KPR Institute of Engineering and Technology
Learn Beyond (Autonomous, NAAC "A")
Avinashi Road, Arasur, Coimbatore.

B.E. – Mechatronics Engineering

Curriculum and Syllabi

Regulations – 2021 (Revised)

I. Vision & Mission of the Institute

Vision

To become a premier institute of academic excellence by imparting technical, intellectual and professional skills to students for meeting the diverse needs of industry, society, the nation and the world at large

Mission

- Commitment to offer value-based education and enhancement of practical skills
- Continuous assessment of teaching and learning processes through scholarly activities
- Enriching research and innovation activities in collaboration with industry and institutes of repute
- Ensuring the academic processes to uphold culture, ethics and social responsibilities

II. Vision & Mission of the Department

Vision

To be a transdisciplinary department for the development of academic excellence and research in the field of Mechatronics, catering to the needs of the Industry and the Society

Mission

- Preparing graduates to suit the requirements of the Industry by offering quality education
- Providing an education ecosystem to foster R&D, innovation, creativity, and entrepreneurship
- Inculcating professionalism, ethics, human values and lifelong learning practices

III. Program Educational Objectives (PEOs)

PEO 1: The graduates of Mechatronics Engineering will possess adequate knowledge and skills to succeed in their professional career

PEO 2: The graduates of Mechatronics Engineering will analyse, design, and develop a transdisciplinary engineering-based products and processes for real world applications

PEO 3: The graduates of Mechatronics Engineering will practice their profession with good ethics and human values

IV. Program Outcomes (POs)

PO 1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems

PO 2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences

PO 3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations

PO 4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions

PO 5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitation

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PO 6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice

PO 7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development

PO 8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

PO 9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions

PO 11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments

PO 12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

V. Program Specific Outcomes (PSOs)

PSO 1: Graduates will be able to apply their gained knowledge and skills to design, develop and implement mechatronics systems in the field of engineering and sciences

PSO 2: Graduates will be able to apply innovative ideas and multidisciplinary approaches to solve real world problems

VI. PEO/PO Mapping

Following three levels of correlation should be used:

1. Low
2. Medium
3. High

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	3	3	3	3	3	1	1	1	2	2	2	2
PEO2	3	3	3	3	3	2	2	2	2	2	2	2
PEO3	1	1	1	1	1	3	2	3	3	2	2	2

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B.E. MECHATRONICS ENGINEERING

REGULATIONS – 2021 (Revised)

(for the students admitted 2022 onwards)

CHOICE BASED CREDIT SYSTEM

CURRICULUM FOR I - VIII SEMESTERS

SEMESTER I

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21GEG01	Heritage of Tamils	HSMC	1	0	0	0	1
2	U21MA101	Calculus and Differential Equations	BSC	3	1	0	0	4
	THEORY COURSES WITH LABORATORY COMPONENT							
3	U21EN101	English for Technologists	HSMC	1	0	2	0	2
4	U21PH101	Engineering Physics	BSC	2	0	2	0	3
5	U21CY101	Engineering Chemistry	BSC	2	0	2	0	3
6	U21CSG01	Problem Solving and C Programming	ESC	2	0	2	0	3
	LABORATORY COURSES							
7	U21MEG01	Engineering Graphics	ESC	0	0	4	0	2
	MANDATORY NON-CREDIT COURSES							
8	U21MYC01	Induction program	MNC	Three Weeks				
			TOTAL	11	1	12	0	18

SEMESTER II

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21GEG02	Tamils and Technology	HSMC	1	0	0	0	1
2	U21MA201	Laplace Transforms and Complex Variables	BSC	3	1	0	0	4
3	U21PH201	Materials Science	ESC	2	0	0	0	2
4	U21ME201	Engineering Mechanics	PCC	3	0	0	0	3
5	U21EC101	Introduction to Electrical and Electronics Engineering	PCC	2	0	0	0	2
	THEORY COURSES WITH LABORATORY COMPONENT							
6	U21EN201	Personality Enhancement	HSMC	1	0	2	0	2
7	U21CSG02	Python Programming	ESC	2	0	2	0	3
	LABORATORY COURSES							
8	U21ECG03	Engineering Studio	ESC	0	0	4	0	2
9	U21MI201	Manufacturing and Automation Practices	ESC	0	0	4	0	2
	MANDATORY NON-CREDIT COURSES							
10	U21MYC02	Environmental Sciences	MNC	1	0	0	0	0
			TOTAL	15	1	12	0	21

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SEMESTER III

Sl. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MA303	Fourier Analysis and Boundary Value Problems	BSC	3	1	0	0	4
2	U21MI301	Kinematics of Machinery	ESC	3	1	0	0	4
3	U21MI302	Sensors and Signal Processing	PCC	3	0	0	0	3
4	U21MI303	Manufacturing Processes	PCC	3	0	0	0	3
5	U21MI304	Electrical Drives and Control	PCC	3	0	0	0	3
	THEORY COURSE WITH LABORATORY COMPONENT							
6	U21MI305	Electronic Devices and Digital Circuits	PCC	2	0	2	0	3
	LABORATORY COURSES							
7	U21MI306	Sensors and Signal Processing Laboratory	PCC	0	0	4	0	2
8	U21MI307	Electrical Drives and Control Laboratory	PCC	0	0	4	0	2
9	U21MI308	Design Studio I	EEC	0	0	0	2	1
	MANDATORY NON-CREDIT COURSES							
10	U21MYC03	Essence of Indian Traditional Knowledge	MNC	1	0	0	0	0
			TOTAL	**18**	**2**	**10**	**2**	**25**

SEMESTER IV

Sl. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MA404	Statistics and Numerical Methods	BSC	3	0	0	0	3
2	U21MI401	Dynamics of Machinery	PCC	3	1	0	0	4
3	U21MI402	Control Systems Engineering	PCC	3	0	0	0	3
4	U21MI403	Programmable Automation Controllers	PCC	3	0	0	0	3
5	U21MI404	Microcontroller and Embedded Systems	PCC	3	0	0	0	3
6		Open Elective - I	OEC	3	0	0	0	3
	LABORATORY COURSES							
7	U21SSG01	Soft Skills - I	HSMC	0	0	2	0	1
8	U21MI405	Programmable Automation Controllers Laboratory	PCC	0	0	4	0	2
9	U21MI406	Microcontroller and Embedded Systems Laboratory	PCC	0	0	4	0	2
10	U21MI407	Design Studio II	EEC	0	0	0	2	1
	MANDATORY NON-CREDIT COURSES							
11	U21MYC04	Indian Constitution	MNC	1	0	0	0	0
			TOTAL	**19**	**1**	**10**	**2**	**25**

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SEMESTER V

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
		THEORY COURSES						
1	U21MI501	Robotics and Automation	PCC	3	0	0	0	3
2		Professional Elective - I	PEC	3	0	0	0	3
3		Professional Elective - II	PEC	3	0	0	0	3
4		Open Elective - II	OEC	3	0	0	0	3
		THEORY COURSES WITH LABORATORY COMPONENT						
5	U21MI502	Hydraulics and Pneumatics Systems	PCC	2	0	2	0	3
6	U21MI503	Unmanned Aerial Vehicle Technology	PCC	2	0	2	0	3
		LABORATORY COURSES						
7	U21SSG02	Soft Skills - II	HSMC	0	0	2	0	1
8	U21MI504	Robotics and Automation Laboratory	PCC	0	0	4	0	2
9	U21MI505	CNC and Metrology Laboratory	PCC	0	0	4	0	2
10	U21MI506	Proto Studio I	EEC	0	0	0	2	1
		MANDATORY NON-CREDIT COURSES						
11	U21MYC05	Cyber Security Essentials	MNC	1	0	0	0	0
			TOTAL	**17**	**0**	**14**	**2**	**24**

SEMESTER VI

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
		THEORY COURSES						
1	U21MI601	Design of Mechatronic Systems	PCC	3	1	0	0	4
2		Professional Elective - III	PEC	3	0	0	0	3
3		Professional Elective - IV	PEC	3	0	0	0	3
4		Open Elective - III	OEC	3	0	0	0	3
		THEORY COURSES WITH LABORATORAY COMPONENT						
5	U21MI602	Electric and Hybrid Technologies in Automobiles	PCC	2	0	4	0	4
6	U21MI603	Smart Home and Building Automation	PCC	2	0	4	0	4
		LABORATORY COURSES						
7	U21SSG03	Soft Skills - III	HSMC	0	0	2	0	1
8	U21MI604	Modelling and Analysis of Mechatronic Systems	PCC	0	0	4	0	2
9	U21MI605	Proto Studio II	EEC	0	0	0	2	1
		MANDATORY NON-CREDIT COURSES						
11	U21MYC06	Introduction to UNSDGs: An Integrative Approach	MNC	1	0	0	0	0
			TOTAL	**17**	**1**	**14**	**2**	**25**

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SEMESTER VII

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
	THEORY COURSES							
1	U21MI701	Entrepreneurship Management	PCC	3	0	0	0	3
2	U21MI702	Machine Vision and Image Processing	PCC	3	0	0	0	3
3		Professional Elective – V	PEC	3	0	0	0	3
4		Professional Elective - VI	PEC	3	0	0	0	3
5		Open Elective - IV	OEC	3	0	0	0	3
	LABORATORY COURSES / LABORATORY COURSE WITH PROJECT COMPONENT							
6	U21MI703	Project work Phase - I	EEC	0	0	0	4	2
			TOTAL	15	0	0	4	17

SEMESTER VIII

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MI801	Project work Phase - II	EEC	0	0	0	16	8
			TOTAL	0	0	0	16	8

INDUSTRIAL TRAINING / INTERNSHIP

SI. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MII01	Industrial Training / Internship *	EEC	0	0	0	0	2
			TOTAL	0	0	0	0	2

***Four Weeks during any semester vacation from III to VI Semester**

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NCC CREDIT COURSES:

Sl. NO.	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21NCC01	National Cadet Corps I	-	1	0	2	0	2
2	U21NCC02	National Cadet Corps II	-	1	0	2	0	2
3	U21NCC03	National Cadet Corps III	-	1	0	2	0	2
4	U21NCC04	National Cadet Corps IV	-	2	0	2	0	3
5	U21NCC05	National Cadet Corps V	-	1	0	2	0	2
6	U21NCC06	National Cadet Corps VI	-	2	0	2	0	3
			TOTAL	8	-	12	-	14

NCC Credit Course (Level 1 – Level 6) are offered for NCC students only. The grades earned by the students will be recorded in the mark sheet, however the same shall not be considered for the computation of CGPA.

TOTAL CREDITS: 165

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PROFESSIONAL ELECTIVES COURSES: VERTICALS

Vertical I ROBOTICS	Vertical II DESIGN AND MANUFACTURING	Vertical III SMART MOBILITY SYSTEMS	Vertical IV INTELLIGENT SYSTEMS	Vertical V INDUSTRIAL AUTOMATION	Vertical VI AVIONICS AND DRONE TECHNOLOGY
Robots and Systems in Smart Manufacturing	Robot and Machine Elements Design	Vehicle Dynamics	Applied Signal Processing	Factory Automation	Avionics
Robot Operating Systems	Design for X	Automotive Electronics	Applied Image Processing	Process Control and Automation	Fluid Mechanics and Dynamics
Agricultural Robotics	CNC Machine Tools and Programming	Automotive Mechatronic Systems	Computer Vision and Deep Learning	Virtual Instrumentation using LabVIEW	Guidance and Control of Avionics
Micro-Robotics	Computer Integrated Systems	Smart Mobility and Intelligent Vehicle Systems	Immersive Technologies and Haptic	Introduction to Industrial Internet of Things	Computational Fluid Dynamics for Drones
Collaborative Robotics	Advanced Manufacturing Systems	Advanced Driver Assistance Systems	System Modelling and Simulation	Motion Control System	Aerodynamics of Drones
Underwater Robotics	Mechatronic Systems in Additive Manufacturing	Automotive System Modelling and Simulation	Machine Learning for Intelligent Systems	Digital Twin and Industry 5.0	Design of UAV
Medical Robotics	Electronics Manufacturing Technology	Automotive Fault Diagnostics	Condition Monitoring and Fault Diagnostics	Cyber Physical Systems	Navigation and Communication Systems
Humanoid Robotics	Computer Aided Inspection and Testing	RC machines	Optimization Techniques	Industrial Automation Protocols	Aircraft Mechatronics

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V to VII. These courses are listed in groups called verticals that represent a particular area of specialization / diversified group. Students are permitted to choose all the Professional Electives from a particular vertical or from different verticals.
The registration of courses for B.E./B.Tech (Honors) or Minor degree shall be done from Semester V to VII.

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PROFESSIONAL ELECTIVE COURSES: VERTICALS

VERTICAL I: ROBOTICS

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIP01	Robots and Systems in Smart Manufacturing	PEC	3	0	0	0	3
2	U21MIP02	Robot Operating Systems	PEC	3	0	0	0	3
3	U21MIP03	Agricultural Robotics	PEC	3	0	0	0	3
4	U21MIP04	Micro-Robotics	PEC	3	0	0	0	3
5	U21MIP05	Collaborative Robotics	PEC	3	0	0	0	3
6	U21MIP06	Underwater Robotics	PEC	3	0	0	0	3
7	U21MIP07	Medical Robotics	PEC	3	0	0	0	3
8	U21MIP08	Humanoid Robotics	PEC	3	0	0	0	3

VERTICAL II: DESIGN AND MANUFACTURING

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIP09	Robot and Machine Elements Design	PEC	3	0	0	0	3
2	U21MIP10	Design for X	PEC	3	0	0	0	3
3	U21MIP11	CNC Machine Tools and Programming	PEC	3	0	0	0	3
4	U21MIP12	Computer Integrated Systems	PEC	3	0	0	0	3
5	U21MIP13	Advanced Manufacturing Systems	PEC	3	0	0	0	3
6	U21MIP14	Mechatronic Systems in Additive Manufacturing	PEC	3	0	0	0	3
7	U21MIP15	Electronics Manufacturing Technology	PEC	3	0	0	0	3
8	U21MIP16	Computer Aided Inspection and Testing	PEC	3	0	0	0	3

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VERTICAL III: SMART MOBILITY SYSTEMS

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIP17	Vehicle Dynamics	PEC	3	0	0	0	3
2	U21MIP18	Automotive Electronics	PEC	3	0	0	0	3
3	U21MIP19	Automotive Mechatronic Systems	PEC	3	0	0	0	3
4	U21MIP20	Smart Mobility and Intelligent Vehicle Systems	PEC	3	0	0	0	3
5	U21MIP21	Advanced Driver Assistance Systems	PEC	3	0	0	0	3
6	U21MIP22	Automotive System Modelling and Simulation	PEC	3	0	0	0	3
7	U21MIP23	Automotive Fault Diagnostics	PEC	3	0	0	0	3
8	U21MIP24	RC machines	PEC	3	0	0	0	3

VERTICAL IV: INTELLIGENT SYSTEMS

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIP25	Applied Signal Processing	PEC	3	0	0	0	3
2	U21MIP26	Applied Image Processing	PEC	3	0	0	0	3
3	U21MIP27	Computer Vision and Deep Learning	PEC	3	0	0	0	3
4	U21MIP28	Immersive Technologies and Haptic	PEC	3	0	0	0	3
5	U21MIP29	Systems Modelling and Simulation	PEC	3	0	0	0	3
6	U21MIP30	Machine Learning for Intelligent Systems	PEC	3	0	0	0	3
7	U21MIP31	Condition Monitoring and Fault Diagnostics	PEC	3	0	0	0	3
8	U21MIP32	Optimization Techniques	PEC	3	0	0	0	3

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VERTICAL V: INDUSTRIAL AUTOMATION

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIP33	Factory Automation	PEC	3	0	0	0	3
2	U21MIP34	Process Control and Automation	PEC	3	0	0	0	3
3	U21MIP35	Virtual Instrumentation using LabVIEW	PEC	3	0	0	0	3
4	U21MIP36	Introduction to Industrial Internet of Things	PEC	3	0	0	0	3
5	U21MIP37	Motion Control System	PEC	3	0	0	0	3
6	U21MIP38	Digital Twin and Industry 5.0	PEC	3	0	0	0	3
7	U21MIP39	Cyber Physical Systems	PEC	3	0	0	0	3
8	U21MIP40	Industrial Automation Protocols	PEC	3	0	0	0	3

VERTICAL VI: AVIONICS AND DRONE TECHNOLOGY

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIP41	Avionics	PEC	3	0	0	0	3
2	U21MIP42	Fluid Mechanics and Dynamics	PEC	3	0	0	0	3
3	U21MIP43	Guidance and Control of Avionics	PEC	3	0	0	0	3
4	U21MIP44	Computational Fluid Dynamics for Drones	PEC	3	0	0	0	3
5	U21MIP45	Aerodynamics of Drones	PEC	3	0	0	0	3
6	U21MIP46	Design of UAV	PEC	3	0	0	0	3
7	U21MIP47	Navigation and Communication Systems	PEC	3	0	0	0	3
8	U21MIP48	Aircraft Mechatronics	PEC	3	0	0	0	3

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OPEN ELECTIVES

(Students shall choose the open elective courses, such that the course contents are notsimilar to any other course contents/title under other course categories).

OPEN ELECTIVES – I (SEMESTER: IV)

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIX01	Graphical System Design using LabVIEW	OEC	3	0	0	0	3
2	U21MIX02	Modern Robotics	OEC	3	0	0	0	3

OPEN ELECTIVES – II (SEMESTER: V)

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIX03	MEMS & NEMS	OEC	3	0	0	0	3
2	U21MIX04	Robotics Process Automation	OEC	3	0	0	0	3

OPEN ELECTIVES – III (SEMESTER: VI)

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIX05	Product Design and Development	OEC	3	0	0	0	3
2	U21MIX06	Introduction to Industrial Internet of Things	OEC	3	0	0	0	3
3	U21MIX07	Design of Mechatronic Systems	OEC	3	0	0	0	3

OPEN ELECTIVES – IV (SEMESTER: VII)

Sl.No	COURSE CODE	COURSE TITLE	CATEGORY	L	T	P	J	C
1	U21MIX08	Cyber Physical Systems	OEC	3	0	0	0	3
2	U21MIX09	Introduction to Industry 4.0	OEC	3	0	0	0	3

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Scheme of Credit distribution – Summary

Sl.No.	Stream	Credits/Semester								Credits
		I	II	III	IV	V	VI	VII	VIII	Total
1.	Humanities and Social Sciences including Management (HSMC)	3	3	-	1	1	1	-	-	9
2.	Basic Science Courses (BSC)	10	4	4	3	-	-	-	-	21
3.	Engineering Science Courses (ESC)	5	9	4	-	-	-	-	-	18
4.	Professional Core Courses (PCC)	-	5	16	17	13	14	6	-	71
5.	Professional Elective Courses (PEC)	-	-	-	-	6	6	6	-	18
6.	Open Elective Courses (OEC)	-	-	-	3	3	3	3	-	12
7.	Employability Enhancement Courses (EEC)	-	-	1	1	1	1	2	8	14
8.	Industrial Training/ Internship	-	-	-	-	-	-	-	2	02
9.	Mandatory Non-Credit Course (MNC)	-	-	-	-	-	-	-	-	-
Total		**18**	**21**	**25**	**25**	**24**	**25**	**17**	**10**	**165**

6-12-22

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6.12.2022

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SEMESTER I

		Category: HSMC				
		L	T	P	J	C
U21GEG01	HERITAGE OF TAMILS (Common to all programs)	1	0	0	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

- To learn the extensive literature of classical tamil
- To review the fine arts heritage of tamil culture
- To realize the contribution of tamils in Indian freedom struggle

COURSE OUTCOMES:

CO1: Understand the extensive literature of Tamil and its classical nature (Understand)
CO2: Understand the heritage of sculpture, painting and musical instruments of ancient people (Understand)
CO3: Review on folk and martial arts of tamil people (Understand)
CO4: Realization of thinai concepts, trade and victory of Chozha dynasty (Understand)
CO5: Understand the contribution of tamils in Indian freedom struggle, Self-esteem movement and siddha medicine (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

SYLLABUS:

UNIT I LANGUAGE AND LITERATURE 3

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

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

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

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UNIT III FOLK AND MARTIAL ARTS 3

Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leatherpuppetry, Silambattam, Valari, Tiger dance – Sports and Games of Tamils

UNIT IV THINAI CONCEPT OF TAMILS 3

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

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

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

Contact Periods:

Lecture: 15 Periods	Tutorial: - Periods	Practical: – Periods	Project – Periods
			Total 15 Periods

TEXT-CUM-REFERENCE BOOKS

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

EVALUATION PATTERN:

Continuous Internal Assessment	Total
	100

6/7/23

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KPRIET
Learn Beyond

SEMESTER I

		Category: HSMC				
U21GEG01	தமிழர் மரபு (அனைத்து துறைகளுக்கும் பொதுவனது)	L	T	P	J	C
		1	0	0	0	1

முன்கூட்டிய துறைசார் அறிவு:

தேவையில்லை

பாடத்தின் நோக்கங்கள்:

- தமிழ் மொழியின் இலக்கியச் செறிவைக் கற்றுணர்தல்
- தமிழர் பண்பாட்டின் தூண்கலைகள் பற்றிய ஒரு மீள்பார்வை
- இந்திய தேசிய இயக்கத்தில் தமிழர்களின் பங்கினை அறிதல்

பாடம் கற்றதின் விளைவுகள்:

CO1: தமிழ் மொழியின் செந்தன்மை மற்றும் இலக்கியங்கள் குறித்த தெரிதல் (புரிதல்)
CO2: தமிழர்களின் சிற்பக்கலை, ஓவியக்கலை மற்றும் இசைக்கருவிகள் குறித்த தெளிவு (புரிதல்)
CO3: தமிழர்களின் நாட்டுப்புறக் கலைகள் மற்றும் வீரவிளையாட்டுகள் குறித்த அறிமுகம் (புரிதல்)
CO4: தமிழர்களின் திணைக் கோட்பாடுகள், சங்ககால வணிகம் மற்றும் சோழர்களின் வெற்றிகள் குறித்த தகவல்கள் (புரிதல்)
CO5: இந்திய தேசிய இயக்கம், சுயமரியாதை இயக்கம் மற்றும் சித்த மருத்துவம் பற்றிய புரிதல் (புரிதல்)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	-	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

பாடத்திட்டங்கள்:

அலகு I மொழி மற்றும் இலக்கியம் 3

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

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அலகு II மரபு - பாறை ஓவியங்கள் முதல் நவீன ஓவியங்கள் வரை - சிற்பக்கலை 3

நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் – பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப்பொருட்கள், பொம்மைகள் – தேர் செய்யும் கலை – சுடுமண் சிற்பங்கள் – நாட்டுப்புறத் தெய்வங்கள் – குமரி முனையில் திருவள்ளுவர் சிலை – இசைக்கருவிகள் – மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் – தமிழர்களின் சமூக, பொருளாதார வாழ்வில் கோவில்களின் பங்கு

அலகு III நாட்டுப்புறக் கலைகள் மற்றும் வீர விளையாட்டுகள் 3

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

அலகு IV தமிழர்களின் திணைக் கோட்பாடுகள் 3

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

அலகு V இந்திய தேசிய இயக்கம் மற்றும் இந்திய பண்பாட்டிற்குத் தமிழர்களின் பங்களிப்பு 3

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

Contact Periods:

Lecture: 15 Periods	Tutorial: - Periods	Practical: – Periods	Project – Periods
			Total 15 Periods

TEXT-CUM-REFERENCE BOOKS

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

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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

மதிப்பீட்டு முறை:

தொடர்ச்சியான உள் மதிப்பீடு	மொத்தம்
	100

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SEMESTER I

		Category: BSC				
U21MA101	CALCULUS AND DIFFERENTIAL EQUATIONS (Common to AD, BM, CE, CH, CS, CS(AIML), EC, IT, ME, MI)	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of matrices and calculus which will enable them to model and analyze physical phenomena involving continuous change
- To understand the methodologies involved in solving problems related to fundamental principles of calculus
- To develop confidence to model mathematical pattern and give appropriate solutions

COURSE OUTCOMES:

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

CO1: Apply the knowledge of matrices with the concepts of eigenvalues to study their problems in core areas (Apply)
CO2: Apply the basic techniques and theorems of functions of several variables in other areas of mathematics (Apply)
CO3: Analyse the triple integrals techniques over a region in two dimensional and three-dimensional geometry (Apply)
CO4: Apply basic concepts of integration to evaluate line, surface and volume integrals (Apply)
CO5: Solve basic application problems described by second and higher order linear differential equations with constant coefficients (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO3	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	1
CO5	3	2	-	-	-	-	-	-	-	-	-	-	3	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I MATRICES **9 + 3**

Eigenvalues and eigenvectors – Properties (without proof) – Cayley Hamilton theorem (without proof) – Diagonalization using orthogonal transformation – Applications

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

Partial derivatives – Total derivative – Jacobians – Taylor's series expansion – Extreme values of functions of two variables – Lagrange multipliers method

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UNIT III MULTIPLE INTEGRALS **9 + 3**

Double integrals – Change of order of integration – Triple integrals – Applications in area and volume

UNIT IV LINE AND SURFACE INTEGRALS **9 + 3**

Line integrals – Surface integrals – Green's theorem in a plane – Gauss divergence theorem – Stokes' theorem (excluding proofs)

UNIT V ORDINARY DIFFERENTIAL EQUATIONS **9 + 3**

Second and higher order linear differential equations with constant coefficients – Variable coefficients – Euler Cauchy equation – Legendre's equation – Method of variation of parameters – Applications

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Pvt Ltd, New Delhi, 2018.
2. Grewal B S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.

REFERENCES:

1. Bali N P and Dr Manish Goyal, "A textbook of Engineering Mathematics", 12th Edition, Laxmi Publications, 2016.
2. Thomas G B and Finney R L, "Calculus and Analytic Geometry", 14th Edition, Pearson Education India, 2018.
3. Maurice D Weir, Joel Hass and Christopher Heil, "Thomas Calculus", 14th Edition, Pearson Education, India, 2018.
4. James Stewart, "Calculus: Early Transcendental", 7th Edition, Cengage Learning, New Delhi, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

6/12/23

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SEMESTER I

U21EN101	ENGLISH FOR TECHNOLOGISTS (Common to AD, BM, CH, CE, CS, CS(AIML), EE, EC, ME, MI, IT)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To infer and interpret the meaning of Technical, Business, Social and Academic contexts
- To enhance the listening skills and facilitate effective pronunciation
- To make effective presentation and conversation in technical and professional environment

COURSE OUTCOMES:

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

CO1: Comprehend language and learn strategies for error-free communication (Understand)
CO2: Improve speaking skills in academic and social contexts (Apply)
CO3: Enhance both reading and writing skills to excel in professional career (Analyse)
CO4: Evaluate different perspectives on a topic (Analyse)
CO5: Develop listening skills to understand complex business communication in a variety of global English accents through Personality Development (Understand)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	1	1	-
CO2	-	-	-	-	-	-	-	-	2	3	-	-	2	-
CO3	-	-	-	-	-	-	-	-	2	3	-	1	2	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	1	-
CO5	-	-	-	-	-	-	-	2	-	3	-	1	2	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I SUBJECTIVE INTROSPECTION 9

Module:1 Vocabulary Building
Activity: Word Puzzles, Snappy words, Word Sleuthing
Module:2 Introducing and Sharing Information
Activity: Get to know oneself, Introducing Peer Members
Module:3 Opinion Paragraph
Activity: Note making, analyzing and writing a review

UNIT II CAREER ENHANCEMENT 9

Module:4 Reading Comprehension
Activity: Reading Newspaper articles/Blogs, Sentence completion
Module:5E-mail Communication
Activity: Drafting personal and professional emails
Module:6 Career Profiling

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Activity: Resume Writing & Digital Profiling

UNIT III LANGUAGE ADEPTNESS 9

Module:7 Rewriting passages
Activity: Conversion of voices & Rephrasing Articles
Module:8 Enhancing Pronunciation skills
Activity: Listening to short technical Reels and reproducing it
Module:9 Making Conversations
Activity: Role play & Narrating Incidents

UNIT IV TECHNICAL WRITING 9

Module:10 Spotting Errors
Activity: Proof reading, Rewriting sentences
Module:11 Data interpretation
Activity: Interpretation of Graphics/Charts/Graphs
Module:12 Expository Writing
Activity: Picture inference, Captions for Posters& Products

UNIT V LANGUAGE UPSKILLING 9

Module:13 Listening for Specific Information
Activity: TED talks/Announcement/Documentaries
Module:14 Presentation
Activity: Extempore & Persuasive Speech
Module:15 Team Communication
Activity: Team building activities, Group Discussion

LIST OF EXERCISES

1. Introducing oneself
2. Role play
3. Listening to short technical Reels
4. Listening to TED Talks/ Announcements/ Documentaries
5. Presentation
6. Group Discussion

Contact Periods:

Lecture: 15 Periods Tutorial: - Periods Practical: 30 Periods Project: - Periods

Total: 45 Periods

TEXTBOOKS:

1. Ashraf Rizvi, "Effective Technical Communication", 2nd Edition, Mc Graw – Hill. India 2017.
2. Rod Ellis, "English for Engineers & Technologists", Vol. II: (English for Engineers and Technologist: A Skills Approach). 2nd Edition, Orient Black Swan, 1990.

REFERENCES:

1. Raymond Murphy, "Intermediate English Grammar", 2nd Edition, Cambridge University Press, 2009.
2. Thomas L Means, "English and Communication for Colleges", 4th Edition, Cengage 2017.
3. Using English: "A Coursebook for Undergraduate Engineers and Technologists", 1st Edition, Orient Black Swan, 2017.

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SEMESTER I

		Category: BSC				
U21PH101	ENGINEERING PHYSICS (Common to all branches)	L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the fundamental principles of laser and fibre optics with their applications
- To acquire the knowledge of ultrasonic waves, thermal conductivity and properties of liquids
- To understand the concepts of crystals

COURSE OUTCOMES:

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

CO1: Demonstrate the types of laser for various industrial and medical applications (Understand)
CO2: Apply the concepts of fibre optics in engineering (Understand)
CO3: Understand the production methods of ultrasonic waves and uses in engineering and medicine (Understand)
CO4: Apply the concepts of thermal conductivity in hybrid vehicles and viscosity of liquids in engineering applications (Understand)
CO5: Explain the basic concepts of crystals and its growth techniques (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO3	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO4	3	2	1	-	-	-	-	-	-	-	-	-	2	1
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)							3: Substantial (High)			

SYLLABUS:

UNIT I LASER **6**

Laser characteristics – Spontaneous and stimulated emission – Pumping methods – CO_2 laser – Semiconductor laser – Material Processing – Selective laser Sintering – Hologram – Medical applications (Opthalmology)

UNIT II FIBER OPTICS **6**

Total internal reflection – Numerical aperture and acceptance angle – Classification of optical fibers (Materials, modes and refractive index profile) – Fiber optical communication system – Displacement and temperature sensor – Medical Endoscopy

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UNIT III ULTRASONICS 6

Properties of ultrasonic waves – Piezoelecrtic generator – Acoustic grating – Applications of ultrasonics in industry– SONAR – NDT – Ultrasonic scanning methods – Fetal heart movement

UNIT IV THERMAL PHYSICS AND PROPERTIES OF FLUIDS 6

Modes of heat transfer – Thermal conductivity – Lee's disc method – Solar thermal power generation – Hybrid vehicles – Microwave oven – Surface tension and coefficient of viscosity – Poiseuille's flow experiment

UNIT V CRYSTAL PHYSICS 6

Unit cell – Bravais lattices – SC, BCC, FCC structures – Miller indices – d spacing in cubic lattice – Crystal growth from melt: Bridgeman Technique – Silicon ingots from Czochralski method – Silicon wafers from ingots and its applications.

LIST OF EXPERIMENTS

1. Determination of the wavelength of a given laser source
2. Determination of acceptance angle and numerical aperture of an optical fibre
3. Determination of velocity of sound and compressibility of a liquid using Ultrasonic interferometer
4. Determination of thermal conductivity of a bad conductor using Lee's disc method
5. Determination of viscosity of the given liquid using Poiseuille's flow method

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods

Total: 60 Periods

TEXTBOOKS:

1. Bhattacharya D K and Poonam Tandon, "Engineering Physics", 2nd Edition, Oxford University Press, Chennai, 2017
2. Marikani A, "Engineering Physics", 3rd Edition, PHI publishers, Chennai, 2021

REFERENCES:

1. Shatendra Sharma and Jyotsna Sharma, "Engineering Physics", 2nd Edition, Pearson India Education Services Private Limited, Chennai, 2018
2. Avadhanulu M N, Kshirsagar P G and Arun Murthy TVS, "A Text book of Engineering Physics", 2nd Edition, S Chand Publishing, New delhi, 2018
3. Thyagaran K, Ajoy Ghatak, "Lasers – Fundamantals and Applications", 2nd Edition, Laxmi Publications Pvt Limited, New delhi, 2019
4. https://nptel.ac.in/downloads/104104085/
5. https://nptel.ac.in/courses/122107035/8/

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SEMESTER I

U21CY101	ENGINEERING CHEMISTRY (Common to all BE./B.Tech. courses)	Category: BSC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To inculcate the fundamentals of water technology and electrochemistry
- To gain basic knowledge of corrosion of metals and alloys
- To acquire knowledge about the properties of fuels and applications of polymers

COURSE OUTCOMES:

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

CO1: Apply the principles of water technology in treatment of industrial and domestic water and estimate the various constituents of industrial water (Apply)
CO2: Describe the principles and applications of electrochemical cells, fuel cells and solar cells (Understand)
CO3: Outline the different types of corrosion processes and preventive methods adopted in industries (Understand)
CO4: Explain the analysis and calorific value of different types of fuels (Understand)
CO5: Classify the polymers and their engineering applications (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	-	-	2	-	1	-	-	1	1	2
CO2	3	1	-	-	-	-	2	-	1	-	-	1	2	2
CO3	3	1	-	-	-	-	2	-	1	-	-	1	-	-
CO4	3	1	-	-	-	-	2	-	1	-	-	1	1	1
CO5	3	1	-	-	-	-	2	-	1	-	-	1	1	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I CHARACTERISTICS OF WATER AND ITS TREATMENT **6**

Characteristics of water – Hardness – Types, Dissolved oxygen, Total dissolved solids, Disadvantages due to hard water in industries – (Scale, Slu1dge, Priming, Foaming and Caustic embrittlement), Water softening methods – Lime-soda, Zeolite, Ion exchange processes and reverse Osmosis and their applications. Specifications of domestic water (ICMR and WHO). Water treatment for municipal supply –Sedimentation with coagulant – Sand Filtration – Chlorination, Disinfection methods– UV treatment, Ozonolysis, Electro dialysis

UNIT II ELECTROCHEMISTRY AND ENERGY STORAGE SYSTEMS **6**

Introduction, Electrodes – (Calomel electrode), Electrochemical series and its applications, Brief introduction to conventional primary and secondary batteries – (Pb acid, Lithium)

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Fuel cells – Polymer membrane fuel cells, Solid-oxide fuel cells – Working principles, advantages, applications.Solar cells – Dye sensitized solar cells –Working principles, characteristics and applications

UNIT III CORROSION AND ITS CONTROL 6

Types – Dry – Chemical corrosion and Wet – Galvanic and differential aeration (Pitting, Crevice, pipeline) – Factors influencing rate of corrosion – Corrosion control methods – Sacrificial anode and impressed current method – Protective coating – Electroplating – Ni plating.
Alloys – Ferrous (stainless steel), Heat treatment – Non-ferrous alloys (Brass -Dutch metal, German Silver) – Composition, properties and uses

UNIT IV FUELS AND COMBUSTION 6

Fuels- Solid fuel: Coal - Analysis of coal (Proximate analysis only) – Liquid fuel – Manufacture of synthetic petrol (Bergius process) – Octane number, cetane number, Knocking in engines- Anti-knocking agents, Gasoline additives, Gaseous fuel: Compressed natural gas (CNG) – Liquefied petroleum gases (LPG) – Composition only.
Calorific value – Higher and lower calorific values – Flue gas analysis (ORSAT method). Measurement of calorific value using bomb calorimeter, Three-way catalytic converter – Selective catalytic reduction of NO_x

UNIT V POLYMERS 6

Introduction – Monomer, dimers, functionality, degree of polymerisation, transition glass temperature Classification of polymers, Difference between thermoplastics and thermosetting plastics, Engineering application of plastics - ABS, PVC, PTFE and Bakelite.
Types of compounding of plastics – Moulding, Injection moulding, Extrusion moulding, Compression moulding
Conducting polymers – Polypyrrole, Polyacetylene, Polyaniline – Structure and applications, Composites – FRP – Properties and applications

LIST OF EXPERIMENTS

1. Determination of total, permanent and temporary hardness of a given sample water by EDTA method
2. Estimation of ferrous ion by potentiometric titration
3. Estimation of Copper in Brass by EDTA method
4. Determination of percentage of moisture, volatile, ash and carbon content in a given sample of coal.
5. Determination of molecular weight and degree of polymerization of an oil sample by viscosity measurement (Ostwald's viscometer).
6. Determination of chloride content in the water sample
7. Determination of strength of HCl by pH metric method

Contact periods:

Lecture:	30 Periods	Tutorial:	– Periods	Practical:	30 Periods	Project	– Periods
						Total	60 Periods

TEXTBOOKS:

1. Jain P C and Monika Jain, "Engineering Chemistry", 16th Edition, Dhanpat Rai Publishing Company, Pvt. Ltd., New Delhi, 2015
2. Vairam S, Kalyani P and Suba Ramesh, "Engineering Chemistry", 2nd Edition, Wiley India Pvt. Ltd, New Delhi, 2014

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2. Prasanta Rath, "Engineering Chemistry", 1st Edition, Cengage Learning India, Pvt. Ltd, Delhi, 2015
3. Shikha Agarwal, "Engineering Chemistry, Fundamentals and Applications", 1st Edition, Cambridge University Press, 2015
4. https://nptel.ac.in/courses/113/104/113104008/

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SEMESTER I

U21CSG01	PROBLEM SOLVING AND C PROGRAMMING Common to All Branches	Category: ESC				
		L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide exposure to problem-solving through programming
- To develop computational thinking perspective of one's own discipline
- To write, compile and debug programs using C language

COURSE OUTCOMES:

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

CO1: Formulate the algorithmic solutions for a given computational problem (Understand)
CO2: Describe modularization, structures and pointers in C language (Understand)
CO3: Design and implement algorithms for a given problem using C control structures (Apply)
CO4: Apply the C programming constructs for searching and sorting techniques (Apply)
CO5: Solve real time problems using suitable non-primitive data structures in C (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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CO4	3	2	2	2	-	-	-	1	2	2	-	2	3	1
CO5	3	2	2	2	-	-	-	1	2	2	-	2	3	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I COMPUTATIONAL THINKING 6

Computational Thinking – Modern Computer – Information based Problem solving – Real world information and Computable Data – Data types and data encoding – Number Systems – Introduction to programming languages – Basics of C programming – variables– Data types – keywords – C program structure – Simple programs in C

UNIT II ALGORITHMIC APPROACH 6

Logic – Boolean Logic – Applications of Propositional logic – Problem Definition – Logical Reasoning and Algorithmic thinking – Pseudo code and Flow chart – Constituents of algorithms – Sequence, Selection and Repetition – Problem understanding and analysis – Control structures in C – Algorithm design and implementation using control structures

UNIT III SEARCHING, SORTING, AND MODULARIZATION 6

Data Organization – Arrays – Introduction to Searching and Sorting – Linear Search, Binary Search – Basic sorting techniques – Two-dimensional arrays – Matrix manipulation – Modularization – Functions

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– Function prototype – Function definition – Function call – Built-in functions (string functions and math functions) – Recursion

UNIT IV STRUCTURES AND POINTERS 6

Pointers – Pointer operators – Pointer arithmetic – Arrays and pointers – Array of pointers – Example Program – Sorting of names – Parameter passing – Pass by value – Pass by reference – Structure – Nested structures – Pointer and Structures – Array of structures – Example Program using structures and pointers – Unions

UNIT V FILES 6

Files – Types of file processing – Sequential access – Random access – Sequential access file – Example Program – Finding average of numbers stored in sequential access file – Random access file – Example Program – Transaction processing using random access files – Command line arguments

LIST OF EXPERIMENTS

A. Lab Programs

1. Using IO Statements, get higher secondary marks of a student. Calculate and display the medical and engineering cut-off marks. [Assume the calculation formula]
2. Develop a C program to emulate the operations of an ATM using control structures. Authentication, Deposit, Withdrawal, and Balance check and pin change operations are to be supported.
3. Develop a calculator to perform the operations including addition, subtraction, multiplication, division and square of a number.
4. Given different prices of a vegetable which is varying through the day (from morning to evening), find out the best buy price and sell price for the maximum profit. Eg. For the prices [33, 35, 28, 36, 39, 25, 22, 31], best buy is at 28 and best sell is at 39.
5. Collect height and weight of 4 of your friends and calculate their body mass index. Use 2-dimensional array to store the values.
6. Weights of 10 students of your class who are standing in a line is given in a random order. Find out if there is a heavy person whose weight is the sum of previous two persons.
7. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
8. From a given paragraph perform the following using built-in functions:
   a) Find the total number of words.
   b) Capitalize the first word of each sentence.
9. Solve Towers of Hanoi using recursion.
10. Develop an expense manager which reads date, product, price and product category. The program should display the total expense amount based on product category or date as per user's selection. Use structures.
11. Develop a banking application to store details of accounts in a file. Count the number of account holders based on a search condition such as - whose balance is less than the minimum balance.

B. Mini Project (SAMPLE)

Create a Railway Reservation system with the following modules of Booking,

- Availability checking
- Cancellation
- Prepare chart

Contact Periods:

Lecture: 30 Periods	Tutorial: – Periods	Practical: 30 Periods	Project: – Periods
			Total 60 Periods

TEXTBOOKS:

1. David D. Railey and Kenny A.Hunt , "Computational Thinking for Modern problem Solver", 1st Edition, CRC Press, 2014

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2. Brian W. Kernighan and Dennis Ritchie, "The C Programming Language", 2nd Edition, Pearson, 2015

REFERENCES:

1. Paolo Ferragina and Fabrizio Luccio, "Computational Thinking First Algorithms", Then Code" ,1st Edition,Springer International Publishing, 2018
2. Reema Thareja, "Programming in C", 2nd Edition, Oxford University Press, 2016
3. Paul Deitel and Harvey Deitel, "C How to Program", 7th Edition, Pearson Publication
4. Juneja, B. L and Anita Seth, "Programming in C",1st Edition, Cengage Learning India Pvt. Ltd., 2011
5. Pradip Dey, Manas Ghosh, "Fundamentals of Computing and Programming in C", 1st Edition, Oxford University Press, 2009

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SEMESTER I

		Category: ESC				
U21MEG01	ENGINEERING GRAPHICS	L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To expose the standards and conventions followed in preparation of engineering drawings
- To develop graphic skills for communication of concepts, ideas and engineering drawings
- To expose on 2D & 3D drawings and its projections

COURSE OUTCOME:

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

CO1: Sketch the curves and orthographic projections of points as per BIS conventions (Apply)
CO2: Illustrate the orthographic projections of straight lines and plane surfaces (Apply)
CO3: Sketch the orthographic projections of solids, lateral surfaces of frustums, truncated solids and its development (Apply)
CO4: Develop the lateral surfaces of simple solids (Apply)
CO5: Interpret the orthographic and isometric views of simple components (Apply)

CO PO Mapping:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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Correlation levels:	1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)													

SYLLABUS:

BASICS OF ENGINEERING DRAWING AND CAD (Not for examination) **12**

Introduction – drawing instruments and its uses – sheet layout – BIS conventions – lines – lettering and dimensioning practices – lines – Co–ordinate points – axes – poly lines – square – rectangle – polygons – splines – circles – ellipse – text – move – copy – off–set – mirror – rotate – trim – extend – break – chamfer – fillet – curves – constraints viz. agency – parallelism – inclination and perpendicularity

UNIT I CONICS, SPECIAL CURVES AND PROJECTION OF POINTS **12**

Construction of parabola – ellipse and hyperbola using eccentricity method – construction of involutes for squares and circles – Construction of Tangent and normal to the above curves – Introduction – method of projection – planes of projection – reference line and notations – Orthographic Projection of points – Points in all four quadrants

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UNIT II PROJECTION OF STRAIGHT LINES AND SURFACES 12

Projection of straight lines – Lines inclined to HP / VP plane – inclined to both HP and VP planes (straight lines are assumed to be in first quadrant only) – Projection of planes – Projection of square – rectangle – pentagon – hexagon and circular plane – inclined to both the plane by change of position method

UNIT III PROJECTION OF SOLIDS 12

Introduction – projection of solids – prisms – pyramids – cylinders and cones with axis inclined to both the planes (Solids resting on HP only)

UNIT IV DEVELOPMENT OF LATERAL SURFACES OF SOLIDS 12

Introduction – Cutting plane – sectional views of right regular solids resting with base on HP – prisms – pyramids – cylinder and cone – True shapes of the sections – Development of lateral surfaces of right regular prisms – pyramids – cylinders – cones resting with base on HP only – Development of the frustums and truncations

UNIT V ORTHOGRAPHIC AND ISOMETRIC PROJECTIONS 12

Orthographic projection – Simple machine components using free hand sketching – Isometric projection – Simple Solid exercises and combination of solids

Contact Periods:

Lecture: – Periods	Tutorial: – Periods	Practical: 60 Periods	Project: – Periods
			Total: 60 Periods

TEXTBOOKS:

1. ND Bhat & VM Panchal, "Engineering Drawing", Charotar Publishing House, Gujarat, 51st Edition, 2013.
2. Venugopal K. and Prabhu Raja V, "Engineering Graphics", New Age International (P) Limited, 6th Edition 2019.

REFERENCE BOOKS:

1. Natrajan K.V., A text book of Engineering Graphics, Dhanalakshmi Publishers, Chennai, 21st Edition 2017.
2. Sam Tickoo, AutoCAD 2013 for Engineers and Designers, Dream tech Press, 1st Edition 2013.
3. M.H.Annaiah & Rajashekar Patil, Computer Aided Engineering Drawing, New Age International Publishers,4th Edition,2012.
4. Basant Aggarwal, Engineering Drawing, Tata Mc Graw Hill Education Private Limited, 1st Edition, 2010.
5. D.M.Kulkarni, A.P.Rastogi, A.K.Sarkar, Engineering Graphics with AutoCAD, PHI Learning Private Limited, New Delhi, Revised Edition,2010.

6/3/23

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EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

6/7/20

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Tamilnadu, India

SEMESTER II

		Category: HSMC				
U21GEG02	TAMILS AND TECHNOLOGY (Common to all programs)	L	T	P	J	C
		1	0	0	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

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

- To learn weaving, ceramic and construction technology of Tamils
- To understand the agriculture, irrigation and manufacturing technology of Tamils
- To realize the development of scientific tamil and tamil computing

COURSE OUTCOMES:

CO1: Understand the weaving and ceramic technology of ancient tamil people nature (Understand)
CO2: Understand the construction technology, building materials in sangam period and case studies (Understand)
CO3: Infer the metal process, coin and beads manufacturing with relevant archaeological evidence (Understand)
CO4: Realize the agriculture methods, irrigation technology and pearl diving (Understand)
CO5: Apply the knowledge of scientific tamil and tamil computing (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	1	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I WEAVING AND CERAMIC TECHNOLOGY 3

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

UNIT II DESIGN AND CONSTRUCTION TECHNOLOGY 3

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

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UNIT III MANUFACTURING TECHNOLOGY 3

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

UNIT IV AGRICULTURE AND IRRIGATION TECHNOLOGY 3

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

UNIT V SCIENTIFIC TAMIL & TAMIL COMPUTING 3

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

Contact Periods:

Lecture: 15 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 15 Periods

TEXT-CUM-REFERENCE BOOKS

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

EVALUATION PATTERN:

Continuous Internal Assessment	Total
	100

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KPRIET

SEMESTER II

		Category: HSMC				
U21GEG02	தமிழரும் தொழில்நுட்பமும் (அனைத்து துறைகளுக்கும் பொதுவனது)	L	T	P	J	C
		1	0	0	0	1

முன்கூட்டிய துறைசார் அறிவு:
தேவையில்லை

பாடத்தின் நோக்கங்கள்:

- தமிழர்களின் சங்ககால நெசவு, பானை வனைதல் மற்றும் கட்டட தொழில்நுட்பம் குறித்து அறிதல்
- தமிழர்களின் சங்ககால வேளாண்மை, நீர்ப்பாசனம் மற்றும் உற்பத்தி முறைகள் குறித்த கற்றல்
- நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிதல்

பாடம் கற்றதின் விளைவுகள்:

CO1: சங்ககாலத் தமிழர்களின் நெசவு மற்றும் பானை வனைதல் தொழில்நுட்பம் குறித்த கற்றுணர்தல் (புரிதல்)
CO2: சங்ககாலத் தமிழர்களின் கட்டட தொழில்நுட்பம், கட்டுமானப் பொருட்கள் மற்றும் அவற்றை விளக்கும் தளங்கள் குறித்த அறிவு (புரிதல்)
CO3: சங்ககாலத் தமிழர்களின் உலோகத்தொழில், நாணயங்கள் மற்றும் மணிகள் சார்ந்த தொல்லியல் சான்றுகள் பற்றிய அறிவு (புரிதல்)
CO4: சங்ககாலத் தமிழர்களின் வேளாண்மை, நீர்ப்பாசன முறைகள் மற்றும் முத்து குளித்தல் குறித்த தெளிவு (புரிதல்)
CO5: நவீன அறிவியல் தமிழ் மற்றும் கணித்தமிழ் குறித்த புரிந்துகொள்ளலும் மற்றும் பயன்படுத்துதலும் (கற்றலை பயன்படுத்துதல்)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO2	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO3	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO4	-	-	-	-	-	-	3	3	-	2	-	3	1	-
CO5	-	-	-	-	-	-	3	3	-	2	-	3	1	-
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)				3: Substantial (High)						

பாடத்திட்டங்கள்:

அலகு I நெசவு மற்றும் பானைத் தொழில்நுட்பம் 3

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

6/3/23

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அலகு II வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் 3

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

அலகு III உற்பத்தித் தொழில்நுட்பம் 3

கப்பல் கட்டும் கலை – உலோகவியல் – இரும்புத் தொழிற்சாலை – இரும்பை உருகுதல், எக்கு – வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் – நாணயங்கள் அச்சடித்தல் – மணி உருவாக்கும் தொழிற்சாலைகள் – கல்மணிகள் – கண்ணாடி மணிகள் – சுடுமண் மணிகள் – சங்கு மணிகள் – எலும்புத் துண்டுகள் – தொல்லியல் சான்றுகள் – சிலப்பதிகாரத்தில் மணிகளின் வகைகள்

அலகு IV வேளாண்மை மற்றும் நீர்ப்பாசனத் *தொழில்நுட்பம்* 3

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

அலகு V அறிவியல் தமிழ் மற்றும் கணினித்தமிழ் 3

அறிவியல் தமிழின் வளர்ச்சி – கணினித்தமிழ் வளர்ச்சி – தமிழ் நூல்களை மின்பதிப்பு செய்தல் – தமிழ் மென்பொருட்கள் உருவாக்கம் – தமிழ் இணையக் கல்விக் கழகம் – தமிழ் மின்நூலகம் – இணையத்தில் தமிழ் அகராதிகள் – சொற்குவைத் திட்டம்

Contact Periods:

Lecture: 15 Periods	Tutorial: - Periods	Practical: – Periods	Project – Periods
			Total 15 Periods

TEXT-CUM-REFERENCE BOOKS

1. தமிழக வரலாறு - மக்களும் பண்பாடும் - கே.கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி - வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை - ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies)
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies)

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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) (Publishedby: 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

மதிப்பீட்டு முறை:

தொடர்ச்சியான உள் மதிப்பீடு	மொத்தம்
	100

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SEMESTER II

U21MA201	LAPLACE TRANSFORMS AND COMPLEX VARIABLES (Common to CE, EE, CH, ME, MI)	Category: BSC				
		L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the mathematical aspects of conversion time domain to frequency domain using Laplace transform and Inverse Laplace transform vice versa
- To use the concepts of complex analysis, in the study of heat flow, fluid dynamics and electrostatics
- To understand the concepts of singularities in the various domains of engineering fields

COURSE OUTCOMES:

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

CO1: Apply the concepts of Laplace transform in core engineering applications (Apply)
CO2: Apply the concepts of Inverse Laplace transform with their properties in engineering field (Apply)
CO3: Analyze the complex functions and their mapping in certain complex planes (Understand)
CO4: Evaluate complex contour integrals directly and use the Cauchy integral theorem in its various versions (Understand)
CO5: Compute the residues of a function at given points or singularities and use the residue theorem to evaluate a contour integral (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	2	-	-	-	-	-	-	-	-	-	-	2	1
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	1
CO5	3	3	-	-	-	-	-	-	-	-	-	-	1	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I LAPLACE TRANSFORM **9 + 3**

Laplace transform – Conditions for existence – Transform of elementary functions – Standard properties (statement only) – Transforms of unit step function – Impulse function – Periodic function – Initial and final value theorems – Convolution theorem(without proof)

UNIT II INVERSE LAPLACE TRANSFORM **9 + 3**

Inverse Laplace transform – Standard properties (statement only) – Second order linear differential equations with constant coefficients

UNIT III COMPLEX DIFFERENTIATION **9 + 3**

Analytic functions: Cauchy-Riemann equations (Cartesian form) and sufficient conditions (excluding proofs) – Harmonic and orthogonal properties of analytic function – Construction of analytic functions – Bilinear transformations

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UNIT IV COMPLEX INTEGRATION **9 + 3**

Complex integration – Statement and applications of Cauchy's integral theorem and Cauchy's integral formula

UNIT V SINGULARITIES AND RESIDUES **9 + 3**

Taylor's and Laurent's series expansions – Singular points – Classification of singularities – Residues – Cauchy's residue theorem

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India Pvt Ltd, New Delhi, 2018.
2. Grewal B S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, New Delhi, 2017.

REFERENCES:

1. Bali N P and Dr Manish Goyal, "A text book of Engineering Mathematics", 12th Edition, Laxmi Publications, 2016.
2. Thomas G B and Finney R L, "Calculus and Analytic Geometry", 14th Edition, Pearson Education India, 2018.
3. James Stewart, "Calculus: Early Transcendental", 7th Edition, Cengage Learning, New Delhi, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER II

		Category: BSC				
U21PH201	MATERIALS SCIENCE (Common to all branches except BME)	L	T	P	J	C
		2	0	0	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To gain the knowledge of conducting and semiconducting materials
- To understand the concepts of magnetic, dielectric and optical properties of materials
- To enhance the knowledge of new engineering materials

COURSE OUTCOMES:

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

CO1: Demonstrate the electrical characteristics of conducting materials (Understand)
CO2: Interpret the properties and types of semiconducting materials (Understand)
CO3: Compare various types of magnetic materials for engineering applications (Understand)
CO4: Explain the fundamental concepts of dielectric and optical materials (Understand)
CO5: Examine new engineering materials for industrial applications (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	1	-	-	-	-	-	1	2	1
CO2	3	2	-	-	-	1	-	-	-	-	-	1	2	1
CO3	3	2	-	-	-	1	-	-	-	-	-	1	2	1
CO4	3	2	-	-	-	1	-	-	-	-	-	1	1	1
CO5	3	2	-	-	-	1	-	-	-	-	-	1	2	1
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)				3: Substantial (High)							

SYLLABUS:

UNIT I CONDUCTING MATERIALS 6

Classical free electron theory – Expression for electrical conductivity and thermal conductivity – Wiedemann - Franz law – Drawbacks – Fermi distribution function – Density of energy states in metals

UNIT II SEMICONDUCTING MATERIALS 6

Intrinsic and Extrinsic semiconductor – Carrier concentration in n-type semiconductor – P-type semiconductor(qualitative) – Applications of semiconductors – Solar cell – LED – Hall effect and its experimental determination

UNIT III MAGNETIC MATERIALS 6

Origin of magnetism – Dia, para and ferro magnetic materials – Domain theory – Soft and hard magnetic materials – Magnetic bubble memories – GMR sensor

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UNIT IV DIELECTRIC AND OPTICAL MATERIALS 6

Dielectrics – Types of polarisation – Electronic polarisation – Dielectric breakdown – Ferroelectrics – Applications of dielectrics – Classification of optical materials – Nonlinear optics – Applications

UNIT V NEW ENGINEERNG MATERIALS AND CHARACTERIZATION TECHNIQUES 6

SMA – SiC – GaN – Rheological materials – Nanomaterials – Synthesis (Ball milling and CVD) – Quantum dot, quantum wire and quantum well(qualitative) – Characterisation techniques – Powder XRD(qualitative) – SEM

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 30 Periods

TEXTBOOKS:

1. Wahab M A, "Solid State Physics: Structure and Properties of Materials", 3rd Edition, Narosa Publishing House, Chennai, 2018
2. Marikani A, "Materials Science", 1st Edition, PHI publishers, Chennai, 2017

REFERENCES:

1. Pillai S O "Solid State Physics", 9th Edition, New Age International Publishers, New Delhi, 2020
2. Bangwei Zhang, "Physical Fundamentals of Nanomaterials", Chemical Industry Press, China, 2018
3. Joginder Singh Galsin, "Solid State Physics – An Introduction to Theory", Academic Press, India, 2019
4. https://nptel.ac.in/courses/108/108/108108122/
5. https://nptel.ac.in/courses/113/105/113105081/

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER II

		Category: PCC				
U21ME201	ENGINEERING MECHANICS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To expose various laws of force for equilibrium of rigid bodies
- To introduce the concepts of properties of surfaces and solids
- To impart knowledge on the fundamentals of dynamics of particles and rigid bodies

COURSE OUTCOMES (CO)

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

CO1: Identify various force systems in a plane (Apply)
CO2: Solve equilibrium of rigid bodies in two dimensions (Apply)
CO3: Calculate the centroid, area and mass moment of inertia for surfaces and solids (Apply)
CO4: Apply the concept of dynamics for particle motions (Apply)
CO5: Determine the friction of elements and dynamics of rigid bodies (Apply)

COURSE ARTICULATION MATRIX:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	-	-	-	-	-	-	-	2	2	2
CO2	3	3	2	1	-	-	-	-	-	-	-	2	2	2
CO3	3	3	2	1	-	-	-	-	-	-	-	2	2	1
CO4	3	3	2	1	-	-	-	-	-	-	-	2	2	2
CO5	3	3	2	1	-	-	-	-	-	-	-	2	2	1
Correlation levels:1: Slight (Low)2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I EQUILIBRIUM OF FORCES 9

Types of force systems – coplanar concurrent forces – Resultant – Moment of a force and its application – Couples and resultant of a force system, equations of equilibrium of coplanar concurrent and non – concurrent force systems, Lami's theorem, resolution of a force into a force and a couple, polygon law of forces for resultant

UNIT II EQUILIBRIUM OF RIGID BODIES 9

Free body diagram – Types of supports – Support reactions – Moment of a force about a point and about an axis – Moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force – Equilibrium of rigid bodies in two dimensions

UNIT III PROPERTIES OF SURFACES AND SOLIDS 9

Centroids and centre of mass – Centroids of lines and areas – Rectangular, circular, triangular areas by integration – T section, I section and Hollow section by using standard formula. Theorems of Pappus – Area moments of inertia of plane areas – Rectangular, circular, triangular areas by integration. T section, I section, Hollow section by using standard formula – Parallel axis theorem and perpendicular

axis theorem. Principal moments of inertia of plane areas – Principal axes of inertia–Mass moment of inertia – Mass moment of inertia for prismatic and cylindrical solids

UNIT IV DYNAMICS OF PARTICLES 9

Displacements, velocity and acceleration – relationship – Relative motion – Curvilinear motion. Newton's laws of motion – Work energy equation – Impulse and momentum – Impact of elastic bodies

UNIT V FRICTION AND ELEMENTS OF RIGID BODY DYNAMICS 9

Friction force – Laws of sliding friction – Equilibrium analysis of simple systems with sliding friction – Wedge friction. Rolling resistance – Translation and Rotation of Rigid Bodies – Velocity and acceleration – General Plane motion of simple rigid bodies such as cylinder, disc/wheel and sphere

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 45 Periods

TEXTBOOKS

1. Vela Murali, "Engineering Mechanics", Oxford University Press, 1st Edition 2010
2. S. S. Bhavikatti, Engineering Mechanics, New Age International Publishers, 3rd Edition 2016.

REFERENCES

1. Beer, F.P and Johnston Jr. E.R., "Vector Mechanics for Engineers: Statics and Dynamics", 8th Edition, Tata McGraw–Hill Publishing company, New Delhi 2014.
2. S. Timoshenko, D.H. Young, J.V. Rao, Sukumar Pati, Engineering Mechanics, 4th Edition, TMH Education, 2016.
3. Sanjay Bansal, R.K. Bansal, A Textbook of Engineering Mechanics, Laxmi Publications Pvt Ltd, 8th Edition,2011

EVALUATION PATTERN:

Continuous Internal Assessments					Final Continuous Assessment
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / Mini Project / MCQ	Written Test	Individual Assignment / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose anyone / two components based on the nature of the course.

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SEMESTER II

		Category: PCC				
		L	T	P	J	C
U21EC101	INTRODUCTION TO ELECTRICAL AND ELECTRONICS ENGINEERING (Common to EC and MI : For EC, It is offered during I Semester and For MI, It is offered during II Semester)	2	0	0	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the basic concepts of electric circuits
- To acquire the knowledge on constructional details of DC and AC machines
- To understand the working of measuring instruments and consumer electronic gadgets

COURSE OUTCOMES:

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

CO1: Outline the fundamental concepts of electric circuits (Understand)
CO2: Utilize DC machines for real time applications (Apply)
CO3: Explain the construction and operation of AC machines (Understand)
CO4: Compare the principles of various measuring instruments (Apply)
CO5: Summarize the consumer electronic gadgets (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	2
CO3	2	-	-	-	-	-	-	-	-	-	-	-	2	2
CO4	3	2	2	-	-	-	-	-	-	-	-	-	2	2
CO5	2	-	-	-	-	-	-	-	-	-	-	-	2	2

Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

SYLLABUS:

UNIT I FUNDAMENTALS OF ELECTRIC CIRCUITS 6

Basic terminology – Voltage, current, power, electromotive force, resistor and its types, capacitors and inductors – Types, V-I relations and energy stored – AC fundamentals – Three phase power supply – Line and phase voltages – Star connection – Delta connection

UNIT II DC MACHINES 6

Construction – Operating principle – Types – Applications of DC generator and motor

UNIT III AC MACHINES 6

Construction – Principle of operation – Types – Applications of transformers – Single and three phase induction motor – Stepper motor – Servo motor

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UNIT IV MEASURING INSTRUMENTS 6

Voltmeter – Ammeter – Digital multimeter – Megger – CRO – Storage oscilloscope – Energy meter – Spectrum Analyzer

UNIT V CONSUMER ELECTRONICS 6

Microphone – Loudspeaker – Display devices – Digital cameras – Smart TV – Washing machine – Microwave oven – Mobile phones

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total: 30 Periods

TEXTBOOKS:

1. S. Salivahnan, R. Rengaraj, G R Venkatakrishnan., "Basic Electrical, Electronics and Measurement Engineering", 1st Edition, Tata McGraw Hill Publishing Company Ltd, 2018
2. A.K.Sawhney, "A course in Electrical and Electronic Measurements and Instrumentation"' 2nd Edition, Dhanpat Rai & Sons, 2005

REFERENCES:

1. Bhattacharya S.K., "Electrical Machines", 4th Edition, McGraw-Hill Education, New Delhi, 2017
2. Mitchel E Schultz, "Basic Electronics", 10th Edition, McGraw Hill Publishers, 2017
3. Bali S P, "Consumer Electronics", 1st Edition, Pearson Education Asia Pvt. Ltd., 2008

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Mini Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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KPRIET
Learn Beyond

SEMESTER II

U21EN201	PERSONALITY ENHANCEMENT Common to AD, BM, CH , CE, CS, CS(AIML),EE,EC,ME,MI,IT)	Category: HSMC				
		L	T	P	J	C
		1	0	2	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To develop of personality traits that contributes in the professional environment
- To create a basic awareness about the significance of soft skills in professional and interpersonal communications
- To enhance the level of self-confidence that helps to excel in the leadership skills

COURSE OUTCOMES:

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

CO1: Nurture a deep understanding of personality development and interpersonal relationship for overall self-development (Understand)
CO2: Communicate proficiently in high-end interviews and in all social situations (Understand)
CO3: Synthesize complex concepts and present them in speech and writing (Analyse)
CO4: Negotiate lead teams towards success (Understand)
CO5: Present ideas in an effective manner using web tools (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	2	3	-	1	1	-
CO2	-	-	-	-	-	-	-	1	2	3	-	1	1	-
CO3	-	-	-	-	-	-	-	-	2	3	-	-	1	-
CO4	-	-	-	-	-	-	-	-	2	3	-	-	1	-
CO5	-	-	-	-	-	-	-	1	-	3	-	-	1	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I LEXICAL REASONING 9

Module:1 Establishing Associations
Activity: Verbal Analogy, Logical Reasoning
Module:2 Lateral Thinking
Activity: Reasoning and Assertions
Module:3 Sentence Completion
Activity: Cloze Test, Single Word Substitutes

UNIT II SOCIAL CORRESPONDENCE 9

Module:4 Etiquettes
Activity: Brain storming & performing in actions
Module:5 Introspection
Activity: SWOT Analysis, Goal Setting
Module:6 Co-verbal Gesture
Activity: Body Language, Nonverbal cues

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UNIT III ART OF NETWORKING 9

Module:7 Addressing a Multitude
Activity: Welcome address, Vote of Thanks, Public Speaking
Module:8 Persuasive Communication
Activity: Making Technical Presentation
Module:9 Career Oriented Communication
Activity: Face to face Conversation, Mock Interview

UNIT IV CRITICAL THINKING 9

Module:10 Organizing ideas
Activity: Mind Mapping
Module:11 Problem Solving Skills
Activity: Conflict management, Case Study
Module:12 Critical Review
Activity: Book/ Movie Review, Comparative Analysis

UNIT V CONTENT WRITING 9

Module:13 Reports
Activity: Writing Event Report, Project Report
Module:14 Writing for Digital platform
Activity: Writing Posts, Blogs
Module:15 Developing Content
Activity: Product Description, Writing Proposals

LIST OF EXERCISES

1. Listening to Inspirational Speech
2. Listening to Product Description
3. Book/Movie Review
4. Presentation
5. Mock Interview
6. Public Speaking

Contact Periods:

Lecture: 15 Periods	Tutorial: – Periods	Practical: 30 Periods	Project: – Periods

Total: 45 Periods

TEXTBOOKS:

1. Meenakshi Raman & Sangeetha Sharma. "Professional English: for AKTU",1st Edition, Oxford University Press. 2018.
2. Barun. K.Mitra. "Personality Development and Soft Skills", OUP India. 2nd Edition, 2016.

REFERENCES:

1. Mathew Allen. "Smart Thinking: Skills for Critical Understanding and Writing", 2nd Edition, OUP India, 2016.
2. Means, Thomas L, "English and Communication for Colleges", 4th Edition, Cengage 2017
3. Using English: "A Coursebook for Undergraduate Engineers and Technologists", 1st Edition, Orient Black Swan, 2017

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EVALUATION PATTERN:

Continuous Internal Assessments				End Semester Examinations
Assessment I (Theory) (100 Marks)		**Assessment II (Practical) (100 Marks)**		
Individual Assignment / Seminar / MCQ	Written Test	Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	**Practical Examinations (Examinations will be conducted for 100 Marks)**
40	**60**	**75**	**25**	
25		**25**		**50**
50				**50**
Total: 100				

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER II

		Category: ESC				
U21CSG02	PYTHON PROGRAMMING Common to All Branches	L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand syntax and semantics of python programming
- To implement programs using python data structures
- To gain expertise in using python libraries for solving real time problems

COURSE OUTCOMES:

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

CO1: Describe the basic operations of tokens in python (Understand)
CO2: Demonstrate the programs using control statements (Apply)
CO3: Develop programs using python data structures (Apply)
CO4: Implement the exceptions in file-handling concepts (Apply)
CO5: Apply the python libraries in real-world problems (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	-	-	-	1	2	2	-	2	2	2
CO2	2	1	1	2	-	-	-	1	2	2	-	2	2	2
CO3	3	2	2	2	-	-	-	1	2	2	-	2	2	2
CO4	3	2	2	2	-	-	-	1	2	2	-	2	2	2
CO5	3	2	2	2	1	-	-	1	2	2	-	2	2	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I LANGUAGE BASICS 6

Python interpreter and interactive mode – Tokens – Data types – Numbers and math functions – Input and Output operations – Comments – Reserved words – Indentation – Operators and expressions – Precedence and associativity – Type conversion – Debugging – Common errors in Python

UNIT II CONTROL STATEMENTS, FUNCTIONS, AND MODULES 6

Selection – Conditional branching statements – if – if-else – Nested-if – if-elif-else statements – Iterative statements – while – for loop – break – continue and pass statements – Functions – Function Definition and Function call – Variable scope and Lifetime – Return statement – Lambda functions or Anonymous functions – Recursion – Modules and Packages

UNIT III PYTHON DATA STRUCTURES 6

Strings – Slicing – Immutability – Built-in string methods and functions – Concatenating – Appending and Multiplying strings – String modules – List – Creation – Accessing values – Slicing – List methods – In-built functions for Lists – Tuples – Creation – Operations on tuples – Traversing – Indexing and

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Slicing – Tuple assignment – In-built functions for tuples – Sets – Creation – Operations – Dictionaries – operations and methods

UNIT IV EXCEPTION AND FILE HANDLING 6

Exceptions – Errors and Exceptions – Handling exception – Built-in and User-defined exceptions – Files – Types – Operations – Open – Read – Write – Close

UNIT V NUMPY and PANDAS 6

Numpy – Introduction – Computations using NumPy functions – Computation on Arrays – Aggregation – Indexing and Sorting – Pandas – Introduction and Basic Pandas Concepts – Data frames – Data Handling

LIST OF EXPERIMENTS

1. Programs on selection and Iteration operations.
2. Get an integer input from a user. If the number is odd, then find the factorial of a number and find the number of digits in the factorial of the number. If the number is even, then check the given number is palindrome or not.
3. Strings and its operations.
4. Given two strings, PRINT (YES or NO) whether the second string can be obtained from the first by deletion of none, one or more characters.
5. List and its operations.
6. Programs for positive and negative indexing.
7. Program to check if the given list is in Ascending order or Not.
8. Tuples and its operations.
9. Python program to convert a tuple to a string.
10. Python program to reverse a tuple.
11. Sets and its operations.
12. Python program to check if a set is a subset of another set.
13. Dictionaries and its operations.
14. Python program to iterate over dictionaries using for loops.
15. Computations using NumPy functions.
16. NumPy program to convert a list of numeric value into a one-dimensional NumPy array.
17. NumPy program to convert a list and tuple into arrays.
18. Data manipulations using Pandas.
19. Program to convert a NumPy array and series to data frames.
20. Program to add, subtract, multiple and divide two Pandas Series.
21. Program to retrieve and manipulate data using dataframes.

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project – Periods

Total 60 Periods

TEXTBOOKS:

1. Reema Thareja, "Python programming: Using problem solving approach", 1st Edition, Oxford Press, 2017
2. William McKinney, Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython, 2nd Edition, Shroff/O'Reilly Publication, 2017

REFERENCES:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016
2. Ashok Namdev Kamthane and Amit Ashok Kamthane, "Programming and Problem Solving with Python", 2nd Edition, McGrawHill Education, 2018

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3. Robert Sedgewick, Kevin Wayne, Robert Dondero, "Introduction to Programming in Python: An Inter-disciplinary Approach",1st Edition, Pearson India Education Services Pvt. Ltd., 2016
4. https://python-iitk.vlabs.ac.in/List%20of%20experiments.html
5. http://greenteapress.com/wp/think-python/

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th colspan="2">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I
(Theory)
(100 Marks)</th><th colspan="2">Assessment II
(Practical)
(100 Marks)</th><th rowspan="2">Theory Examinations (Examinations will be conducted for 100 Marks)</th><th rowspan="2">Practical Examinations (Examinations will be conducted for 100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record (Rubrics Based Assessments)</td><td>Test</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td><td></td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>25</td><td>25</td></tr>
<tr><td colspan="4">50</td><td colspan="2">50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER II

U21ECG03	ENGINEERING STUDIO (Common to all Programmes)	Category: ESC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- NIL

COURSE OBJECTIVES:

- To enable the students understand the functioning of simple to complex devices and systems
- To help the students design and build simple applications on their own
- To create an immersive environment in the engineering lab

COURSE OUTCOMES:

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

CO1: Understand basics of electronics (Understand)
CO2: Use basic electronic components and Arduino for prototyping (Apply)
CO3: Create simple real time use cases (Create)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	2	-	-	-	1	-	-	1	2	2
CO2	3	3	3	3	2	2	1	1	2	-	-	1	2	2
CO3	3	3	3	3	3	2	3	3	3	-	-	3	2	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

LIST OF EXPERIMENTS

Basics of Electronics

1. Breadboard Basics – LED glowing, Ohm's Law
   Series and Parallel Circuits
2. Controlling the circuit response using Potentiometer
   Capacitor Charging and Discharging
3. Water level Indicator using transistor
   Touch sensor using transistor
4. Automatic night light- (LDR –transistor) circuit
   Fire alarm Circuit
5. IR Sensor-Obstacle detecting circuit
   Doorbell using 555 Timer circuit
6. LED Chaser circuit using Counter IC
   Shadow detector using IC741
7. Regulated output using Regulator IC
   Logic gate Realization

Basics of IoT (With Arduino)

1. Basics of ARDUINO and IoT
   Working with LEDs

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2. Working with digital switch
   Adjusting voltage using potentiometer
3. Measuring the presence / absence of light using LDR
   Finding the distance of an object using ultrasonic sensor
4. Finding the Temperature and Humidity in the surroundings
   Detecting the motion of human using PIR
5. Working with Servo motor
   Establish communication using Bluetooth

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total 60 Periods

EVALUATION PATTERN:

Continuous Internal Assessments
Evaluation of course workbook, Tasks **(Rubrics based)**
100

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SEMESTER II

		Category: ESC				
U21MI201	MANUFACTURING AND AUTOMATION PRACTICES	L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide exposure in manufacturing and automation processes related to mechatronics.
- To provide hands on training experiences in woodwork, sheet metal, welding, soldering, sensors and actuators.
- To provides hands-on experience in additive manufacturing process (FDM and SLA)

COURSE OUTCOMES:

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

CO1: Identify the various tools and measuring equipment used in manufacturing and automation process related to mechatronics. (Understand)
CO2: Fabricate products using carpentry and sheet metal (Apply)
CO3: Perform operations such as welding and soldering (Apply)
CO4: Connect and run the sensors and actuators. (Apply)
CO5: Develop simple components using 3D printer (Apply)

CO PO Mapping:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	-	1	-	1	-	1	1	-	1	2	1
CO2	3	1	1	-	3	-	1	-	2	1	-	2	2	2
CO3	3	1	1	-	1	-	1	-	3	2	-	1	2	2
CO4	3	1	1	-	1	-	1	-	3	2	-	1	2	2
CO5	3	1	1	-	1	-	1	-	3	2	-	1	2	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

LIST OF EXPERIMENTS

Introduction to Fabrication

1. Fabrication of wooden box/tray/any innovative model using T-joint, Dovetail joint, Mortise and Tenon joint.
2. Fabrication of sheet metal tray/funnel/any innovative model using cutting, drilling, taping, polishing and assembly operation.
3. Preparation of MS plate for Lap, Butt and Tee joints using arc welding
4. Soldering of a simple circuit consists of THC and SMD components.

Introduction to Sensors and Actuators

5. Test the response and range of the inductive proximity sensor to various materials.
6. Test the response and range of the capacitive sensor to various materials.

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7. Perform direct control of single-acting cylinder for both extension and retraction.
8. Perform direct and indirect control of double-acting cylinder.

Introduction to Additive Manufacturing Process

9. 3D prototyping of simple components using FDM method.
10. 3D Printing of simple geometric shapes using SLA printer.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project: – Periods

Total: 60 Periods

REFERENCES:

1. Workshop Manual

EVALUATION PATTERN:

Continuous Internal Assessments		**End Semester Examinations**
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

		Category: BSC				
U21MA303	FOURIER ANALYSIS AND BOUNDARY VALUE PROBLEMS (Common to CE, EE, ME, MI)	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of partial differential equations and its solutions
- To understand the concept of Fourier series and Fourier transform techniques in the field of engineering
- To understand the mathematical aspects that contribute to the solution of one- and two-dimensional partial differential equations

COURSE OUTCOMES:

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

CO1: Apply the fundamental concepts of partial differential equations to solve real life practical applications (Apply)
CO2: Demonstrate Fourier series to study the behaviour of periodic functions and their applications in system communications and digital signal processing (Apply)
CO3: Analyze the spectral characteristics of signals using Fourier transforms to find the discrete/continuous function arising in signals (Apply)
CO4: Apply Fourier series to solve an initial–boundary value problem for one dimensional wave and heat equation (Apply)
CO5: Apply Fourier series to solve an initial–boundary value for two-dimensional heat equations (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO2	3	2	-	-	-	-	-	-	-	-	-	1	3	2
CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO4	3	2	-	-	-	-	-	-	-	-	-	-	3	2
CO5	2	2	-	-	-	-	-	-	-	-	-	-	3	2
Correlation levels:	1: Slight (Low)		2: Moderate (Medium)							3: Substantial (High)				

SYLLABUS:

UNIT I PARTIAL DIFFERENTIAL EQUATIONS **9 + 3**

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Solution methods for second order homogeneous equations with constant coefficients

UNIT II FOURIER SERIES **9 + 3**

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

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UNIT III FOURIER TRANSFORM **9 + 3**

Fourier transform pair – Fourier sine and cosine transforms – Properties (without proof) – Transforms of simple functions – Convolution theorem – Parseval's identity

UNIT IV ONE DIMENSIONAL BOUNDARY VALUE PROBLEMS **9 + 3**

Fourier series solution – Vibration of strings – One dimensional wave equation – One dimensional heat flow equation (unsteady state)

UNIT V TWO-DIMENSIONAL BOUNDARY VALUE PROBLEMS **9 + 3**

Fourier series solution – Two-dimensional (steady state) heat flow equations (Cartesian form only) separation of variables

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXTBOOKS:

1. Erwin Kreyszig, "Advanced Engineering Mathematics",10th Edition Wiley India Pvt Ltd, New Delhi, 2018.
2. Grewal B. S, "Higher Engineering Mathematics", 44th Edition, Khanna Publishers, 2021.

REFERENCES:

1. Bali N.P and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications; 12th Edition, 2016.
2. Wylie C. R. and Barrett L. C, "Advanced Engineering Mathematics", 6th Edition, Tata McGraw-Hill, New Delhi, 2016.
3. Narayanan S, Manicavachagom Pillay T. K. and Ramanaiah G, "Advanced Mathematics for Engineering Students", Vol. II & III, 2nd Edition, S. Viswanathan Publishers Pvt. Ltd, Chennai, 1998.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

		Category: ESC				
U21MI301	KINEMATICS OF MACHINERY	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- U21ME201: Engineering Mechanics
- U21MEG01: Engineering Graphics

COURSE OBJECTIVES:

- To introduce the basics of mechanisms
- To train the students to construct velocity diagram, acceleration diagram and cam profiles
- To provide in-depth understanding of kinematic principles of gears, gear trains and friction in various machine elements

COURSE OUTCOMES:

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

CO1: To create simple mechanisms based on the degrees of freedom (Apply)
CO2: To apply the concepts of kinematics to compute the velocity and acceleration of planar mechanisms by using graphical method (Apply)
CO3: To design and analyse the profile of various cam mechanisms for different applications (Apply)
CO4: To demonstrate the kinematic aspects of gears and gear trains (Apply)
CO5: To demonstrate the understanding of friction principles in clutches, brakes and bearings (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	-	-	-	-	-	-	-	2	2	1
CO2	3	3	2	2	-	-	-	-	-	-	-	2	3	1
CO3	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO4	3	3	2	2	-	-	-	-	-	-	-	2	3	2
CO5	3	3	2	2	-	-	-	-	-	-	-	2	3	2
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I BASICS OF MECHANISMS **9 + 3**

Classification of mechanisms - Basic kinematic concepts and definitions - Degree of freedom, Mobility - Kutzbach criterion, Gruebler"s criterion - Grashof's Law - Kinematic inversions of four bar chain and slider crank chains - Limit positions - Mechanical advantage - Transmission Angle - Description of some common mechanisms - Quick return mechanisms, Straight line generators, Universal Joint - Rocker mechanisms

UNIT II KINEMATICS OF LINKAGE MECHANISMS **9 + 3**

Displacement, velocity and acceleration analysis of simple mechanisms - Graphical method– Velocity and acceleration polygons - Velocity analysis using instantaneous centre - Kinematic analysis of simple mechanisms - Coincident points - Coriolis component of Acceleration - Introduction to linkage synthesis problem

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UNIT III KINEMATICS OF CAM AND FOLLOWER **9 + 3**

Classification of cams and followers - Terminology and definitions - Displacement diagrams - Uniform velocity, parabolic, simple harmonic and cycloidal motions - Derivatives of follower motions - Layout of plate cam profiles - Specified contour cams - Circular arc and tangent cams - Pressure angle and undercutting - Sizing of cams

UNIT IV GEARS AND GEAR TRAINS **9 + 3**

Types of gears - Spur gear - Law of toothed gearing - Involute gearing - Interchangeable gears - Gear tooth action interference and undercutting - Nonstandard teeth - Gear trains - Parallel axis gears trains - Epicyclic gear trains - Automotive transmission gear trains

UNIT V FRICTION DEVICES **9 + 3**

Clutches, Brakes and Bearings - Classification of clutches - Torque transmission capacity - Considerations for uniform wear and uniform pressure theory - Single plate and multi-plate clutch, centrifugal clutch. Classification of brakes - Braking effect - Classification of Brake - Analysis of Brakes – Classification of bearing - Friction in journal bearings

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project: – Periods

Total: 60 Periods

TEXTBOOKS:

1. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, New Delhi, 2017.
2. Singh, V.P., "Theory of Machines", 6th Edition, Dhanpat Raj & Co., New Delhi, 2017.

REFERENCES:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, Oxford University Press, England, 2014.
2. Khurmi, R.S and Gupta, K, "Theory of Machines", 14th revised Edition, S. Chand & Co. Ltd, New Delhi, 2020.
3. https://nptel.ac.in/courses/112105268

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose anyone / two components based on the nature of the course.

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SEMESTER III

		Category: PCC				
U21MI302	SENSORS AND SIGNAL PROCESSING	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21PH101: Engineering Physics
- U21EC101: Introduction to Electrical and Electronics Engineering

COURSE OBJECTIVES:

- To understand the concepts of measurement and sensors
- To learn the different sensors used to measure various physical parameters
- To learn the fundamentals of signal processing circuits used in mechatronics system development

COURSE OUTCOMES:

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

CO1: Infer the basic concepts of measurement systems and sensors (Understand)
CO2: Demonstrates the sensor's basic working principles based on the change in R, L, and C, and smart sensors (Understand)
CO3: Explain the working principle and applications of proximity, ranging, magnetic and heading sensors (Understand)
CO4: Infer the basic concepts of the signals and operational amplifier (Understand)
CO5: Select a suitable signal conditioning system to enhance the quality of the signal (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	1	2	1
CO2	3	1	2	2	-	-	-	-	-	-	-	1	2	2
CO3	3	1	2	2	-	-	-	-	-	-	-	1	2	2
CO4	3	1	2	2	-	-	-	-	-	-	-	1	2	2
CO5	3	1	2	2	-	-	-	-	-	-	-	1	3	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION TO MEASUREMENT AND SENSORS 9

Basics of Measurement – Classification of errors – Error analysis – Static and dynamic characteristics of transducers – Performance measures of sensors – Classification of sensors – Sensor Output Signal Types - Sensor calibration techniques

UNIT II RESISTIVE, INDUCTIVE, CAPACITIVE, AND SMART SENSORS 9

Resistive transducers: Potentiometer, RTD, Thermistor – Thermocouple – Strain gauge – Torque measurement – Force measurement – Radiation sensor- Inductive transducer: LVDT, RVDT – Capacitive transducers – Introduction to Smart Sensors – Film sensor, MEMS & Nano Sensors

UNIT III PROXIMITY, RANGING, MAGNETIC AND HEADING SENSORS 9

Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR) - Magnetic Sensors –types, principle, requirement and

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advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, gyroscope, inclinometers

UNIT IV FUNDAMENTALS OF SIGNALS AND OPERATIONAL AMPLIFIERS 9

Standard signals – Operations on signal – Classification of Continuous Time (CT) and Discrete Time (DT) signals – Periodic and aperiodic signal, odd and even signal, energy and power signal, deterministic and random signal, causal and non-casual signal – Ideal op-amp– DC characteristics – Bias, offset, thermal drift – AC characteristics – Frequency response, slew rate

UNIT V SIGNAL CONVERTERS AND PROCESSING 9

Signal Converters: Design of S/H circuit, D/A converter (weighted resistor and R- 2R ladder types), A/D converters (Flash type, Successive approximation types) using op-amps. **Signal Processing:** DC bridges: Classification of resistances – Wheatstone bridge. AC bridges: Introduction –Sources and Detectors – Maxwell's inductance bridge – Wien's bridge

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Sawhney. A.K, "A Course in Electrical and Electronics Measurements and Instrumentation", 18th Edition, Dhanpat Rai & Company Private Limited, New Delhi, 2015.
2. Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2011

REFERENCES:

1. John G. Webster, "Measurement, Instrumentation, and Sensors Handbook", 2nd Edition, CRC Press, United States, 2018
2. D Choudhury Roy., "Linear Integrated Circuits ", 5th Edition, New Academic Science, New Delhi, 2018.
3. Ramon Pallas.Amey and John G.Webster, "Sensors and Signal Conditioning", 2nd Edition, John Wiley & Sons, 2012.
4. Simon Haykin and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley, 2021.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

		Category: PCC				
U21MI303	MANUFACTURING PROCESSES	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To impart fundamentals knowledge on traditional and non-traditional manufacturing processes
- To equip the students with practical knowledge of the manufacturing processes
- To demonstrate the application of manufacturing processes in different components

COURSE OUTCOMES:

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

CO1: To study the concepts and basic mechanics of material removal processes and the significance of advanced CNC machining. (Understand)
CO2: To learn the basics, application, and limitation of various welding process. (Understand)
CO3: To impart the knowledge on various casting process. (Understand)
CO4: To familiarize with the advanced manufacturing process. (Understand)
CO5: To teach the basics of machine tools with reciprocating and rotating motions and abrasive finishing processes (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	2	2	3	-	-	-	-	-	-	1	2	2
CO2	3	1	2	2	3	-	-	-	-	-	-	1	2	2
CO3	3	1	2	2	3	-	-	-	-	-	-	1	2	2
CO4	3	1	2	2	3	-	-	-	-	-	-	1	2	2
CO5	3	1	2	2	3	-	-	-	-	-	-	1	2	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

SYLLABUS:

UNIT I MATERIAL REMOVAL PROCESSES **9**

Classification of machining processes and machine tools, different types of cutting tools, Nomenclature of single point and multi point cutting tool, Concept of cutting speed, feed and depth of cut. Coolants. Drilling, Boring and broaching machines. Indexing head, milling operations using simple, differential, and compound indexing. Introduction to CNC Machines and laser cutting machines

UNIT II SHEET METAL AND WELDING PROCESSES **9**

Introduction to sheet metal forming operations, Types of presses, drives, Operations: shearing bending, spinning, embossing, blanking, coining and deep drawing. Die materials, compound and progressive dies and punches. Classification of welding processes, electric arc, special welding methods: MMAW, GTAW, GMAW, GMAW-CO2 12 welding, submerged arc welding, electro-slag

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welding, electron beam welding, laser beam welding, ultrasonic welding, resistance welding, welding defects, and arc blow

UNIT III CASTING AND FORMING PROCESSES 9

Types of Casting, Gating system, Special casting methods: Centrifugal casting, Permanent mold casting, Investment casting, Shell mold casting, Plaster mold casting, CO_2 mold casting, Casting defects and remedies. Forging, Rolling, Extrusion, Wire Drawing and Tube drawing, Forging Defects and Remedies

UNIT IV ADVANCED MANUFACTURING PROCESSES 9

Types of advanced manufacturing processes, Process principle, application, and limitations of: Ultra Sonic Machining, Abrasive Water Jet Machining, Chemical, Photo-Chemical, Bio-chemical and Electro-Chemical Machining and Electro Discharge Machining

UNIT V FINISHING PROCESSES 9

Operations and applications of surface, cylindrical and centreless grinding processes; dressing, truing and balancing of grinding wheels; grading and selection of grinding wheels. Magnetic Abrasive Finishing

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Groover, M. P., "Fundamentals of Modern Manufacturing", John Wiley and Sons Inc., 6th Edition, 2015
2. Kalpakjian. S, "Manufacturing Engineering and Technology", Pearson Education India Edition, 6th Edition, 2018.

REFERENCES:

1. Rao, P. N., "Manufacturing Technology (Vol. 1&2)", Tata McGraw Hill, 2013
2. Michael Fitzpatrick, Machining and CNC Technology, McGraw-Hill Education; 4th Edition, 2013.
3. Mishra P. K., "Nonconventional Machining", Narosa Publishing House, New Delhi, 2018
4. Jain V. K.,"Advanced Machining Processes", Allied Publishers, New Delhi, 12th Edition, 2010

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

		Category: PCC				
U21MI304	ELECTRICAL DRIVES AND CONTROL	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21EC101: Introduction to Electrical and Electronics Engineering

COURSE OBJECTIVES:

- To learn the basic concepts of power semiconductor devices and electric drives
- To acquire the knowledge in the characteristics and operation of DC, AC drives and servo motor
- To understand the control techniques of DC, AC drives and servo motor

COURSE OUTCOMES:

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

CO1: Explain the construction and operation of power semiconductor devices (Understand)
CO2: Illustrate the characteristics of various electric drives (Understand)
CO3: Infer the operation and control techniques of DC motor drives (Understand)
CO4: Explicit the operation and control strategies of AC motor drives and servo motor (Understand)
CO5: Select the motor drives for industrial applications (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO4	3	2	2	-	-	-	-	-	-	-	-	1	2	1
CO5	3	2	2	1	-	-	-	-	-	-	-	1	2	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I POWER SEMICONDUCTOR DEVICES 9

VI and Switching Characteristics: SCR, TRIAC, BJT, MOSFET and IGBT – Triggering and commutation circuit – Snubber circuit

UNIT II CHARACTERISTICS OF DRIVES 9

Electric drive – Equations governing motor load dynamics –Steady state stability – Multi quadrant Dynamics: acceleration, deceleration, starting & stopping – Selection of power rating – Speed torque characteristics: Various types of load and drive motors

UNIT III DC DRIVES 9

Speed control of DC motors using controlled rectifiers – DC choppers: Four quadrant operation – BLDC motors – Principle of operation – Drive schemes – Characteristics and control

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Tamilnadu, India

UNIT IV AC DRIVES 9

Induction motor drives – Torque equation – Speed control of 3-phase induction motor – Stator voltage control – Stator voltage and frequency control – Stator current control – Static rotor resistance control – Slip power recovery scheme – Servo Mechanism

UNIT V DRIVE APPLICATIONS 9

Selection of motor – Digital techniques in speed control – Microcontroller based control of electric drives – Drive applications in robotic process automation – Case Studies

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Bimbhra B.S., "Power Electronics", 5th Edition, Khanna Publishers, New Delhi, 2018
2. Vedam Subrahmanyam," Electric Drives: Concepts and Applications", 2nd Edition, McGraw Hill, New Delhi, 2017

REFERENCES:

1. Singh M.D. & Kanchandhani K.B., "Power Electronics", 2nd Edition, McGraw Hill, New Delhi, 2017
2. Theraja B.L. & Theraja A.K., "A Textbook of Electrical Technology", Revised Edition, S. Chand& Co. Ltd., New Delhi, 2015
3. Gobal K. Dubey, "Fundamentals of Electrical Drives", 2nd Edition, Narosa Publishing House, New Delhi, 2022

EVALUATION PATTERN:

Continuous Internal Assessments					End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

		Category: PCC				
U21MI305	ELECTRONIC DEVICES AND DIGITAL CIRCUITS	L	T	P	J	C
		2	0	2	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamentals of semiconductor devices
- To understand the basics of digital logic circuits
- To design the combinational logic circuits and sequential circuits

COURSE OUTCOMES:

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

CO1: Illustrate the fundamentals of semiconductor materials and junction diodes (Understand)
CO2: Experiment with BJT and JFET characteristics (Understand)
CO3: Verify the Boolean functions using logic gates (Understand)
CO4: Design the combinational circuits (Apply)
CO5: Construct the sequential circuits (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	-	-	2	-	-	-	-	-	-	1	2	2
CO2	3	2	1	-	-	-	-	-	2	-	-	1	2	2
CO3	3	2	1	-	-	-	-	-	2	-	-	1	2	2
CO4	3	3	2	-	-	-	-	-	2	-	-	1	2	2
CO5	3	2	1	-	-	-	-	-	2	-	-	1	2	2
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I SEMICONDUCTOR DEVICES 6

Classification of semiconductors – Conductivity of semiconductors – PN junction diodes, Zener diode – I-V Characteristics - Applications, rectifiers and Zener voltage regulators

UNIT II TRANSISTOR THEORY 6

NPN and PNP Transistors – Early effect – Input and output characteristics of CE configuration – Construction and operation of JFET and MOSFET

UNIT III DIGITAL ELECTRONICS FUNDAMENTALS 6

Number systems–Boolean Algebra – Boolean postulates and laws – De-Morgan's Theorem - Minimization of Boolean expressions – Canonical forms – Gate level minimization- Karnaugh map, Tabulation Method – Don't care conditions

UNIT IV COMBINATIONAL LOGIC CIRCUITS 6

Half Adder - Full Adder – Half Subtractor - Full Subtractor – Multiplexer – Demultiplexer - Encoder / Decoder.

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UNIT V SEQUENTIAL LOGIC CIRCUITS 6

Latches: SR and D – SR, JK, D and T Flip flops - Excitation tables –Realization of one flip flop using other flip flops – Analysis and design of clocked sequential circuits with state diagram and State table - Design of synchronous and asynchronous counters

LIST OF EXPERIMENTS

1. Study the volt-ampere characteristics of PN diode and Zener diode
2. Application of Zener diode as voltage regulator
3. Characteristics of digital logic IC's
4. Implementation of combinational logic design using MUX IC's
5. Characteristics of SR and JK flip-flops
6. Simulation of full wave rectifier using multisim software

Contact Periods:

Lecture: 30 Periods Tutorial: – Periods Practical: 30 Periods Project: – Periods
Total: 60 Periods

TEXTBOOKS:

1. S. Salivahanan, N.Sureshkumar, A. Vallavaraj, Electronic Devices and Circuits, 3rd Edition, Tata McGraw–Hill Inc., 2010.
2. M.Morris Mano, Michael D Ciletti, "Digital Design", 6th Edition, Pearson, 2018

REFERENCES:

1. Jacob Millman, Christos C Halkias, Satyabrata Jit, Electronic Devices and Circuits, 4th Edition, McGraw Hill India, 2015
2. Yang, Fundamentals of Semiconductor devices, 1st Edition, McGraw Hill International, 2017
3. Thomas L.Floyd, "Digital Fundamentals", 11th Edition, Prentice Hall, 2015
4. A.Anand Kumar, "Fundamentals of Digital Circuits", 2nd Edition, PHI Learning, 2013

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th colspan="2">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I
(Theory)
(100 Marks)</th><th colspan="2">Assessment II
(Practical)
(100 Marks)</th><th rowspan="2">Theory Examinations
(Examinations will be conducted for 100 Marks)</th><th rowspan="2">Practical Examinations
(Examinations will be conducted for 100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Mini Project / MCQ</td><td>Written Test</td><td>Evaluation of Laboratory Observation, Record
(Rubrics Based Assessments)</td><td>Test</td></tr>
<tr><td>40</td><td>60</td><td>75</td><td>25</td><td></td><td></td></tr>
<tr><td colspan="2">25</td><td colspan="2">25</td><td>25</td><td>25</td></tr>
<tr><td colspan="4">50</td><td colspan="2">50</td></tr>
<tr><td colspan="6">Total: 100</td></tr>
</table>

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SEMESTER III

U21MI306	SENSORS AND SIGNAL PROCESSING LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21ECG03: Engineering Studio
- U21MI201: Manufacturing and Automation Practices

COURSE OBJECTIVES:

- To learn about various force, pressure and vibration measuring sensors.
- To learn about various Temperature, optical and magnetic field-measuring sensors
- To learn about various displacement and speed-measuring sensors.

COURSE OUTCOMES:

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

CO1: Identify and measure the physical parameters using sensors and signal conditioning units. (Apply)
CO2: Analyze and measure the physical parameters using sensors (Apply)
CO3: Utilize the measurement systems to characterize the given physical quantity (Apply)
CO4: Interface the operational amplifier with sensors (Apply)
CO5: Measure the physical quantities using bridge circuits (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	2	-	-	1	2	1
CO2	3	2	1	2	-	-	-	-	2	-	-	1	2	1
CO3	3	2	1	2	-	-	-	-	2	-	-	1	2	1
CO4	3	2	1	2	-	-	-	-	2	-	-	1	2	2
CO5	3	2	1	2	-	-	-	-	2	-	-	1	2	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

LIST OF EXPERIMENTS

1. Determination of load, torque, and force using strain gauge
2. Study the characteristics of pressure sensor and piezoelectric accelerometer sensor
3. Determination of displacement using LVDT & RVDT
4. Determination of the characteristics of various temperature sensors (Thermocouple, RTD & Thermistors).
5. Determination of the Characteristics of light detectors (Optical Sensors).
6. Study the characteristics of Hall Effect sensor and its applications
7. Measurement of water level using capacitive level sensor
8. Measurement of speed, position, and direction using encoders
9. Measurement of linear and angular displacement using potentiometer
10. Measurement of torque using torque sensor
11. Study the characteristics of three stage instrumentation amplifier with its applications
12. Measurement of the unknown resistance, inductance and capacitance using bridge circuits

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Contact Periods:

Lecture:	– Periods	Tutorial: – Periods	Practical: 60 Periods	Project	– Periods
				Total	60 Periods

EVALUATION PATTERN:

Continuous Internal Assessments		**End Semester Examinations**
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

U21MI307	ELECTRICAL DRIVES AND CONTROL LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21EC101: Introduction to Electrical and Electronics Engineering

COURSE OBJECTIVES:

- To acquire the knowledge on DC/AC machines, power semiconductor devices and drives
- To understand the characteristics of DC/AC machines and power semiconductor devices
- To apply the power converters for industrial applications

COURSE OUTCOMES:

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

CO1: Infer the performance and characteristics of DC/AC machines and starters (Understand)
CO2: Demonstrate the speed control methods of DC shunt motor (Understand)
CO3: Understand the VI and switching characteristics of power semiconductor devices (Understand)
CO4: Examine the performance of DC motor and induction motor drives (Apply)
CO5: Analyze the performance of servomotor using controller (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	-	-	-	-	2	-	-	1	1	1
CO2	3	2	1	2	-	-	-	-	2	-	-	1	2	1
CO3	3	2	1	2	-	-	-	-	2	-	-	1	2	1
CO4	3	2	1	2	-	-	-	-	2	-	-	1	2	2
CO5	3	2	1	2	2	-	-	-	2	-	-	1	2	2
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

LIST OF EXPERIMENTS

1. Study of three-point, four-point, Star – Delta and DoL starters
2. Load test on DC shunt motor
3. Load test on three phase induction motor
4. Speed control of DC shunt motor
5. VI and Switching characteristics of SCR and TRIAC
6. VI and Switching characteristics of MOSFET
7. VI and Switching characteristics of IGBT
8. DSP based control of induction motor drives
9. DSP based control of DC motor drives
10. Simulation of Closed loop V/f control of induction motor
11. Speed control of DC servomotor using PID controller

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total 60 Periods

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EVALUATION PATTERN:

Continuous Internal Assessments		**End Semester Examinations**
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER III

		Category: EEC				
U21MI308	DESIGN STUDIO - I	L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITES:

- U21ECG03: Engineering Studio

COURSE OBJECTIVES:

- To inculcate the problem-solving and Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product
- To enable hands-on experience for active learning

COURSE OUTCOMES:

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

CO1: Understand Design thinking, system thinking, mapping the problem statements to UNSDG (Understand)
CO2: Apply the design thinking steps "Empathize, Define, ideate and prototype" (Apply)
CO3: Create Experimental proof of concept (Create)
CO4: Demonstrate teamwork, project management, technical report writing and presentation skills (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	3	3	3	3	3	3	3	3	-	-	-	2	1
CO2	3	3	3	3	3	3	3	3	3	-	2	1	2	3
CO3	3	3	3	3	3	3	3	3	3	-	3	2	3	1
CO4	-	-	-	-	2	-	-	2	3	3	3	1	3	1
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

COURSE CONDUCTION:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor.
- With the guidance of assigned mentor, the students will find & validate a problem statement, map to UNSDG, identify the skills required for the project and self-learn.
- Applying the design thinking concept, the students will provide a solution and produce the version 1 of prototype.
- The student will learn teamwork, project management, technical report writing and presentation skills through this course.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: – Periods Project: 30 Periods

Total: 30 Periods

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EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER IV

U21MA404	STATISTICS AND NUMERICAL METHODS (Common to EE, ME & MI)	Category: BSC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To understand the concepts of probability and statistics in the field of engineering
- To understand the concepts of testing the hypothesis for large and small samples
- To understand the concepts in design of experiments in the field of engineering

COURSE OUTCOMES:

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

CO1: Apply probability axioms and the moments of discrete and continuous random variables to core engineering problems (Apply)
CO2: Analyse large and small sample tests and perform small sample tests based on Chi-square, t and F distributions (Understand)
CO3: Design an experiment with proper observations and measurement to get a valid result using various design methods (Understand)
CO4: Identify the basic concepts of solving algebraic and transcendental equations (Understand)
CO5: Solve initial value problems of ordinary differential equations using numerical techniques (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	2	1
CO2	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO3	3	2	-	-	-	-	-	-	-	-	-	-	2	1
CO4	2	2	-	-	-	-	-	-	-	-	-	-	2	1
CO5	2	2	-	-	-	-	-	-	-	-	-	-	2	1
Correlation levels:		1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)				

SYLLABUS:

UNIT I PROBABILITY **9**

Probability – Axioms of probability – Conditional probability – Total probability – Baye's Theorem – Discrete and continuous random variable

UNIT II TESTING OF HYPOTHESIS **9**

Large sample test for single mean and difference of means – Small sample test: t distribution – Chi square distribution – F distribution

UNIT III DESIGN OF EXPERIMENTS **9**

One way and two-way classifications – Completely randomized design – Randomized block Design – Latin square design

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UNIT IV SYSTEM OF EQUATIONS 9

Newton Raphson method – Gauss elimination method – Gauss Jordon method – Iterative methods of Gauss Jacobi and Gauss Seidel

UNIT V NUMERICAL SOLUTIONS OF ORDINARY DIFFERENTIAL EQUATIONS 9

Taylor's series method – Euler method – Modified Euler method – Fourth order Runge kutta method for solving first order differential equations

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total: 45 Periods

TEXTBOOKS:

1. Johnson R A, Miller I, Freund J, Miller and Freund's, "Probability and Statistics for Engineers", 8th Edition, Pearson Education, Asia,2015
2. Grewell B S, "Numerical methods in Science and Engineering", 9th Edition, Khanna Publishers, 2015
3. Gupta S C and Kapoor V K, "Fundamentals of Mathematical Statistics", 10th Edition, Sultan Chand Publishers, 2014

REFERENCES:

1. Bali N P and Manish Goyal "A textbook of Engineering Mathematics", 12th Edition, Laxmi Publishers, 2016

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

		Category: ESC				
U21MI401	DYNAMICS OF MACHINERY	L	T	P	J	C
		3	1	0	0	4

PRE–REQUISITES:

- U21ME201: Engineering Mechanics
- U21MI301: Kinematics of Machinery

COURSE OBJECTIVES:

- To understand the force-motion relationship in components subjected to external forces and analysis of standard mechanisms
- To understand the effects of unbalance and vibration resulting from prescribed motions in a mechanism
- To understand the principles in mechanisms used for speed control and stability control

COURSE OUTCOMES:

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

CO1: Interpret inertia force, torque for reciprocating mechanisms and parameters of flywheel (Apply)
CO2: Illustrate the static and dynamic unbalance of revolving and reciprocating masses (Apply)
CO3: Determine the frequencies of free and damped vibrations (Apply)
CO4: Calculate the frequencies of forced and torsional vibration systems (Apply)
CO5: Classify different types of governors used for speed control of an engine and apply the principles of gyroscopic effects for stability control on various transport vehicles (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	2	3	2
CO2	3	2	1	1	-	-	-	-	-	-	-	2	3	2
CO3	3	2	1	1	-	-	-	-	-	-	-	2	3	2
CO4	3	2	1	1	-	-	-	-	-	-	-	2	3	2
CO5	3	2	1	1	-	-	-	-	-	-	-	2	2	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I FORCE ANALYSIS **9 + 3**

Dynamic force analysis - Inertia force and Inertia torque - D Alembert's principle - Dynamic Analysis in reciprocating engines - Gas forces - Inertia effect of connecting rod - Bearing loads - Crank shaft torque - Turning moment diagrams - Fly Wheels - Flywheels of punching presses - Dynamics of Cam-follower mechanism.

UNIT II BALANCING **9 + 3**

Static and dynamic balancing - Balancing of rotating masses - Balancing a single cylinder engine - Balancing of Multi-cylinder inline, V-engines - Partial balancing in engines - Balancing of linkages - Balancing machines - Field balancing of discs and rotors.

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UNIT III FREE AND DAMPED VIBRATIONS **9 + 3**

Basic features of vibratory systems - Degrees of freedom - Single degree of freedom - Free vibration - Equations of motion - Natural frequency - Types of Damping - Free vibration with viscous damping, critically damped system, under damped system

UNIT IV FORCED AND TORSIONAL VIBRATIONS **9 + 3**

Response of one degree freedom systems to periodic forcing - Harmonic disturbances -Disturbance caused by unbalance - Support motion - Transmissibility - Vibration isolation vibration measurement - Torsional systems - Natural frequency of single, two and three rotor systems, Torsionally Equivalent System - Stepped shaft and Geared shaft

UNIT V MECHANISM FOR CONTROL **9 + 3**

Governors - Types - Centrifugal governors - Gravity controlled and spring controlled centrifugal governors - Characteristics - Effect of friction - Controlling force curves. Gyroscopes - Gyroscopic forces and torques - Gyroscopic stabilization - Gyroscopic effects in Automobiles, ships and airplanes.

Contact Periods:

Lecture: 45 Periods Tutorial: 15 Periods Practical: – Periods Project – Periods

Total 60 Periods

TEXTBOOKS:

1. Rattan, S.S, "Theory of Machines", 4th Edition, Tata McGraw-Hill, New Delhi, 2017.
2. Khurmi, R.S and Gupta, K, "Theory of Machines", 14th Revised Edition, S. Chand & Co. Ltd, New Delhi, 2020.

REFERENCES:

1. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 4th Edition, Oxford University Press, England, 2014.
2. Singh, V.P., "Theory of Machines", 6th Edition, Dhanpat Raj & Co., New Delhi, 2017
3. https://nptel.ac.in/courses/112104114

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

U21MI402	CONTROL SYSTEMS ENGINEERING	Category: PCC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21MA201: Laplace Transforms and Complex Variables

COURSE OBJECTIVES:

- To introduce knowledge on system modelling and response
- To understand the behaviour of system in time domain and frequency domain
- To understand the concept of stability analysis, controllers, compensators and state variable approach

COURSE OUTCOMES:

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

CO1: Determine the transfer function of electrical and mechanical systems (Understand)
CO2: Analyze the performance of Linear Time Invarient (LTI) system using time domain approach (Understand)
CO3: Analyze the response of LTI system using frequency domain approach (Apply)
CO4: Interpret the stability of LTI system using Routh Hurwitz criterion, Root locus and Nyquist stability criterion (Apply)
CO5: Analyze the performance of system using state space approach (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	-	-	-	-	-	-	-	1	2	1
CO2	3	2	1	1	-	-	-	-	-	-	-	1	2	1
CO3	3	2	1	1	1	-	-	-	-	-	-	1	3	1
CO4	3	2	1	1	1	-	-	-	-	-	-	1	3	1
CO5	3	2	1	1	-	-	-	-	-	-	-	1	2	1
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I SYSTEM MODELING AND REPRESENTATION 9

Control system – Basic elements – Feed forward and feedback control theory – Electrical and mechanical transfer function models – Block diagram reduction – Signal flow graph

UNIT II TIME RESPONSE ANALYSIS 9

Transient response – Steady state response –Type and order – Performance of first order and second order system – Effect of an additional zero and pole – Steady state error – Study of PD, PI and PID control

UNIT III FREQUENCY RESPONSE ANALYSIS 9

Frequency response – Frequency domain specifications – Bode plot – Polar Plot – Design of compensators using Bode plot – Lag, lead and lag - lead compensation

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UNIT IV STABILITY ANALYSIS 9

Concept of stability – Characteristic equation – Routh Hurwitz criterion – Relative stability – Root locus concept – Nyquist stability criterion

UNIT V STATE VARIABLE ANALYSIS 9

State variable representation – Physical, phase and canonical variable - Conversion of state variable model to transfer function and transfer function to state variable model – Concept of controllability and observability

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Norman S. Nise, "Control System Engineering", 6th Edition, John Wiley & Sons, 2018
2. Ogata K, "Modern Control Engineering", 5th Edition, PHI, 2012

REFERENCES:

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

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

		Category: PCC				
U21MI403	PROGRAMMABLE AUTOMATION CONTROLLERS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21MI302: Sensors and Signal Processing
- U21MI304: Electrical Drives and Controls

COURSE OBJECTIVES:

- To understand the need for automation, I/O devices, PLC architecture and working
- To develop PLC ladder logic programming for various case studies
- To understand the SCADA functions, DCS, communication protocols, HMI and Industry 4.0

COURSE OUTCOMES:

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

CO1: Explain the input/output devices and PLC architecture (Understand)
CO2: Apply basics programming knowledge to perform simple ladder logic Programming (Apply)
CO3: Develop ladder logic Program using Timer/Counter, Data manipulation instructions and interface HMI for given application case studies (Apply)
CO4: Understand the Concepts of SCADA and DCS (Understand)
CO5: Infer different communication protocols (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	1	2	1	3	1	-	-	-	-	-	-	2	2	1
CO2	3	3	3	3	3	-	-	-	-	-	-	2	3	1
CO3	3	3	2	3	3	-	-	-	-	-	-	2	3	1
CO4	3	3	2	3	2	-	-	-	-	-	-	2	2	1
CO5	3	3	2	3	2	-	-	-	-	-	-	2	2	1
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I AUTOMATION AND PLC **9**

Introduction to Automation, Discrete and Analog I/O devices, Relay Vs PLC, PLC: Definition and Architecture, Types of PLC, I/O Modules, Special I/O Modules, PLC Scan cycle. Selection, Installation, Maintenance and troubleshooting of PLC

UNIT II BASIC PLC PROGRAMMING **9**

Programming languages of PLC- Introduction to Ladder logic programming: NO & NC connections, Latching, and Interlocking- Conversion of Relay ladder logic to PLC ladder logic programming. Editing, Compiling and Running of PLC ladder programming- I/O Addressing- Sourcing and sinking- Ladder logic programming for Discrete I/O's

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UNIT III ADVANCED PLC PROGRAMMING 9

Programming using Timer and counter instructions- Data manipulation Instructions: Arithmetic, Comparison, Scaling and move functions- Ladder logic programming for Analog I/O's- Developing PLC Ladder logic programming for given application case studies- HMI

UNIT IV SCADA AND DCS 9

Introduction to SCADA system: Architecture and Generations, Remote terminal units, Master and Slave Station of SCADA- Tagging, Graphics, Alarming and data logging, Trending chart, History of data, Report generation- Distributed Control System: Overview, Architecture, Features and Advantages - DCS applications and Case Study

UNIT V COMMUNICATION PROTOCOLS 9

Industrial Data Communications- Modbus- HART- Device Net- Profibus- Field bus- Serial communication- Modbus/ Modbus TCP/IP- Mechatrolink- CAN- Ether CAT- Human machine interfaces- Industry 4.0

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Petruzella Frank D., "Programmable Logic Controllers", 5th Edition, McGraw-Hill, New York, 2019.
2. Stuart Boyer A, "SCADA Supervisory Control and data acquisition", 4th Edition, ISA, France, 2016.

REFERENCES:

1. John W. Webb, Ronald A. Reis, "Programmable Logic Controllers Principles and Applications", 5th Edition, PHI publication, 2002.
2. Stuart G McCrady, "Designing SCADA application software -A Practical Approach", Elsevier, Netherlands, 2013.
3. Moustafa Elshafei, "Modern Distributed Control Systems: A comprehensive coverage of DCS technologies and standards", CreateSpace Independent Publishing Platform, 1st Edition, 2016.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		Assessment II (100 Marks)		Total Internal Assessments	End Semester Examinations
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

		Category: PCC				
U21MI404	MICROCONTROLLER AND EMBEDDED SYSTEMS	L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- U21MI305: Electronic Devices and Digital Circuits

COURSE OBJECTIVES:

- To familiarize the architecture and assembly language programming of microprocessor and microcontroller
- To perform embedded C programming using PIC 18 microcontroller's architecture
- To interface peripherals and external I/o's with the microcontroller using embedded C programming

COURSE OUTCOMES:

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

CO1: Interpret the basic concepts of 8085 microprocessor and 8051 Microcontroller (Understand)
CO2: Develop assembly language programming for 8051 Microcontroller (Apply)
CO3: Infer the architecture and functions of PIC 18 Microcontroller (Understand)
CO4: Perform embedded C programming using PIC 18 microcontroller (Apply)
CO5: Develop the embedded C program for the peripheral and external I/O's (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	-	-	-	-	-	-	2	2	1
CO2	3	2	1	2	3	-	-	-	-	-	-	2	3	2
CO3	3	2	3	3	3	-	-	-	-	-	-	2	3	2
CO4	3	2	3	3	3	-	-	-	-	-	-	2	3	3
CO5	3	2	3	3	3	-	-	-	-	-	-	2	3	3
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION TO MICROPROCESSOR AND MICROCONTROLLER **9**

8085 Microprocessor Architecture and Pin diagram – Addressing modes – Registers - ALU, Bus systems - Instruction sets – Interrupts – Microprocessor Vs Microcontroller – 8051 Microcontroller Architecture - Features and Specifications.

UNIT II ASSEMBLY LANGUAGE PROGRAMMING **9**

Fundamentals of Assembly Language Programming – Instruction to Assembler – Basic Arithmetic and Logical Programming – Interfacing and Programming of Serial Communication – Stepper motor interfacing of 8051 Microcontroller.

UNIT III PIC 18 MICROCONTROLLER **9**

Architecture of PIC 18 – Pin Description – Memory organization: Program memory – Data Memory – I/O Ports – Timers – Counters – External hardware interrupts– USART – ADC.

UNIT IV EMBEDDED C PROGRAMMING USING PIC 18 MICROCONTROLLER 9

Introduction to Embedded C Programming – Assembly language programming Vs Embedded C programming – Programming Structure – Data types – memory models – Infinite loops and interrupts handling – I/O port programming – Timer programming – Counter programming – Serial communication.

UNIT V PERIPHERAL INTERFACING 9

Switch keypad – LCD – LED – ADC and DAC – I/O Programming – Sensors – Relays – Solenoid Valve and Heater – Stepper Motors – PWM Programming – Closed Loop Control Programming of DC Motors – Traffic Light control.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods
Total: 45 Periods

TEXTBOOKS:

1. Ramesh Goankar, "Microprocessor 8085 Architecture, Programming and Interfacing", 6th Edition, Penram International publishers, Mumbai, 2013.
2. Mazidi, Muhammad Ali, Mckinlay, Rolin D. & Causey Danny, "PIC Microcontroller and Embedded Systems using Assembly and C for PIC 18", 2nd Edition, Pearson Education Asia, Noida, 2021.

REFERENCES:

1. Frank Vahid and Tony Givagis, "Embedded System Design", 2018, Wiley.
2. Wayne Wolf, "Computers as Components: Principles of Embedded Computer Systems Design", Elsevier, 2013.
3. Muhammad Ali Mazidi, Janice Gillipse Mazidi, Rolin D. Mckinlay, "The 8051 Microcontroller and Embedded Systems using Assembly and C", 2nd Edition, Pearson Education India, 2007.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
Individual Assignment / Seminar / MCQ	Written Test	Individual Assignment / Seminar / MCQ	Written Test		
40	**60**	**40**	**60**	**200**	**100**
Total				**40**	**60**
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

		Category: HSMC				
U21SSG01	SOFT SKILLS – I	L	T	P	J	C
		0	0	2	0	1

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To inculcate potential skills and to work as a team effectively.
- To develop confidence and enhance interpersonal skills.

COURSE OUTCOMES:

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

CO1: Enhance decision making and negotiation skills (Analyze)
CO2: Maintain open, effective, and Professional Communication (Apply)

CO-PO MAPPING:

POs / Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	1	-	-
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I VERBAL COMPETENCE **10**

Verbal Analogy – Spotting Errors – Ordering of Sentences – Cloze Test – Effective Listening – Reading Comprehension

UNIT II EFFECTIVE COMMUNICATION **10**

Overcoming Communication Barriers – Body Language and its Etiquettes – Contextual Communication – 7C's of Communication – Listening to Documentaries

UNIT III INTERPERSONAL SKILLS **10**

Group Decision Making – Paralanguage – Negotiation Skills – Preparation & Planning, Bargaining & Problem Solving –Self Grooming – SWOT Analysis

Contact Periods:

Lecture: - Periods Tutorial: - Periods Practical 30 Periods Project – Periods
Total 30 Periods

TEXTBOOKS:

1. Prashant Sharma,"Soft Skills: Personality Development for Life Success",1st Edition, BPB Publications,2022
2. Suresh Kumar E, Sreehari P and Savithri J, "Communication Skills and Soft Skills: An Integrated Approach", 1st Edition, Dorling Kindersley, 2011.

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REFERENCES:

1. Jeff Butterfield, "Problem Solving and Decision Making", 2nd Edition, Course Technology, 2010.
2. Wushow Bill Chou, "Fast-Tracking your Career: Soft Skills for Engineering and IT Professionals", 1st Edition, IEEE Press, 2013.

EVALUATION PATTERN:

Continuous Internal Assessments	Marks
Test - I	50
Test - II	50
Total	100

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SEMESTER IV

U21MI405	PROGRAMMABLE AUTOMATION CONTROLLERS LABORATORY	Category: PCC				
		L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21MI306: Sensors and Signal Processing Laboratory
- U21MI307: Electrical Drives and Controls Laboratory

COURSE OBJECTIVES:

- To familiar and exercise the relay ladder logic program and wire the field devices for the given applications
- To control and monitor the field devices using PLC and HMI for the given applications
- To design the SCADA screen and display the essential parameters for the real-world applications

COURSE OUTCOMES:

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

CO1: Demonstrate Relay ladder logic program for the given application (Apply)
CO2: Interpret PLC ladder logic program and wire the Discrete I/O's with PLC (Apply)
CO3: Develop PLC ladder logic program for the Analog I/O's (Apply)
CO4: Monitor and control the real-world application case studies using PLC and HMI programming (Apply)
CO5: Develop SCADA screen and supervise the real-world application case studies (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	2	3	-	-	-	2	1	-	2	3	2
CO2	3	2	1	2	3	-	-	-	2	1	-	2	3	2
CO3	3	2	2	2	3	-	-	-	2	1	-	2	3	2
CO4	3	2	1	2	3	-	-	-	2	1	-	2	3	2
CO5	3	2	2	2	3	-	-	-	2	1	-	2	3	2
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

LIST OF EXPERIMENTS

1. Develop the relay ladder logic program for the sequence:
   a. Using NO& NC pushbutton and indicator lamb, perform the 2 input Logic Gate function such as AND, OR, NOT, NOR, NAND, EX-OR and EX-NOR.
   b. When the start push button is pressed, light should turn ON continuously until the stop push button is pressed.
   c. When the start push button 1 & 2 are pressed turn on Light 1 & 2 continuously, then Interlock the light 1 and light 2.
2. Using the timer and counter perform the relay logic operation:
   a. When the proximity sensor senses a metal object switch on the light after 10 Sec.
   b. Switch on the Contactor after the lever switch senses 5 objects.
3. Design and simulate a given application using PLC ladder logic program.
4. Develop the PLC program and wire the discrete I/O components with the PLC for the given case study by Implementing Timer, Counter, Compare and Math instructions.

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5. Develop the PLC Program to Control Traffic Light and display the status of the traffic light in HMI.
6. Control and monitor the Temperature of water using PLC and HMI.
7. Develop the PLC ladder logic program to control the speed of the of AC motor using PLC and display the high, low and current speed of the motor using HMI.
8. Develop and perform the position control of the servo motor using PLC.
9. Develop the SCADA screen to graphically represent the entire system, which shows the status of I/O's, events, alarm function to continuously monitor and control the given application.
10. Design the SCADA screen for the given application which consist of trend chart, data logging and report generation.

Additional experiments:

1. Develop the PLC program to control the speed of the motor based on the input light intensity.
2. Perform the unwinding and rewinding application using AC drive panel.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total 60 Periods

TEXTBOOKS:

1. Laboratory manual.

EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

		Category: PCC				
U21MI406	MICROCONTROLLER AND EMBEDDED SYSTEMS LABORATORY	L	T	P	J	C
		0	0	4	0	2

PRE–REQUISITES:

- U21MI306: Sensors and Signal Processing Laboratory

COURSE OBJECTIVES:

- To learn about microcontroller and Embedded programming
- To develop assembly language and Embedded C programming to perform I/O interfacing
- To control the real-world application using Embedded C programming

COURSE OUTCOMES:

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

CO1: Perform the arithmetic and logical operations using microprocessors and microcontroller by means of assembly language programming (Apply)
CO2: Simulate embedded C program for given applications (Apply)
CO3: Interface the sensors, actuators and other I/O's with microcontrollers (Apply)
CO4: Design, monitor and logging the sensory data's using microcontrollers (Apply)
CO5: Develop the application to acquire and transfer of data using IoT platform (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	2	-	-	-	2	-	-	2	3	2
CO2	3	2	2	1	2	-	-	-	2	-	-	2	3	2
CO3	3	2	2	1	2	-	-	-	2	-	-	2	3	2
CO4	3	2	2	1	2	-	-	-	2	-	-	2	3	2
CO5	3	2	2	1	2	-	-	-	2	-	-	2	3	2
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

LIST OF EXPERIMENTS

1. Arithmetic functions using 8085 Microprocessor using Assembly language programming
2. Sorting an array of data into ascending and descending order using 8085 Microprocessor using assembly language programming
3. Interfacing of switch and LED with 8051 Microcontroller using assembly language programming
4. Study on editing, debugging and simulation of Embedded C programming in software platform
5. Interfacing of stepper motor to rotate in clockwise and anti-clockwise using Embedded C programming
6. Development of Embedded C Programming to Interface LCD Screen
7. Detection and counting of the object using Embedded C Programming
8. Data logging of Real time temperature data using Embedded C programming
9. Development of Embedded C Program for the actuation of pneumatic cylinders for required sequence
10. Development of Embedded C Program to monitor the level of water and transfer the data using IoT module

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Additional Experiments:

1. Traffic light programming
2. PID controller

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: 60 Periods Project – Periods

Total 60 Periods

TEXTBOOKS:

1. Laboratory Manual

EVALUATION PATTERN:

Continuous Internal Assessments		End Semester Examinations
Evaluation of Laboratory Observation, Record **(Rubrics Based Assessments)**	Test	
75	25	
100		100
60		40
100		

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

U21MI407	DESIGN STUDIO - II	Category: EEC				
		L	T	P	J	C
		0	0	0	2	1

PRE–REQUISITES:

- U21MI308: Design Studio - I

COURSE OBJECTIVES:

- To inculcate the problem-solving and Innovation mindset
- To provide a platform for self-learning, experimenting, solving the real-world problems and to develop a product.
- To enable hands-on experience for active learning.

COURSE OUTCOMES:

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

CO1: Apply the problem-solving techniques (Design thinking and system thinking)
CO2: Create and validate low fidelity prototype / Experimental proof of concept. (TRL 4)
CO3: Demonstrate teamwork, project management, technical report writing and presentation skills

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	3	3	3	3	3	-	2	1	-	-
CO2	3	3	3	3	3	3	3	3	3	-	3	2	-	-
CO3	-	-	-	-	2	-	-	2	3	3	3	1	-	-
Correlation levels:	1: Slight (Low)				2: Moderate (Medium)					3: Substantial (High)				

COURSE CONDUCTION:

- The students will be divided into batches (maximum 4 students / batch). They will be provided the space, time, resources, and a mentor for this design clinic 2 course.
- With the guidance of assigned mentor, the students will find & validate a problem statement, map to UNSDG, identify the skills required for the project and self-learn.
- Applying design thinking & system thinking concept the students will solve the problem and produce the version 1 of prototype. (TRL 4)
- The student will learn teamwork, project management, technical report writing and presentation skills through this course.

Contact Periods:

Lecture: – Periods Tutorial: – Periods Practical: – Periods Project 30 Periods

Total 30 Periods

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EVALUATION PATTERN:

Review 0 (Within 10 days of commencement of semester)	Review 1 (Between 35th to 40th working day)	Review 2 (Between 80th to 90th working day)	Total
0	40	60	100

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SEMESTER IV

U21MIX01	GRAPHICAL SYSTEM DESIGN USING LabVIEW	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn the fundamentals of graphical programming techniques with instrument interfaces
- To understand the data acquisition in real time systems
- To learn the various software and hardware tools for testing, measurement and control
- To know the signal processing and analysis tool for industrial applications

COURSE OUTCOMES:

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

CO1: Demonstrate the basic concepts of Virtual Instrumentation. (Understand)
CO2: Interpret the software tools in Virtual Instrumentation using GSD platform. (Understand)
CO3: Develop programming concepts in graphical programming environment. (Apply)
CO4: Interface data acquisition hardware with software tools. (Apply)
CO5: Develop programming concepts with advanced software tools. (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	2		
CO2	3	3	3	3	2	-	-	-	-	-	-	2		
CO3	3	3	3	3	2	-	-	-	-	-	-	2		
CO4	3	3	3	3	2	-	-	-	-	-	-	2		
CO5	3	3	3	3	2	-	-	-	-	-	-	2		
Correlation levels:			1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)			

SYLLABUS:

UNIT I INTRODUCTION TO GSD 9

Historical perspectives and architecture of a virtual instrument, Graphical System Design (GSD) - G programming/ modular programming - Controls and indicators - Data flow programming using numeric, string, boolean functions - Data types - Editing, debugging and running a virtual instrument

UNIT II GSD PROGRAMMING TECHNIQUES 9

Graphical programming palettes and tools, function and libraries in GSD platform - String and file I/O: high level and low-level file I/O's to read / write a file - Sub-VI programming, Structures: FOR loops, WHILE loops, Shift Registers and CASE structures

UNIT III GSD SOFTWARE TOOLS 9

Arrays and clusters - Bundle/Unbundle and Bundle/Unbundle - Plotting data: waveform graphs and charts - Attribute nodes - Local and global variables - Formula nodes, sequence structures and timed looped structures

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UNIT IV GSD DATA ACQUISITION HARDWARE 9

Basics of DAQ hardware and software - concepts of data acquisition - Configuring and addressing the hardware - Real time data acquisition using hardware: USB based DAQ with programming - Seven-segment LED display/ motor/ buzzer/ speaker

UNIT V SIGNAL PROCESSING AND CONTROL 9

Signal processing and analysis tool: Fourier transform, power spectrum analysis - Communication protocol: TCP IP client server - Control design and simulation tool: build basic transfer function for open and closed loop system with PID controller.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project: – Periods

Total 45 Periods

TEXTBOOKS:

1. Jeffery Travis and Jim Kring, "LabVIEW for Everyone: Graphical programming made easy and Fun", 3rd Edition, Pearson Education, India, 2009.
2. Jovitha Jeroma, "Virtual Instruments using LabView", PHI Learning Pvt Ltd, New Delhi, 2010

REFERENCES:

1. Gary W. Jonson and Richard Jennings "Labview Graphical Programming", 4th Edition, McGraw Hill, New York, 2017.
2. Gupta, Joseph and John, "Virtual Instrumentation using LabVIEW", 2nd Edition, Tata McGraw Hill, 2010.

EVALUATION PATTERN:

Continuous Internal Assessments				Total Internal Assessments	End Semester Examinations
Assessment I (100 Marks)		Assessment II (100 Marks)			
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER IV

U21MIX02	MODERN ROBOTICS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To Understand the forward kinematics in space frame
- To Derive the Lagrangian equations of motion by hand for simple robot systems
- To Understand the constraints in grasping and robot manipulation

COURSE OUTCOMES:

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

CO1: Use the Modern Robotics code library and the CoppeliaSim robot simulator (Understand)
CO2: Express the joint axes of open-chain robots at the end-effector of the robot (Understand)
CO3: Apply the equation governing the kinetic energy of a robot and a rigid body (Apply)
CO4: Apply the concept of C-space obstacles in the analysis of motion planning (Apply)
CO5: Classify the contact situation between a rigid body and external contacts as a contact mode (Understand)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	-	-	-	-	-	-	1		
CO2	3	2	2	2	2	-	-	-	-	-	-	1		
CO3	3	2	2	2	2	-	-	-	-	-	-	1		
CO4	3	2	2	2	2	-	-	-	-	-	-	1		
CO5	3	2	2	2	2	-	-	-	-	-	-	1		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I FOUNDATIONS OF ROBOT MOTION 9

Introduction to the specialization – Modern Robotics code library – CoppeliaSim robot simulator – light board video-generation tool - Configuration space and degrees of freedom of rigid bodies and robots

UNIT II ROBOT KINEMATICS 9

Product of exponentials formula for forward kinematics in the space frame – end -effector frame – forward kinematics – screw axis

UNIT III ROBOT DYNAMICS 9

Lagrangian formulation of dynamics – centripetal and Coriolis forces – robot mass matrix – dynamics of a rigid body – Newton-Euler inverse dynamics for an open-chain robot.

UNIT IV ROBOT MOTION PLANNING AND CONTROL 9

Over view of motion planning – C-space obstacles – graphs and trees – A* graph search – path planners – motion planning

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UNIT V ROBOT MANIPULATION AND WHEELED MOBILE ROBOTS 9

Kinematics of contact – contact types (rolling, sliding, and breaking) – graphical methods for representing kinematic constraints in the plane – form-closure grasping (complete kinematic constraint).

Contact Periods:

Lecture: 45 Periods Tutorial: - Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Kevin M. Lynch and Frank C. Park, "Modern Robotics", Cambridge University Press in May 2017, ISBN 9781107156302
2. John J. Craig, "Introduction to Robotics: Mechanics & Control", 3rd edition, McGraw-Hill Education, New Delhi, 2013

REFERENCES:

1. (https://www.coursera.org/learn/modernrobotics)
2. Bruno Siciliano, Lorenzo Sciavicco, Luigi Villani, Giuseppe Oriolo, "Robotics Modelling, Planning and Control", Springer, 2013
3. Howie Choset, Seth Hutchinson, Kevin M. Lynch, "Principles of Robot Motion Theory, Algorithms, and Implementations", ISBN 9780262033275

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER V

U21MIX03	MEMS & NEMS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn about the basic concepts of MEMS and NEMS
- To familiarizes the concept of fabrication, manufacturing and packaging of Microsystem
- To know the applications of Micro and Nano product for various applications

COURSE OUTCOMES:

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

CO1: Interpret the basics of micro sensors and micro actuators (Understand)
CO2: Identify the suitable fabrication process of microsystem (Understand)
CO3: Develop the micro systems for various applications (Apply)
CO4: Elucidate the function of nanoscale materials (Understand)
CO5: Design and analyze the Nano-electronic devices (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	-	-	-	-	-	-	-	2		
CO2	3	2	2	2	-	-	-	-	-	-	-	2		
CO3	3	2	2	2	-	-	-	-	-	-	-	2		
CO4	3	2	2	2	-	-	-	-	-	-	-	2		
CO5	3	2	2	2	-	-	-	-	-	-	-	2		
Correlation levels: 1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)														

SYLLABUS:

UNIT I MICROSYSTEMS, MICROSENSORS AND ACTUATORS **9**

Overview - Microsystems - Working principle of Microsystems - Micro sensors - Micro actuation techniques - Micropump - Micromotors - Microvalves - Microgrippers.

UNIT II MICROSYSTEM FABRICATION **9**

Substrates - Single crystal silicon wafer formation - MEMS materials - Photolithography - Ion implantation - Diffusion - Oxidation - CVD - Physical Vapor Deposition - Deposition by epitaxy – Etching process.

UNIT III MICROSYSTEM MANUFACTURING AND DESIGN **9**

Bulk Micromanufacturing - Surface Micromachining - LIGA - SLIGA. Micro system packaging - Materials - Die level - Device level - System level - Packaging techniques - Surface bonding - Wire bonding – Sealing - Design considerations - Micro System Applications

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UNIT IV INTRODUCTION AND OVERVIEW: NANOSCALE 9

Mendeleyev's Periodic Table of Elements and Electronic Configurations - Nanoengineering and Nanoscience - Carbon Nanoelectronics: Carbon Nanotubes - Analysis of Carbon Nanotubes - Classification of Carbon Nanotubes

UNIT V MODELING OF NANO-ELECTROMECHANICAL SYSTEMS 9

Introduction to Modelling, Analysis, and Simulation of NEMS - Newtonian Mechanics - Functional Nano-Electro-mechanical Systems - Piezo actuators: Steady-state models and Characteristics.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Tai-Ran Hsu, "MEMS And Microsystems: Design and Manufacture", 1st Edition, McGraw-Hill Education Pvt. Ltd, New Delhi, 2017.
2. Lyshevski, S.E, "Nano- and Micro-Electromechanical Systems: Fundamentals of Nano- and Microengineering", 2nd Edition, CRC Press, 2005.

REFERENCES:

1. Zhang, Dan, Wei, Bin, "Advanced Mechatronics and MEMS Devices II", 1st Edition, Springer International Publishing, 2017.
2. Takahata, K, "Advances in Micro/Nano Electromechanical Systems and Fabrication Technologies" 1st Edition, InTech Pvt. Ltd, 2013.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER V

U21MIX04	ROBOTICS PROCESS AUTOMATION	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To provide insights on robotic process automation (RPA) technology and its value proposition
- To introduce different platforms for RPA
- To illustrate basic programming concepts and the underlying logic/structure related to RPA
- To describe the different types of variables, control flow and data manipulation techniques in RPA platform
- To describe automation to email and various types of exceptions and strategies to handle

COURSE OUTCOMES:

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

CO1: Gain insights into Robotic Process Automation Technology (Understand)
CO2: Demonstrate the underlying logic/structure related to RPA (Understand)
CO3: Classify several types of data inside a workflow and, gain skills in building workflows in RPA platform (Understand)
CO4: Comprehend different types of variables, pdf automation and data manipulation techniques (Understand)
CO5: Design automation to Email and various types of Exceptions and strategies to handle (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	2	-	-	-	-	-	-	2		
CO2	3	3	3	3	2	-	-	-	-	-	-	2		
CO3	3	3	3	3	2	-	-	-	-	-	-	2		
CO4	3	3	3	3	2	-	-	-	-	-	-	2		
CO5	3	3	3	3	2	-	-	-	-	-	-	2		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION TO RPA 9

Emergence of Robotic Process Automation (RPA), Evolution of RPA, Future of RPA, Differentiating RPA from Automation, Defining Robotic Process Automation & its benefits, What RPA is Not, Types of Bots, Application areas of RPA, How Robotic Process Automation works, RPA development methodology and key considerations.

UNIT II ROBOTIC PROCESS AUTOMATION PLATFORMS 9

Components of RPA - RPA Platforms - Types of templates, user interfaces, domain in activities, variables, arguments, imports panel and user events - About Ui Path - The future of automation - Record and Play - Downloading and installing UiPath Studio - Learning Ui Path Studio - Task recorder - Step-by-step examples using the recorder.

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UNIT III TAKING CONTROL OF THE CONTROLS 9

Finding and attaching windows - Finding the control - Techniques for waiting for a control - Act on controls - mouse and keyboard activities - Working with UiExplorer - Handling events - Revisit recorder - Screen Scraping - When to use OCR - Types of OCR available - How to use OCR - Avoiding typical failure points.

UNIT IV DATA MANIPULATION AND PDF AUTOMATION 9

Data Manipulation, Automation of Virtual Machines, Introduction to Native Citrix Automation, Text and Image Automation, PDF Automation, Computer Vision.

UNIT V EXCEPTION HANDLING, DEBUGGING AND LOGGING 9

Exception Handling, Debugging, and Logging - Exception handling - Common exceptions and ways to handle them - Logging and taking screenshots - Debugging techniques - Collecting crash dumps - Error reporting - Future of RPA.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Tom Taulli , "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress publications, 2020.
2. Learning Robotic Process Automation: Create Software robots and automate business processes with the leading RPA tool - UiPath by Alok Mani Tripathi, Packt Publishing, Mumbai, 2018.

REFERENCES:

1. A Gerardus Blokdyk, "Robotic Process Automation: RPA - A Complete Guide ", 5STARCooks publishers, Toronto, 2020.
2. Richard Murdoch, "Robotic Process Automation: Guide to Building Software Robots, Automate Repetitive Tasks & Become an RPA Consultant",1st Edition, Independently published, 2018.
3. Adeel Javed, Anum Sundrani , Nadia Malik and Sidney Madison Prescott, "Robotic Process Automation using UiPath StudioX: A Citizen Developer's Guide to Hyperautomation", 1st Edition, Apress publishers, 2021.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER VI

U21MIX05	PRODUCT DESIGN AND DEVELOPMENT	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn about product development methods based on current innovative trends
- To understand the requirements of customers and product planning process
- To learn the product specifications and concept generation screening and testing
- To know the product architecture, industrial design considerations and prototyping

COURSE OUTCOMES:

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

CO1: Infer the basic need for new product design and development process (Understand)
CO2: Identify opportunities and customer needs for new product development (Apply)
CO3: Arrive at product specification and develop concepts for new product (Apply)
CO4: Establish the overall product architecture and assess its industrial design (Apply)
CO5: Assess the design from environmental, manufacturing and supply chain perspective and develop prototypes (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	1	1	-	-	-	3		
CO2	3	3	3	2	2	2	1	1	-	-	-	3		
CO3	3	3	3	2	2	2	1	1	-	-	-	3		
CO4	3	3	3	2	2	2	1	1	-	-	-	3		
CO5	3	3	3	2	2	2	1	1	-	-	-	3		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I DEVELOPMENT PROCESSES AND ORGANIZATIONS 9

Introduction to new product and product design - Characteristics of successful product development - The challenges in product development - Product development process - Adapting generic product development process - Product development process flows -Product development organizations.

UNIT II OPPORTUNITY IDENTIFICATION AND PRODUCT PLANNING 9

Types of opportunities - Structure of Opportunity Identification - Opportunity identification process; Product Planning Process - Four types of product development projects - Steps in Product Planning - Identifying Customer needs.

UNIT III PRODUCT SPECIFICATIONS AND CONCEPT GENERATION 9

Product Specifications - Target and final specifications. Concept generation: Five step method - Concept selection - Concept screening - Concept scoring - Concept testing.

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UNIT IV PRODUCT ARCHITECTURE AND INDUSTRIAL DESIGN 9

Implications of the architecture - Establishing the architecture - Delayed differentiation - Platform Planning - System level design issues. Industrial Design - Assessing the Need for Industrial Design and its impact - Industrial design process and management - Assessing the quality of Industrial Design.

UNIT V DESIGN CONSIDERATIONS AND PROTOTYPING 9

Design for environment - Design for manufacturing and supply chain; Prototyping - Principles - Technologies - Planning for prototypes - Robust design – Process flow.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Ulrich, Karl T., Eppinger, Steve D., and Yang, Maria C., "Product Design and Development", 7th Edition, McGraw-Hill Education, 2020.
2. Devdas Shetty, "Product Design for Engineers", Cengage Learning, Boston, 2016.

REFERENCES:

1. Maddock M. and Uriarte L., "Brand New: Solving the Innovation Paradox – How Great Brands Invent and Launch New Products, Services and Business Models", John Wiley & Sons, Inc., New Jersey, 2011.
2. Steven W. Trimble and Abdelrahman N. Shuaib, "Product Design and Development Handbook", Cognella, United States, 2022.

EVALUATION PATTERN:

<table>
<tr><th colspan="4">Continuous Internal Assessments</th><th rowspan="2">Total Internal Assessments</th><th rowspan="3">End Semester Examinations</th></tr>
<tr><th colspan="2">Assessment I (100 Marks)</th><th colspan="2">Assessment II (100 Marks)</th></tr>
<tr><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td>*Individual Assignment / Case Study / Seminar / Project / MCQ</td><td>Written Test</td><td></td></tr>
<tr><td>40</td><td>60</td><td>40</td><td>60</td><td>200</td><td>100</td></tr>
<tr><td colspan="4" rowspan="2">Total</td><td>40</td><td>60</td></tr>
<tr><td colspan="2">100</td></tr>
</table>

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER VI

U21MIX06	INTRODUCTION TO INDUSTRIAL INTERNET OF THINGS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn about the modify of existing industrial systems with IoT concepts
- To understand the importance of IIoT architecture, sensors and interfacing units
- To learn the protocols required for industrial data transmission
- To know the IIoT application domains in various industries with AR and VR technologies

COURSE OUTCOMES:

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

CO1: Comprehend the fundamentals of IIoT and its potential, challenges (Understand)
CO2: Infer the various components and architecture of IIoT (Understand)
CO3: Design the sensors based IIoT architecture with interface standards (Apply)
CO4: Realize and choose the Protocols and Cloud platforms for different IIoT solutions (Apply)
CO5: Build the concepts of Design Thinking for industrial applications (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	3	-	-	-	-	-	-	1		
CO2	3	2	2	2	3	-	-	-	-	-	-	1		
CO3	3	2	2	2	3	-	-	-	-	-	-	1		
CO4	3	2	2	2	3	-	-	-	-	-	-	1		
CO5	3	2	2	2	3	-	-	-	-	-	-	1		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)					3: Substantial (High)					

SYLLABUS:

UNIT I INTRODUCTION 9

Introduction - IoT Architecture – Application-based IoT Protocols – Infrastructure-based protocols - Data protocols -Transport protocols. Cloud Computing: Types of cloud - Business aspects of cloud – Virtualization - Key aspect of cloud computing - Mobile cloud computing - Fog Computing: Applications of Fog computing. Sensor Cloud: Applications of Sensor Cloud - Big Data.

UNIT II IIOT ARCHITECTURES 9

Overview of IoT components - Various architectures of IoT and IIoT, Advantages and disadvantages, Industrial internet - Reference architecture; IIoT system components: Sensors, Gateways, Routers, Modem, Cloud brokers, servers, and its integration, WSN, WSN network design for IoT.

UNIT III SENSOR AND INTERFACING 9

Introduction to Sensors, Transducers, Classifications - Roles of sensors in IIoT - Various types of sensors - Design of sensors: sensor architecture, special requirements for IIoT sensors - Role of actuators - Types of actuators - Hardwire the sensors with different protocols such as HART,

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UNIT IV PROTOCOLS AND CLOUD 9

Introduction to Industrial data transmission, Features & Components: Fieldbus, Profibus, HART, Interbus, Bitbus, CC-link, Modbus, Batibus, DigitalSTROM, Controller area network, DeviceNet, LonWorks, ISA 100.11a, Wireless HART, LoRa & LoRaWAN, NB-IoT, IEEE 802.11AH. Clouds : Types of clouds

UNIT V INDUSTRIAL IOT- APPLICATION DOMAINS 9

Healthcare, Power plants - Inventory management and quality control - Plant safety and security (Including AR and VR safety applications), Facility management - Oil - Chemical and pharmaceutical industry - Applications of UAVs in Industries.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Anandarup Mukherjee, Chandana Roy, Sudip Misra," Introduction to Industrial Internet of Things and Industry 4.0", 1st Edition, CRC Press, 2020.
2. Alasdair Gilchrist, "Industry 4.0: The Industrial Internet of Things", 1st Edition, Apress, New York, 2017.

REFERENCES:

1. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", John Wiley& Sons publications, United Kingdom, 2013.
2. Olivier Hersent, David Boswarthic &, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", 2nd Edition, Wiley publication, New Jersey, 2012.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

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SEMESTER VI

U21MIX07	DESIGN OF MECHATRONICS SYSTEM	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To learn about Mechatronics system design, simulation, ergonomics, and safety
- To understand theoretical and practical aspects of system modelling, interfacing, real time data acquisition and control
- To learn the real time interfacing tools and man-machine interface
- To know about the various mechatronics systems and its applications

COURSE OUTCOMES:

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

CO1: Identify the basic elements of mechatronics and its integration concepts (Understand)
CO2: Develop the system models and familiar the Mechatronics design process (Understand)
CO3: Corelate the suitable interface for mechatronics system (Understand)
CO4: Develop the physical systems based on mechatronics design process (Apply)
CO5: Build the mechatronics systems for real time applications (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	-	-	-	-	-	-	3		
CO2	3	2	3	2	2	-	-	-	-	-	-	3		
CO3	3	2	3	2	2	-	-	-	-	-	-	3		
CO4	3	2	3	2	2	-	-	-	-	-	-	3		
CO5	3	2	3	2	2	-	-	-	-	-	-	3		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I FUNDAMENTALS OF MECHATRONICS SYSTEMS 9

Introduction - Key elements - Mechatronics design process - Types of Design: Traditional and Mechatronics design - Integrated product design - Advanced approaches in Mechatronics Design - Industrial design, modelling and analysis - Ergonomics and Safety.

UNIT II BASIC SYSTEM MODELLING 9

Introduction - Model categories - Fields of application - Model development - Model verification - Model validation - Simulators and Simulation - Design of mixed system: Electromechanical system design - Model transformation - Domain independent description forms: Bond graph and Block Diagram - Simulator coupling.

UNIT III SYSTEM INTERFACING 9

Introduction - Elements of data acquisition and control system - Overview of I/O process -Installation of I/O card and software - TIA/EIA serial interface standards (RS232/422/485) -General Purpose Interface Bus (IEEE 488) - GUI card - Ethernet switch - Man Machine Interfaces.

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UNIT IV CASE STUDY ON MECHATRONICS SYSTEMS 9

Motion control using DC Motor, AC Motor and Servomotor - Internal Combustion Engine with Drive Train - Auto focus Camera - Transducer calibration system - Strain gauge weighing system - Controlling temperature of a hot/cold reservoir using PID.

UNIT V CASE STUDY ON INTELLIGENCE SYSTEMS 9

Machine tool control system - Electronics engine management system - Pick and place industrial manipulator - Autonomous mobile robot - Artificial Intelligence in Mechatronics - Car parking barrier - Fuzzy controlled washing machine.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Devdas Shetty & Richard A. Kolk, "Mechatronics System Design", 2nd Edition, CT Cengage Learning, Stamford, 2012.
2. Bolton W., "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", 6th Edition, Pearson Education Limited, New York, 2018.

REFERENCES:

1. Robert H. Bishop, "The Mechatronics handbook. Fundamentals and modelling", 2nd Edition, CRC Press, London, 2017.
2. Bradley D, Seward D, Dawson D & Burge S, "Mechatronics and the Design of Intelligent Machines and Systems" 1st Edition, CRC Press, London, 2017.

EVALUATION PATTERN:

Continuous Internal Assessments					
Assessment I (100 Marks)		**Assessment II (100 Marks)**		**Total Internal Assessments**	**End Semester Examinations**
*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test	*Individual Assignment / Case Study / Seminar / Project / MCQ	Written Test		
40	60	40	60	200	100
Total				40	60
				100	

*Role Play / Group Discussions / Debates / Oral Presentations / Poster Presentations / Technical presentations can also be provided. Course Coordinator can choose any one / two components based on the nature of the course.

6/7/23

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SEMESTER VII

U21MIX08	CYBER PHYSICAL SYSTEMS	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To acquire knowledge and skills on various hardware and software design aspects of Cyber-Physical Systems (CPS) - modeling, analysis, and design
- To understand the functions, security and privacy aspects of CPS
- To know the mechatronics system design and its integration systems

COURSE OUTCOMES:

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

CO1: Explain the fundamentals of cyber physical systems, its potential and challenges (Understand)
CO2: Infer the various components and architecture of CPS (Understand)
CO3: Interpret the functions of CPS multitasking and scheduling (Understand)
CO4: Explain the concepts of CPS in security and privacy aspects (Understand)
CO5: Design the mechatronics system with integration of CPS for different applications tools (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	1	-	-	-	-	-	-	-	1		
CO2	3	2	2	1	-	-	-	-	-	-	-	1		
CO3	3	2	2	1	-	-	-	-	-	-	-	1		
CO4	3	2	2	1	-	-	-	-	-	-	-	1		
CO5	3	2	-	-	-	-	-	-	-	-	-	1		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION 9

Cyber-Physical Systems (CPS) in the real world, Basic principles of design and validation of CPS, CPS HW platforms: Processors, Sensors, Actuators, CPS network, CPS SW stack RTOS, Scheduling real time control tasks.

UNIT II DESIGN OF EMBEDDED SYSTEMS 9

Types of Processors - Parallelism. Memory architectures - Memory technologies - Memory hierarchy - Memory models. Input and Output - I/O Hardware - Sequential software in a concurrent world - Analog/Digital interface.

UNIT III MULTITASKING AND SCHEDULING 9

Imperative Programs - Threads - Processes and message passing. Scheduling with fixed timing parameters - Memory effects, Multiprocessor/ Multicore scheduling - Accommodating variability and uncertainty- Managing other resources - Rhythmic tasks scheduling.

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UNIT IV SECURITY OF CYBER-PHYSICAL SYSTEMS 9

Cyber security requirements - Defining security and privacy - Attack model - Counter measures - System theoretic approaches - Examples of security and privacy in action - Approaches to secure cyber-physical systems - Ongoing security and privacy challenges for CPSs- Ethical hacking.

UNIT V DESIGN OF MECHATRONICS SYSTEM AND CPS 9

V Model and its variants - System boundary definition - Multi-view and multi-level modelling - Topological modelling - Semantic interoperability modelling - Multi-agent modelling - Collaboration modelling - internal block diagrams - multi-agent development platform - Software tools - Java, Modelica. Case Study: Suspension control, Healthcare: Artificial Pancreas/Infusion Pump/Pacemaker, Green buildings: Automated lighting, AC control, Digital twin system.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Edward A. Lee and Sanjit A. Seshia, "Introduction to Embedded Systems: A Cyber-Physical Systems Approach", 2nd Edition, MIT press, United Kingdom, 2017.
2. Song H., Rawat D. B., Jeschke S. and Brecher C., "Cyber-physical systems: foundations, principles and applications", Morgan Kaufmann, United States, 2016.

REFERENCES:

1. Rajeev Alu, "Principles of Cyber-Physical Systems", MIT Press, United Kingdom, 2016.
2. Rodrigues, Joel Jose PC, Ivan Stojmenovic, and Danda B. Rawat, "Cyber-physical systems: from theory to practice", CRC Press, Florida, 2015.

EVALUATION PATTERN:

Continuous Internal Assessments					
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Total				40	60
				100	

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6/7/23

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KPRIET
Learn Beyond

SEMESTER VII

U21MIX09	INTRODUCTION TO INDUSTRY 4.0	Category: OEC				
		L	T	P	J	C
		3	0	0	0	3

PRE–REQUISITES:

- Nil

COURSE OBJECTIVES:

- To recognize need and trends of Industry 4.0.
- To understand concepts and technologies supporting Industry 4.0
- To explore challenges and industrial applications of Industry 4.0

COURSE OBJECTIVES:

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

CO1: Understand the basic concepts of Industry 4.0 and the other related fields (Understand)
CO2: Identify the smart devices required for Industry 4.0 (Apply)
CO3: Analyze the different smart platforms adopted for Industry 4.0 (Apply)
CO4: Recognize the data management principles and cloud computing for Industry 4.0 (Understand)
CO5: Implement the IFndustry 4.0 to solve engineering problems (Apply)

CO-PO MAPPING:

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	3	1	-	-	-	-	-	-	2		
CO2	3	3	3	3	1	-	-	-	-	-	-	2		
CO3	3	3	3	3	1	-	-	-	-	-	-	2		
CO4	3	3	3	3	1	-	-	-	-	-	-	2		
CO5	3	3	3	3	1	-	-	-	-	-	-	2		
Correlation levels:	1: Slight (Low)			2: Moderate (Medium)						3: Substantial (High)				

SYLLABUS:

UNIT I INTRODUCTION 9

Various Industrial Revolutions, Digitalization and the Networked Economy, Digital twin - Trends of Industrial Big Data and Predictive Analytics for Smart Business Transformation, Lean Production Systems. Additive manufacturing, Robotization and automation, Current situation of Industry 4.0.

UNIT II SMART DEVICES IN INDUSTRY 4.0 9

Sensing & actuation, Internet of Things (IoT) & Industrial Internet of Things (IIoT) & Internet of Services, Smart Manufacturing, Smart Devices and Products, Smart Logistics, Predictive Analytics

UNIT III SMART PLATFORMS IN INDUSTRY 4.0 9

Cyberphysical Systems, Robotic Automation and Collaborative Robots, Support System for Industry 4.0, Cyber Security, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis

UNIT IV DATA MANAGEMENT AND CLOUD COMPUTING 9

Resource - based view of a firm, Data as a new resource for organizations, Harnessing and sharing knowledge in organizations, Cloud Computing Basics, Cloud Computing and Industry 4.0

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UNIT V CHALLENGES AND INDUSTRIAL APPLICATIONS 9

Industry 4.0 laboratories, IIoT case studies, Application Domains, Business Issues, Opportunities and Challenges, Strategies for competing in an Industry 4.0 world. Introduction to Industry 4.0 to Industry 5.0 Advances.

Contact Periods:

Lecture: 45 Periods Tutorial: – Periods Practical: – Periods Project – Periods

Total 45 Periods

TEXTBOOKS:

1. Gilchrist, A, "Industry 4.0: the industrial internet of things", 1st Edition, Apress Publishers, New York, 2016.
2. Schwab, K, "The fourth industrial revolution", 1st Edition, Portfolio Penguin Publishers, United Kingdom, 2017.

REFERENCES:

1. Garbie, I, "Sustainability in manufacturing enterprises: Concepts, analyses and assessments for industry 4.0", 1st Edition, Springer International Publishing, Switzerland, 2016.
2. Sudip Misra , Chandana Roy and Anandarup Mukherjee, "Introduction to Industrial Internet of Things and Industry 4.0", 1st Edition, CRC Press, New Delhi, India, 2020.

EVALUATION PATTERN:

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				100	

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