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)

The Graduates of B.E – MECHATRONICS ENGINEERING programme will be able to:

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	23EE407	Control Theory	3/0/2	5	4	4,8,9
3	23MT403	Fluid and Thermal Engineering	3 / 0 /2	5	4	4,8,9
4	23MT406	Robotic System Engineering	3/0/2	5	4	4,8,9
5	23MT407	Electrical Actuators and Drives	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
			Total	**30**	**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	8	-	-	-	-	28	16.97
4	Professional Core (PCC)	8	7	12	15	11	11	-	-	64	38.79
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 (28 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.	23EE407	Control Theory	3/0/2	5	4	4,8,9
8.	23CY203	Programming in Java	1/0/4	5	4	4,9

PROFESSIONAL CORE COURSES (64 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.	23MT403	Fluid and Thermal Engineering	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.	23MT501	Autotronics and Vehicle Intelligence	3/0/0	3	3	4,8,9
16.	23MT503	Hydraulics and Pneumatics System	3/0/2	5	4	4,8,9
17.	23MT506	Programming in Embedded C++	3/0/2	5	4	4,8,9
18.	23MT602	Industrial Management and Professional Ethics	3/0/0	3	3	4,8,9
19.	23MT603	Computer Networks and Cyber Security	3/0/0	3	3	4,8,9,16
20.	23MT601	Computer Integrated Manufacturing	3/0/2	5	4	4,8,9
21.	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	Biomechatronics	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

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 – 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

23EE407	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. State-space modeling: Electrical systems and Mechanical system - Block diagram models - Signal flow graph - Introduction to stepper and servo motor - Case study: Modelling of inverted pendulum-cart system.

TIME AND FREQUENCY RESPONSE ANALYSIS **15**

Time domain specifications - Types of test signals - Step response of first and second order system - Steady state error - Generalized error coefficients - Concept of stability - Routh Hurwitz criterion - Root locus technique - Frequency domain specifications - Bode plot - Polar plot.

CONTROLLERS AND COMPENSATORS **15**

Design of P, PI, PD and PID controllers - Compensators: Introduction to lag, lead and lag-lead networks - Lag compensator design using Bode plot - Controllability and Observability - Electro-Mechanical Systems: Introduction - problem setup and design requirements, optimal control of electro-mechanical systems using PID controller - Introduction to Fuzzy Logic Controllers: Architecture, major components and design steps.

TOTAL PERIODS (THEORY): 45

LIST OF EXPERIMENTS

1.Model the mechanical, electrical system and simulate its behaviour to derive its transfer function.
2. Simulate different block arrangements and reduce as a single transfer function.
3. Determination of transfer function of armature-controlled DC motor.
4. Determination of transfer function of field-controlled DC motor.
5. Position control of servo motor and stepper motor systems.
6. Study and operation of inverted pendulum system using V-lab.
7. Determination of response for different test inputs of first and second order system using V-lab.
8. Time response analysis for a second order system using simulation.
9. Analyse the stability of a linear system by Bode plot and Polar plot using V- lab.

10. Design of P, PI, PD and PID controllers for type-0 and type-1 system using simulation.
11. Design of lag compensator for uncompensated system using simulation.
12. Controller realization for an electro-mechanical system using MATLAB/Simulink.
13. Design of fuzzy logic controller for real time applications using MATLAB/Simulink.

TOTAL PERIODS (LAB): 30

TOTAL PERIODS: 75

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 the time domain	[AN]
CO3	Analyze the frequency response using Bode plot and Polar plot and examine the stability of the control systems using Root locus, Routh-Hurwitz criteria methods	[AN]
CO4	Design the controllers and compensators	[AP]
CO5	Manipulate the design steps of electro-mechanical systems and fuzzy logic controllers	[AP]

TEXTBOOKS

1.I. J. Nagrath and M. Gopal, “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”, 10th Edition, 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. A. Nagoorkani, “Control Systems Engineering”, 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

23MT403	FLUID AND THERMAL ENGINEERING	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 & 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- Characteristics- Power Stages- DC Starters -Speed control techniques- Three Phase Induction Motors: Principle of operation- Types- Torque-speed characteristics, Single phase induction motors, Synchronous motors: Construction and working, Types, Starting. Applications of Induction motors in Industries.

DEVICES AND CONTROLLED RECTIFIERS **15**

Characteristics of Power Diode, Thyristor, MOSFET -Thyristor Protection, Single-phase diode rectifier- Phase Controlled Rectifiers (single-phase), Dual Converters (single-phase), Principle of DC-to-DC Converter operation, Single phase Inverter & Single Phase AC Voltage Controller- Application in Traction system.

ELECTRICAL DRIVES **15**

Introduction to electrical drives- Choice of Electrical drives, types of drives, Classes of duty, Closed-Loop (current-limit, torque and speed) Control of Drives, Brushless DC Motor Drives, Stepper Motor Drives, Servo Motor Drives, Variable Frequency Drives-Applications of Drives in automation Industries.

TOTAL PERIODS: 45

LIST OF EXPERIMENTS

1. Compute the efficiency and performance characteristics of D.C.shunt motor and use 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. Experiment on Servo motor position control system
6. Implement position control using a stepper motor.
7. Design and simulate the Single phase controlled rectifier.
8. Implement and simulate various DC motor speed control techniques
9. Simulation of BLDC motor fed by a DC-AC inverter
10. Simulate the operation of a 3-phase inverter-fed induction motor

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	Examine the functions of various motor drives.	[AN]
CO5	Choose appropriate machines and electrical drives through their acquired knowledge	[AP]

TEXTBOOKS

1. Nagrath I.J. and D. P. Kothari, “Electric Machines”, Fifth Edition, Tata McGraw Hill, 2017.
2. Rashid M H, “Power Electronics: Devices, Circuits and Applications”, Fourth Edition, 2017
2. Dubey Gopal K,” Fundamentals of Electrical Drives”, Alpha Science International Ltd, 2017.

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”, Elsevier, 4th Edition, 2013
3. Bimbhra P S, “Power Electronics”, Khanna Publishers, Fifth Edition, 2018

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

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.
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