties of fluids and apply pressure measurement techniques using manometers in fluid systems	[U]
CO2	Analyze fluid flow using Bernoulli and continuity equations	[AN]
CO3	Evaluate the performance of heat engines, refrigerators, and heat pumps	[AN]
CO4	Interpret energy interaction in systems using steady flow energy equation	[U]
CO5	Solve problems using heat transfer and refrigeration concepts	[AP]

TEXTBOOKS

1. R. K. Bansal, A Textbook of Fluid Mechanics and Hydraulic Machines, Laxmi Publications,11th edition, 2024. ISBN: 9788131808153.
2. P.K Nag, Engineering Thermodynamics, Tata McGraw Hill, 6th edition, 2017.
3. R. K Rajput, “A Textbook of Heat and Mass Transfer”, S Chand & Co Ltd., 7th Edition, 2019.

REFERENCE BOOKS

1. Yunus A. Cengel, John M. Cimbala, “Fluid Mechanics Fundamentals and Applications”, McGraw Hill education (India) Private Limited, 4th edition, 2018.
2. Yunus A. Cengel, Michael A. Boles, “Thermodynamics: An engineering approach”, McGraw Hill education India pvt. Ltd. 9th edition, 2019.
3. Yunus A. Cengel, Afshin J Ghajar, “Heat and Mass Transfer: Fundamentals and Applications”, McGraw Hill Education (INDIA) Private Limites; Sixth edition,2020.

WEB RESOURCES

1. https://nptel.ac.in/courses/112106294 Engineering Thermodynamics
2. https://nptel.ac.in/courses/105103192 - Fluid Mechanics
3. https://archive.nptel.ac.in/courses/112/108/112108149/
4. https://egyankosh.ac.in/bitstream/123456789/29676/1/Unit-2.pdf
5. https://theory.physics.manchester.ac.uk/~xian/thermal/chap2.pdf
6. https://testbook.com/mechanical-engineering/vapour-absorption-refrigeration-system

23MT406	ROBOTIC SYSTEM ENGINEERING	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To acquire the concepts and techniques in robot manipulator control and robot dynamics
2. To impart knowledge on design and implementation of robot applications and their relationship to other automated technologies
3. To understand the basics of machine vision and its application in robotics
4. To explore various robotic components and end effectors
5. To introduce students to the Robotic Operating System (ROS) and mobile robotic systems

ROBOT COMPONENTS **15**

Introduction-Laws of robotics- Robot Anatomy- Configuration of Robot- Work Volume- Robot Drive Systems- Control System- Precision of Movement- Robot Application. Robot end effectors- Types of end effectors-Mechanical Grippers-Types of gripper mechanisms-Tools as end effectors- Lead through Programming

ROBOT DYNAMICS AND KINEMATICS **15**

Introduction- Lagrangian Mechanics- Effective moment of Inertia- Dynamic Equations for multiple DOF Robots. Basics of trajectory planning. Robot kinematics: Introduction to Manipulator Kinematics- Position representation- Forward and Reverse transformation of 2DOF arm- 3DOF arm in 2D- Homogeneous transformations and robot kinematics- DH Representation of forward kinematic equations of robot.

ROBOT OPERATING SYSTEM AND MOBILE ROBOTS **15**

Introduction - difference from other meta-operating systems–services – Robot Operating System (ROS) framework Introduction to Wheeled Mobile Robots – Locomotion - Motion control - Perception - Sensors for mobile robots: wheel sensor, heading sensor, accelerometers, inertial measurement - Localization - localization-based navigation. Case study - Mobile robot in military application.

TOTAL PERIODS: 45

LIST OF EXPERIMENTS

1. Using the Robot Studio Software simulate the following experiments
   a) Write your short name using six axis ABB robot
   b) Simulate the pick and place operation
2. Simulate the pick and place operation in a six-axis robot using suitable software.
3. Simulate the path following mobile robot using suitable software.
4. Open loop and PID control system for a simple mobile robot
5. Trajectory planning for Robot Manipulators

6. Simple, rapid programming using Teach Pendant
7. Teach Work object and TCP setting to ABB six axis robot using Teach pendant
8. Teach the ABB six axis robot
   a) To identify the given components are Metal or Non – metal using Teach pendant
   b) Machine tending operation of ABB six axis robot using Teach pendant
9. Teach the ABB six axis robot
   a) Welding simulation of ABB six axis robot using Teach pendant
   b) Painting simulation of ABB six axis robot using Teach pendant
10. Teach the ABB six axis robot
   a) Matrix palletizing operation of ABB six axis robot using Teach pendant with single suction cup
   b) Cartoon palletizing operation of ABB six axis robot using Teach pendant with multi suction cup

TOTAL PERIODS (LAB): 30
TOTAL PERIODS: 75

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1	Outline the basic concepts of Robotics and Robot components	[U]
CO2	Choose appropriate concept of end effectors in robotics and basic robot programming techniques	[AP]
CO3	Analyze the robot kinematic position and dynamic equations	[AN]
CO4	Explain the concept of Robotic Operating system	[U]
CO5	Illustrate the basics of wheeled mobile robotics	[U]

TEXTBOOKS

1. M.P.Groover, "Industrial robotics- Technology, programming and Applications", McGrawHill, 2017
2. Saeed B. Niku, "Introduction to Robotics: Analysis, Systems, Applications", 2nd edition Pearson Education India, 2015
3. Roland Siegwart, IllahR.Nourbakhsh, "Introduction to Autonomous Mobile Robots", 2nd Edition, 2011

REFERENCE BOOKS

1. King Sun Fu, Rafael C. González, C. S. George Lee, "Robotics: control, sensing, vision, and intelligence", Tata Mcgraw-Hill Publication, 2016
2. Robin R Murphy, “Introduction to Al Robotics”, Fourth Edition, MIT Press, 2016.
3. Gregory Dudek, Michael Jenkin, “Computational Principles of Mobile Robotics”, Cambridge University Press, 2024

WEB RESOURCES

1. https://onlinecourses.nptel.ac.in/noc23_me51/preview
2. http://nptel.ac.in/courses/112101099/
3. https://www.toptal.com/robotics/introduction-to-robot-operating-system
4. https://www.coursera.org/learn/robotics-engineering--applications
5. https://www.coursera.org/learn/modernrobotics-course2

23MT407	ELECTRICAL ACTUATORS AND DRIVES	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To provide knowledge about the construction, operating principles, and applications of DC and AC machines.
2. To explore comprehensive knowledge of the operating principles, characteristics, and applications of power semiconductor devices.
3. To impart an understanding of electrical drives and their various industrial applications

DC AND AC MACHINES **15**

Construction and Operating Principle- Classification- EMF and Torque Equations-Speed control techniques- Three Phase Induction Motors: Principle of operation- Types- Torque-speed characteristics - Single phase induction motors - Permanent Magnet Synchronous Motors in Electric Vehicles

DEVICES AND CONTROLLED RECTIFIERS **15**

Power Diode, Thyristor, Power MOSFET - Role of single-phase controlled rectifiers in EVs - Speed Control of DC Motors using single phase Dual Converter – DC to DC converter operation for Battery operated vehicles – Single phase inverters - Voltage regulators in Robotic applications

ELECTRICAL DRIVES **15**

Elements of Electric Drive System - Choice & Types of drives, Classes of duty, Brushless DC Motor Drives in wheeled robots, Stepper Motor Drives in 3D Printers, Servo Motor Drives in robotic arms, Variable Frequency Drives in industrial automation.

TOTAL PERIODS: 45

LIST OF EXPERIMENTS

1. Compute the efficiency and performance characteristics of D.C. shunt motor using Load test.
2. Compute the efficiency and performance characteristics of D.C.series motor using Load test.
3. Apply the different methods of speed control in D.C. shunt motor.
4. Calculate the slip and sketch the torque-speed characteristics of three-phase induction motor
5. Simulate the characteristics of power diode, thyristor and power MOSFET.
6. Design and simulate the electrical systems with RLC components and using measuring sensors to observe the output waveforms.
7. Design and simulate the Single-phase controlled rectifier with Load.
8. Simulate speed control of converter fed DC motor.
9. Simulate DC -DC converter operation to step up and step down the voltage for

Battery Vehicles
10. Design and Simulate the single-phase Inverter fed Induction motor
11. Simulation of converter fed BLDC motor.
12. Simulate single phase ac voltage regulator with resistive and inductive loads.

TOTAL PERIODS: 30

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

CO1 Demonstrate the operation of various electrical machines. [U]

CO2 Identify various methods of speed control of motors [AP]

CO3 Interpret the operation of power electronic devices and converters. [U]

CO4 Illustrate the functions of various motor drives. [AP]

CO5 Choose appropriate machines and electrical drives for robotics and automation applications [AP]

TEXTBOOKS

1. Kothari DP and Nagrath IJ, “Electric Machines”, Fifth Edition, McGraw Hill, India 2017.
2. Rashid M H, “Power Electronics: Devices, Circuits and Applications”, Fourth Edition, 2017, Pearson Education
3. Mohamed El-Sharkawi “Fundamentals of Electric Drives”, 2nd Edition,Cengage Learning, 2019

REFERENCE BOOKS

1. V. K. Mehta and R. Mehta, “Principles of Electrical Machines”, Fourth Revised Reprint,S. Chand, 2018
2. Austin Hughes, William Drury, “Electric Motors and Drives: Fundamentals, Types and Applications”, Fifth Edition, Elsevier Science and Technology, 2019
3. Bimbhra P S, “Power Electronics”, Khanna Publishing House, Seventh Edition, 2025, India

WEB RESOURCES

1.http://nptel.ac.in/courses/108105053/
2 https://www.electrical4u.com/electrical-engineering-articles/electric-motor/
3 https://www.electricaleasy.com/p/electrical-machines.html
4 https://studyelectrical.com.
5. https://archive.nptel.ac.in/courses/108/104/108104140/
6. https://www.coursera.org/courses?query=electrical

23MT408	CONTROL THEORY	L	T	P	C
		3	0	2	4

COURSE OBJECTIVES

1. To understand the methods of system representation and to derive their transfer function models.
2. To provide an adequate knowledge of systems in time domain and its stability analysis.
3. To accord basic knowledge in obtaining the open loop and closed loop frequency responses of systems.
4. To introduce the design of controllers and compensators.

SYSTEM MODELLING **15**

Basic elements of control systems - Open loop and closed loop systems - Transfer function modelling: Electrical systems and Mechanical system - Translational, Rotational. - Block diagram models - Signal flow graph.

TIME AND FREQUENCY RESPONSE ANALYSIS **15**

Types of test signals - Step response of first and second order system - Time domain specifications - Steady state error - Generalized error coefficients - Frequency domain specifications - Bode plot - Polar plot.

STABILITY ANALYSIS, CONTROLLERS AND COMPENSATORS **15**

Concept of stability - Routh Hurwitz criterion - Root locus technique - Design of P, PI, PD and PID controllers - Compensators: Introduction to lag compensator- Lag compensator design using Bode plot - State-space modelling: Electrical systems and Mechanical system - Controllability and Observability – Introduction to Fuzzy Logic Controllers: Architecture, major components and design steps.

TOTAL (THEORY): 45 PERIODS

LIST OF EXPERIMENTS

1. Determination of transfer function of armature-controlled DC motor.
2. Determination of transfer function of field-controlled DC motor.
3. Position control of stepper motor and servo motor systems.
4. Simulate different block arrangements and reduce as a single transfer function.
5. Study the effect of adding poles and zeros to the forward path transfer function of a control system.
6. Determination of the closed loop response of first and second order system with unity feedback for different test inputs using simulation.
7. Time response analysis for a second order system using simulation.
8. Analyse the stability of a linear system by Bode plot and Root locus using simulation.
9. Design of P, PI, PD and PID controllers for type-0 and type-1 system using simulation.
10. Design of lag compensator for uncompensated system using simulation.
11. Controller realization for an Electro-Mechanical System using Simulink.
12. Design of fuzzy logic controller for real time applications using Simulink.

TOTAL (LAB): 30 PERIODS

TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to,

CO1	Construct the mathematical model of various control systems and obtain the transfer function of a system.	[AP]
CO2	Analyze the first and second order systems in time domain.	[AN]
CO3	Analyze the frequency response using Bode plot and Polar plot	[AN]
CO4	Examine the stability of a system using Root locus and Routh-Hurwitz criteria methods.	[AP]
CO5	Illustrate the design steps for P, PI, PID controllers, compensators and fuzzy logic controllers.	[AP]

TEXT BOOKS

1. Nagrath I. J. and Gopal M., “Control Systems Engineering”, 7th Edition, New Age International Publishers, 2022.
2. Katsuhiko Ogata, “Modern Control Engineering”, 5th Edition, Pearson, New Delhi, 2015.
3. Farid Golnaraghi and Benjamin C. Kuo, “Automatic Control systems”, 10thEdition, Wiley,2017.

REFERENCE BOOKS

1. Norman S. Nise, “Control Systems Engineering”, 8th Edition, Wiley, New Delhi, 2024.
2. Richard C. Dorf, Robert H.Bishop, “Modern Control Engineering”, 13th Edition, Pearson Education, New Delhi, 2016.
3. Nagoorkani A., “Control Systems Engineering”, 3rd Edition, RBA Publications, 2018.

WEB RESOURCES

1. https://archive.nptel.ac.in/courses/107/106/107106081/
2. https://www.coursera.org/learn/modeling-feedback-systems
3. https://onlinecourses.nptel.ac.in/noc22_ee21/preview
4. https://www.udemy.com/course/fuzzy-logic-matlab/?couponCode=NVDIN35
5. https://www.colorado.edu/ecee/academics/online-programs/ms-ee-coursera/curriculum/systems-and-controls

23CY203	PROGRAMMING IN JAVA	L	T	P	C
		1	0	4	3

COURSE OBJECTIVES

1. To understand JavaBeans standards, class structure, static members, and fundamental Core Java constructs such as variables, data types, arrays, and strings.
2. To apply conditional and control statements, access specifiers, and regular expressions for structured program flow and pattern-based logic implementation.
3. To develop modular object-oriented programs using classes, encapsulation, inheritance, polymorphism, abstraction, and interfaces.
4. To implement robust Java applications using exception handling, user-defined exceptions, assertions, and generics for secure and reusable code.
5. To demonstrate practical knowledge of multithreading, JDBC operations, collections, and servlets for building concurrent, database-driven, and web-based applications..

OVERIVEW OF JAVA **5**

Overview of Java– Defining Classes in Java– Methods– Access Specifiers– Static Members– Java Doc Comments–JavaBean Standards- DataTypes-Wrapper Classes- Variables– Operators– Conditional Statements- Control Statements– Arrays- String– StringBuilder– StringBuffer. Streams– Instance Control Flow & Regular Expressions- Instance Block and Instance Flow Of Execution. Regular Expressions (RegEx), Pattern Matching.

OBJECT ORIENTED PROGRAMMING **5**

Class and Object, Encapsulation, Keywords, Constructors: Introduction & Constructor Overloading, Inheritance Types of Inheritance, Up Casting, Down Casting, IS-A Relationship & HAS-A Relationship, Composition Vs Aggregation. Polymorphism: Method Overloading & Method Overriding. Abstraction & Interface: Abstract Methods and Abstract classes, Interfaces. Exception Handling- Exception Hierarchy, Multiple Exceptions In a Catch Block, Overriding Methods And Exception, User defined Exception.

SERVLET PROGRAMMING **5**

The Assert Keyword, The Generics Framework, Collections: Set, List, Map & Tree, The Iterator Interface. Working with Hashtable Collection Threads: Threads, Basic Thread Control Methods, Multithreading. JDBC: Drivers, CURD operations, Database Connectivity. Servlets : Servlet Life Cycle, Servlet Request and Response, web.xml and its need, Servlet Configuration, Session Tracking.

TOTAL (Theory): 15 PERIODS

LIST OF EXPERIMENTS

1. Basic Java programs using loops (Pattern Problems).
2. Implement a Java program to perform array and string operations.
3. Implementation of a student application using class and objects.
4. Implementation of date, numbers, currency, and tokenizing.
5. Implementation of encapsulation and inheritance.
6. Implementation of method overloading and overriding.
7. Implement a Java program using abstract classes and interfaces.
8. Programs using the collection interface.
9. Implementation of multi-threading for generation of prime numbers and Fibonacci series.
10. Program to handle multiple exceptions using try, catch, and finally blocks.
11. Implement a simple application using servlets.
12. Implement CRUD operations using JDBC.
13. Project:Console-based project with OOPS concepts

TOTAL (Lab): 60 PERIODS
TOTAL: 75 PERIODS

COURSE OUTCOMES

Upon completion of the course, students shall have ability to

C201.1	Develop the features of Core Java Paradigm.	[AP]
C201.2	Apply Looping Statements, Arrays, Strings in Real Time Environment.	[AP]
C201.3	Apply OOPS Concepts in the Real Time Applications.	[AP]
C201.4	Apply the concepts of Exception Handling in real world applications and usage of collection frameworks.	[AP]
C201.5	Develop Multithreaded Applications..	[AP]

TEXTBOOKS

1. Herbert Schildt, “Java: The Complete Reference”, 9th edition, Tata McGraw Hill, 2014.
2. Kathy Sierra, “Head First Java: A Brain-Friendly Guide, 2nd Edition, Oreilly, 2009.
3. Herbert Schildt, “Java A Beginner's Guide, Create, Compile and Run Java Programs Today”, 8th edition, Tata McGraw Hill, 2020.

REFERENCE BOOKS

1. Paul Deitel, Harvey Deitel, ”Java How To Program”, 10th Edition, Prentice Hall Publications, 2014.
2. Y. Daniel Liang, ”Introduction to Java Programming”, 9th Edition, Prentice Hall Publications, 2015.
3. Ed Roman, RIma Patel, Sriganesh, Gerald Brose, “Mastering Enterprise JavaBeans” 3rd edition, Wiley, 2005.

WEB RESOURCES

1. http://www.nptel.ac.in
2. http://www.javaworld.com
3. https://www.learnjavaonline.org/
4. https://www.codecademy.com/learn/learn-java
5. https://www.coursera.org/courses?query=java
6. https://www.tutorialspoint.com/java/index.htm

MANDATORY COURSE

23MCC11	DISASTER MANAGEMENT AND PREPAREDNESS	2/0/0/0
Nature of Course	Theory	
Pre requisites	-	

Course Objectives

1.	To understand the fundamental concepts, types, and characteristics of disasters and hazards.
2.	To understand the environmental and socio-economic impacts caused by disasters.
3.	To understand preparedness strategies, early warning systems, and stakeholder roles in disaster management.
4.	To apply suitable disaster preparedness and mitigation measures for risk reduction.

Course Outcomes

Upon completion of the course, students shall have ability to

CO1	Comprehend the key concepts, causes, and categories of disasters.	[U]
CO2	Discuss the environmental, social, and economic impacts of various disasters.	[U]
CO3	Interpret hazard, vulnerability, and risk assessment approaches in disaster contexts.	[U]
CO4	Describe the elements of preparedness, early warning, and stakeholder roles in disaster management.	[U]
CO5	Adopt preparedness and mitigation strategies to achieve effective disaster risk reduction.	[AP]

Course Contents:

Module 1:	**Introduction and Types of Disasters**	**10 Hrs**

Concepts and definitions: Disaster, hazard, vulnerability, resilience, capacity, risk – Types and characteristics of disasters – Natural disasters: floods, droughts, cyclones, earthquakes, tsunamis, volcanoes, landslides, coastal hazards, wildfires etc. – Human-induced disasters: industrial accidents, chemical/nuclear hazards, transportation accidents, urban flooding, terrorist attacks etc. – Disaster profiles in India.

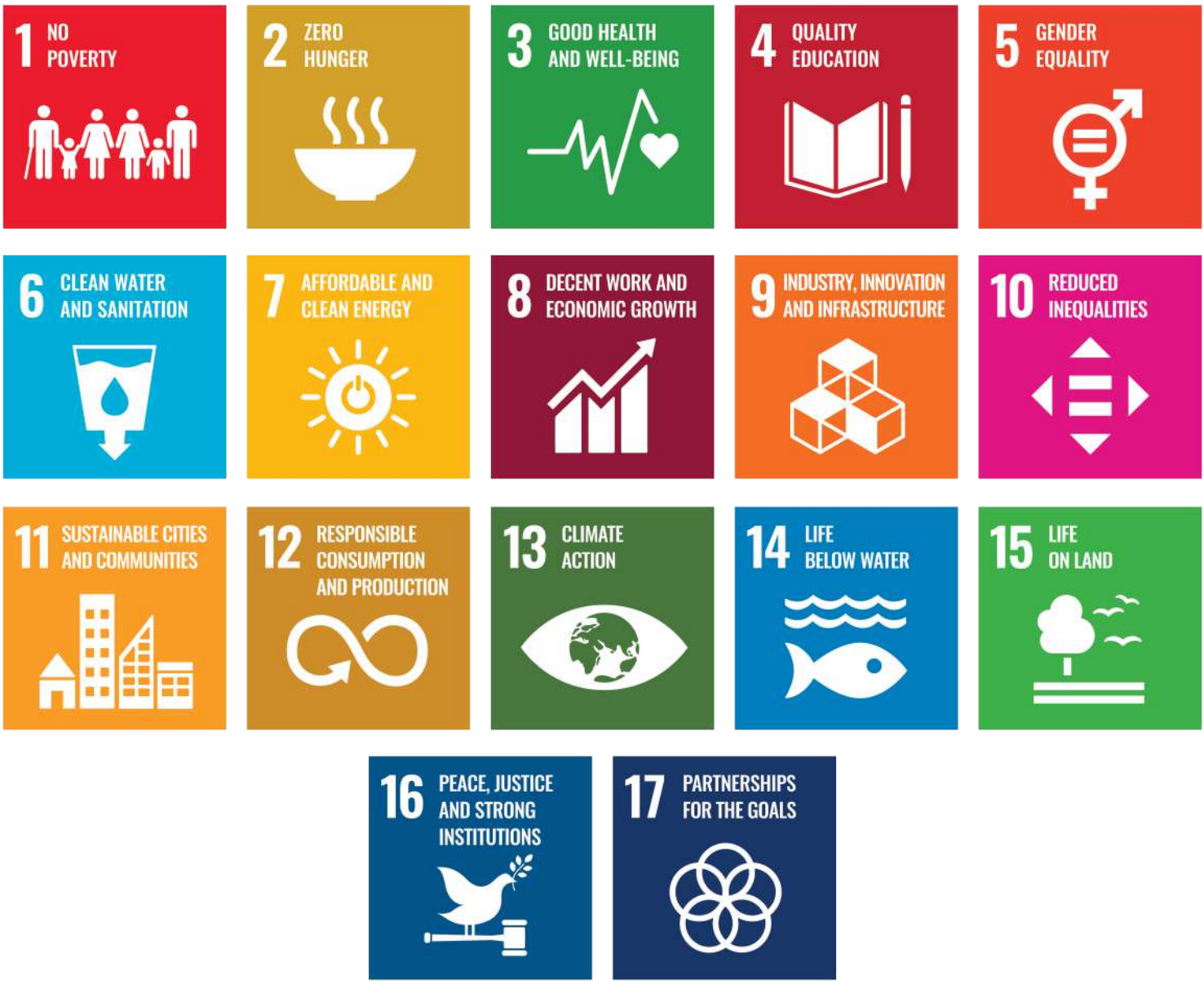
Module 2:	**Disaster Impacts and Preparedness Planning**	**10 Hrs**

Impacts of disasters: environmental, social, economic, physical, psychological and political – Special focus groups: children, women, elderly, differently-abled – Hazard zoning and risk mapping – Concepts of preparedness planning – Community-based disaster preparedness – Public awareness and education – Disaster drills, mock exercises, emergency communication and first-aid practices.

Module 3:	**Disaster Risk Reduction and Management Systems**	**10 Hrs**

Disaster Management Cycle: prevention, mitigation, preparedness, response, rehabilitation and reconstruction – Risk and vulnerability assessment – Early warning systems – Emergency operation centers – Incident command system – Roles and responsibilities of Government agencies, local bodies, NGOs, armed forces, community groups and international organisations – Policy frameworks: Sendai Framework for DRR, National Disaster Management Act and institutional mechanisms in India.	
Total Hours	**30 Hrs**
Text Books:	
1.	S.C. Sharma, Disaster Management, Khanna Publishing House, 2022.
2.	Palanivel K., —Disaster Management , Allied Publishers, 2015.
3.	Sulphey M.M., —Disaster Management PHI Learning Publications, 2017.
Reference Books:	
1.	Shrivastava A.K., —Text book of Disaster Management, Scientific Publications, 2021.
2.	Rajendra Kumar Pandey., —Disaster Management in India, SAGE Publications Pvt. Ltd., 2020.
3.	Arulsamy S., and Jeyadevi J., —Disaster Management, Neelkamal Publications, 2016.
IS Code of Practice:	
1.	IS 15498: 2023 – Guidelines for Improving the Cyclonic Resistance of Low-Rise Houses and Other Buildings, BIS, New Delhi.
2.	IS 17163: 2020 – Site-Specific Investigation and Stability Analysis of Landslides — Guidelines, BIS, New Delhi.
3.	IS 1893 (Part 1): 2016 – Criteria for Earthquake Resistant Design of Structures, BIS, New Delhi.
Web References:	
1.	https://ndma.gov.in/
2.	https://www.ndrf.gov.in/
Online Resources:	
1.	https://onlinecourses.swayam2.ac.in/cec19_hs20/preview
2.	https://www.coursera.org/learn/disaster-preparedness

SUSTAINABLE DEVELOPMENT GOALS



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