HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

B. TECH. MECHATRONICS
(Duration: 4 Years)

REGULATION 2022
(Inline with NEP 2020)

REGULATION, CURRICULUM and SYLLABUS

(Applicable for students admitted from 2022 onwards)

DEPARTMENT OF MECHATRONICS ENGINEERING

SCHOOL OF ENGINEERING AND TECHNOLOGY

HINDUSTAN INSTITUTE OF TECHNOLOGY AND SCIENCE

HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

MOTTO, VISION, MISSION AND VALUE STATEMENT OF INSTITUTE

Motto

To Make Every Man a Success and No Man a Failure.

Vision

To be an International Institute of Excellence, providing a conducive environment for education with a strong emphasis on innovation, quality, research and strategic partnership blended with values and commitment to society.

Mission

- To create an ecosystem for learning and world class research.
- To nurture a sense of creativity and innovation.
- To instill highest ethical standards and values with a sense of professionalism.
- To take up activities for the development of Society.
- To develop national and international collaboration and strategic partnership with industry and institutes of excellence.
- To enable graduates to become future leaders and innovators.

Value Statement

Integrity, Innovation, Internationalization

DEPARTMENT OF MECHATRONICS ENGINEERING
VISION

To be recognized internationally in providing mechatronics education, nurturing professional engineers with outstanding competencies for innovation, research and entrepreneurial skills.

MISSION

M1: To provide a conducive academic environment with state of art laboratory infrastructure

M2: To promote collaborative research and innovation with global institutions and industries

M3: To offer interdisciplinary curricula and learning practices to meet the dynamic global demands

M4: To impart technical, managerial and lifelong learning skills, embedded with ethical values and social relevance

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO - I : **Successful career and adaptability to industry:** Graduates will exhibit knowledge and skills to apply mechatronics engineering to address real world engineering problems.

PEO - II : **Modern design tools and multi-disciplinary project execution:** Graduates shall demonstrate practical and innovative skills in integrating various mechatronics elements through group design and project work in an industry, entrepreneurship, research or academia.

PEO - III : **Contribution to Mechatronics field and lifelong learning:** Graduates shall conduct research in interdisciplinary topics and contribute to scientific community/ society/ industries

PROGRAMME OUTCOMES (PO's)

Engineering Graduates will be able to:

PO1 : Engineering knowledge: Apply the knowledge of mathematics, science,

engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 : **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.

PO3 : **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.

PO4 : **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.

PO5 : **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 limitations.

PO6 : **The Engineer & 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.

PO7 : **Environment & Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8 : **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9 : **Individual & Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10 : **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.

PO11 : **Project Management & 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.

PO12 : **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.

PROGRAMME SPECIFIC OUTCOMES: (PSO's)

Graduates of B.Tech Mechatronics students will be able to

PSO1 : Design, develop and evaluate elements of mechatronic systems.

PSO2 : Interface and integrate mechatronics systems to align with global industrial standardssatisfying the societal needs.

PEOs and POs:

B.Tech Mechatronics Program Outcomes (POs) leading to the achievements of the objectives (PEOs) are summarised in the following table.

Programme Educational Objectives (PEOs)	Programme Outcomes (POs)													
	1	2	3	4	5	6	7	8	9	10	11	12	PSO1	PSO2
I	3	3	3	3	3	3	2	2	2	2	3	3	3	3
II	2	2	3	3	3	2	2	2	3	2	3	3	3	3
III	2	2	2	2	2	3	3	3	3	2	2	3	3	3

		Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
YEAR 1	SEMESTER 1	1	Matrices and Calculus	2.8	2.6	1.6	1.4	1.6	-	-	-	-	-	-	1.4	1.6	1.4
		2	**Any one course to be opted**														
			Engineering Physics	3	3	1.4	1.4	1.8	-	-	-	2.6	-	-	2.2	1.4	2
			Engineering Materials	3	2	1.4	-	-	-	1.6	-	-	-	-	2	1.6	1.6
		3	**Any one course to be opted**														
			Communication Skills	-	-	-	-	-	-	-	1.4	0.4	2.8	1.8	2	1.2	1.4
			Personality Development and Soft Skills	-	-	-	-	-	-	-	1.4	0.4	2.8	1.8	2	1.2	1.4
		4	**Any one course to be opted**														
			Programming in Python	2.4	2.4	2.4	1.2	1	1.4	-	1.2	1	0.8	0.8	1.2	1.8	1.4
			Engineering Graphics and Computer Aided Design	2.4	1.4	1.2	-	1.6	-	-	1.4	1.6	1.8	-	2	1	0.8
		5	Design Thinking	1.4	1.2	1.6	2	1.8	2.8	2.8	2	2.4	2.4	0.8	2	2.4	2.6
		6	**Any one course to be opted**														
			Engineering Practices Lab	3	2	-	2	-	1	-	-	-	-	-	-	1	1
			Fab Lab for Core Engineering	3	3	3	2	3	-	-	-	-	-	-	1	1	1
		7	**Any one course to be opted(Outreach)**														
			Outreach (NCC) – Level I **#**	-	-	-	-	-	-	-	-	-	3	-	-	-	-
			Outreach (NSS, Y's Men, Rotaract) – Level I **#**	-	-	-	-	-	-	-	-	-	3	-	-	-	-
		8	**Any one course to be opted (Indian/Foreign Language)**														
			Tamil (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Hindi (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Telugu (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			French (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			German (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Spanish (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Korean (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Mandarin (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-

			Japanese (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			OR														
			Universal Human Values	-	-	-	-	2	3	3	3	3	3	3	3	-	-
		9	Tamil Culture and Technology	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-

		Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
YEAR 1	SEMESTER 2	1	Analytical Mathematics	4	3	2	1	2	-	-	-	-	-	-	2	3	-
		2	**Any one course to be opted**														
			Engineering Physics	3	3	-	2	2	-	-	-	-	-	-	3	1	1
			Engineering Materials	3	2	1	-	-	-	2	-	-	-	-	2	1	-
		3	**Any one course to be opted**														
			Communication Skills	-	-	-	-	-	-	-	2	2	3	3	2	1	1
			Personality Development and Soft Skills	-	-	-	-	3	4	-	2	3	4	3	1	1	1
		4	Mechatronic Systems Engineering	3	3	2	1.2	1.2	0.2	0.2	0.8	-	-	0.2	1.2	1.2	0.4
		5	**Any one course to be opted**														
			Programming in Python	3	3	3	1	3	-	-	-	1	1	1	1	2	1
			Engineering Graphics and Computer Aided Design	3	1	2	-	3	-	-	-	-	-	-	2	3	2
		6	**Any one course to be opted**														
			Engineering Practices Lab	3	2	-	2	-	1	-	-	-	-	-	-	1	1
			Fab Lab for Core Engineering	3	3	3	2	3	-	-	-	-	-	-	1	1	1
		7	**Any one course to be opted(Outreach)**														
			Outreach (NCC) – Level I **#**	-	-	-	-	-	-	-	-	-	3	-	-	-	-
			Outreach (NSS, Y's Men, Rotaract) – Level I **#**	-	-	-	-	-	-	-	-	-	3	-	-	-	-
		8	**Any one course to be opted (Indian/Foreign Language)**														
			Tamil (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Hindi (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-

			Telugu (Regional Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			French (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			German (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Spanish (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Korean (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Mandarin (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			Japanese (Foreign Language)	-	-	-	-	-	-	0.4	0.4	0.4	3	0.4	0.6	-	-
			OR														
			Universal Human Values	-	-	-	-	2	3	3	3	3	3	3	3	-	-
		9	Mandatory Course I														

YEAR 2	SEMESTER 3	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
		1	Applied Mathematics and Transforms	3	3	2	2	2	-	-	-	-	-	-	2	-	-
		2	Advanced Academic Writing	-	-	-	-	1	2	1	3	2	3	1	2	3	2
		3	Embedded Systems for Mechatronics	3	3	2.4	1.8	1.6	-	-	-	-	-	-	1.6	3	0.8
		4	Applied Mechanics	3	3	2	-	0.6	-	-	2	1	0.6	-	2	2	-
		5	Manufacturing Technology	3	3	1.6	1.6	-	-	-	1	1	-	-	1	2	-
		6	Department Elective-1														
		7	Environmental Science and Sustainable Development	2	2	2	-	-	1	3	-	-	-	-	2	-	-
		8	Design Project – 1	3	3	2	1	3	2	1	3	3	3	3	2	-	-
		9	Internship -1 (To be carried out in summer after 2nd semester and evaluated in 3rd semester)	1	1	-	-	2	0.67	-	1	1.67	1.67	1.67	0.67	0.67	1
		10	Mandatory Course II														

YEAR 2	SEMESTE	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
		1	Statistics and Data Analytics	3	3	1	3	2.6	0.8	0.4	-	-	-	-	2	3	2

		2	Professional Editing and Project Writing	-	-	-	-	1	2	1	3	2	3	1	2	3	2
		3	Solid and Fluid Mechanics	3	3	1.6	-	0.6	-	-	2	2	0.6	-	3	2	-
		4	Electrical Machines and Drives	3	3	1.4	1.4	-	-	-	1	2	1	-	2	2	1
		5	Fluid Power Automation (Industry Collaborated Course)	3	3	1.6	0.8	1.6	-	-	2	2	-	-	1	2	1
		6	Department Elective-2														
		7	Non-Department Elective-1														
		8	Design Project – 2	3	3	2.67	2	3	2	2	3	3	3	3	1	-	-
		9	Mandatory Course III														

YEAR 3	SEMESTER 5	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
		1	Public Speaking	2	-	2	-	3	3	-	-	2	3	2	3	3	2
		2	Control Systems	3	3	2.8	1.8	-	-	-	-	-	-	-	2	1.8	1.8
		3	Industrial Automation	3	3	3	2	2	-	-	-	-	-	1	1	2	2
		4	Design of Mechanical Elements	3	3	3	-	1	-	-	1	-	-	-	1	2	-
		5	Department Elective-3														
		6	Non-Department Elective-2														
		7	Design Project – 3	3	3	2.67	2	3	2	2	3	3	3	3	1	0	0
		8	Entrepreneurship	2.75	2.5	1.75	2.5	2.25	2.75	1.75	1.5	2.75	2.5	2	3	2.5	2.5
		9	Internship -2 (to be evaluated in 5th semester. To be carried out in summer after 4th semester))	1	1	-	-	2	0.67	-	1	1.67	1.67	1.67	0.67	0.67	1

YEAR 3	SEMESTER 6	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
		1	English for Competitive Examinations	2	-	2	-	3	3	-	-	2	3	2	3	3	1
		2	Motion Control	3	3	2	1.6	1.4	1.6	0.6	0.8	0.8	0.8	-	1	2	2.8

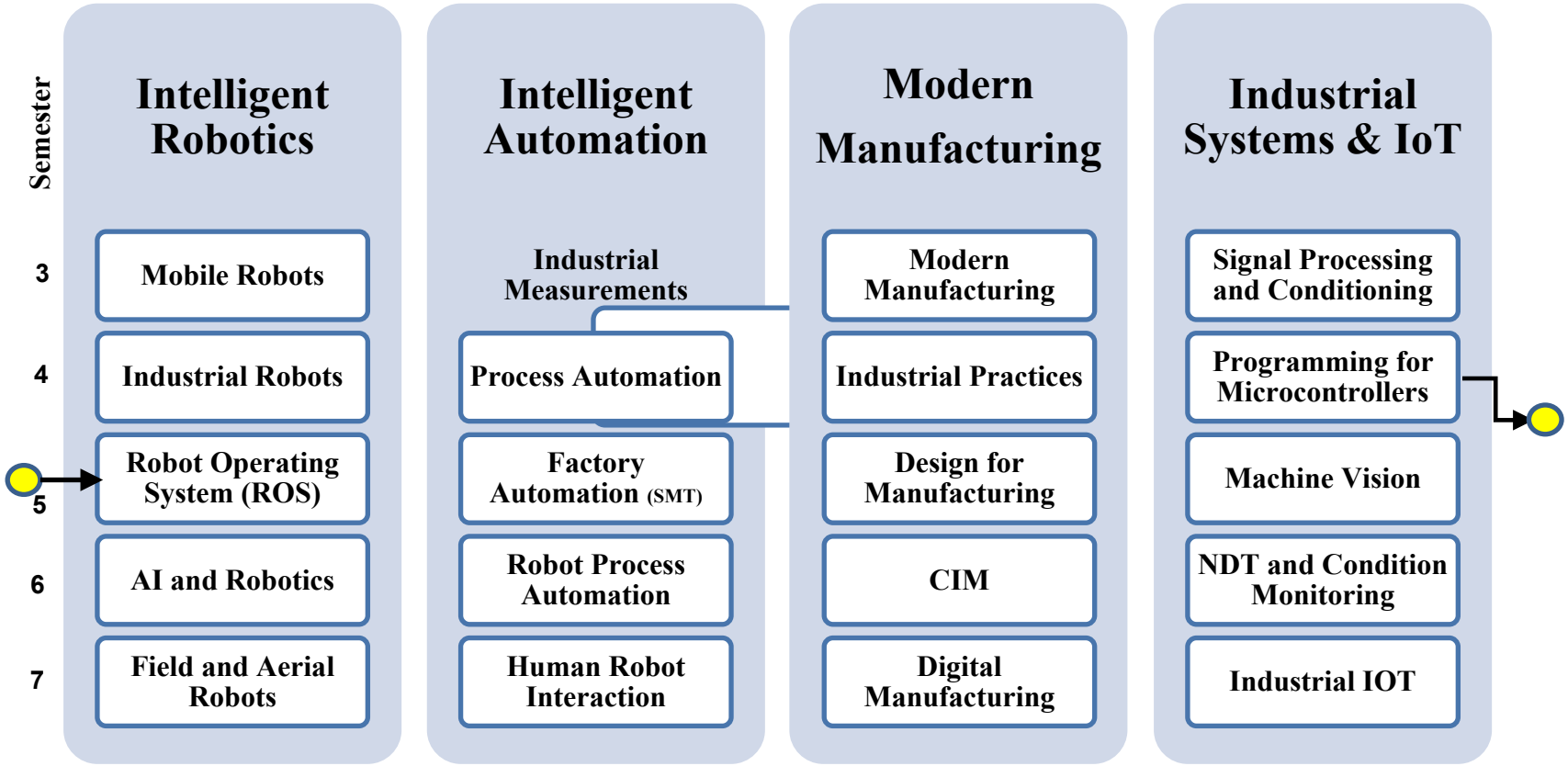
		3	Industrial Electronics	3	3	3	0.5	-	-	-	-	-	-	-	2	2	0.5
		4	CNC Engineering	3	3	-	-	1.4	-	-	-	-	-	-	2	2	-
		5	Department Elective-4														
		6	Non-Department Elective-3														
		7	Industry 4.0	3	3	3	3	2	-	1	-	2	3	3	0.8	2	2
		8	Design Project – 4	3	3	2.67	2	3	2	2	3	3	3	3	1	-	-

		Sl. No	**COURSE NAME**	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**
YEAR 4	**SEMESTER 7**	1	Verbal Reasoning and Interview Skills	2	-	2	-	3	3	-	-	2	3	2	3	3	1
		2	Principles of Robotics	3	3	2.8	2.2	1.6	0.4	0	1.6	1	1	-	2	3	1.4
		3	Artificial Intelligence for Mechatronics	3	3	2.4	2.2	2.4	0.2	0.2	0.8	2	1	0.4	2	1.6	3
		4	Design of Mechatronics System	2.4	2.8	1.2	1.2	3	2.4	1.8	2	2.2	2.6	2	3	2	2
		5	Department Elective-5														
		6	Non-Department Elective-4														
		7	Research Methodology & IPR	2.4	2.8	1.2	1.2	3	2.4	1.8	2	2.2	2.6	2	3	2	2
		8	Project Phase - 1	3	1	2	-	-	2	1	1	2	1	1	2	-	-

YEAR 4	SEMESTER 8	Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
		1	Project Phase - 2	3	3	2	2	3	1	1	1	3	1	3	1	-	-

DEPARTMENT ELECTIVE COURSES: VERTICALS

DEPARTMENTAL ELECTIVES (DE) OFFERED UNDER FOUR VERTICALS



VERTICAL 1: INTELLIGENT ROBOTICS

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
1	Mobile Robots	3	3	3	2.8	2	1.6	-	-	-	0.8	1	1.8	2	3
2	Industrial Robots	3	3	1.8	1.8	1.4	-	-	-	-	-	-	-	2	0.2
3	Robotic Operating System	3	2.4	2.2	1	2.8	1	-	-	1.6	0.8	0.2	0.8	2	3
4	AI and Robotics	3	3	2	2	1.75	0.5	0.5	1	1	1	-	2	2	1.5
5	Field and Aerial Robotics	3	3	1.8	1.8	1.6	0.6	0.4	0.8	0.8	0.8	-	1.8	0.4	0.6

VERTICAL 2: INTELLIGENT AUTOMATION

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
1	Industrial Measurements	3	3	1.4	1.4	-	-	-	1	2	1	-	2	2	1
2	Process Automation	3	3	0.8	0.8	-	-	-	-	1	1	-	2	2	1
3	Factory Automation	3	3	2	1.6	1.4	1.6	0.6	0.8	0.8	0.8	-	1	2	2.8
4	NDT and Condition Monitoring	3	3	2.2	2	1.4	2	0.4	0.4	0.4	1	0.4	1.6	1	2
5	Industrial IOT	3	3	3	2	-	-	-	-	3	3	2	3	2	2

VERTICAL 3: MODERN MANUFACTURING

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
1	Modern Manufacturing Systems	3	3	1.6	0.8	0.8	-	-	2	2	-	-	1	2	1

2	Industrial Practices	3	3	1.8	1.8	1.4	-	-	-	-	-	-	-	2	2
3	Design for Manufacturing	3	3	1.8	1.4	1.4	-	-	-	3	3	2	3	2	2
4	Computer Integrated Manufacturing	3	3	1.6	0.8	0.8	-	-	2	2	-	-	1	2	-
5	Digital Manufacturing	3	3	1.8	1.8	1.4	-	-	-	-	-	-	-	2	2

VERTICAL 4: INDUSTRIAL SYSTEMS & IOT

Sl. No	COURSE NAME	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PS O1	PS O2
1	Sensor Signal Processing and Signal Conditioning	3	3	2.4	1.8	1.6	-	-	-	-	-	-	1.6	3	0.8
2	Programming for Microcontrollers	3	3	2.4	1.8	1.6	-	-	-	-	-	-	1.6	3	0.8
3	Machine Vision	3	3	2	1.6	1.4	1.6	0.6	0.8	0.8	0.8	-	1	2	2.8
4	Robotic Process Automation	2.6	2.8	2.4	1	2.4	-	-	0.8	2	2.4	1.2	1.4	0.4	0.8
5	Human Robot Interaction	2	3	3	1	3	1.2	1.2	1	1.2	1.2	1.2	1.2	1.8	1.6

B. TECH. MECHATRONICS

GENERAL COURSE STRUCTURE & THEME

A. Definition of Credit:

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (P) per week	1 Credit

B. Range of Credits: In the light of the fact that a typical Model Four-year Under Graduate degree program in Engineering has about 160 credits, we have adopted 165 credits.

C. Structure of UG Program: The structure of UG program shall have essentially the following categories of courses with the breakup of credits as given:

S. No.	Category Code	Category	Breakup of Credits
1.	HS	Humanities & Social Science Courses	16
2.	BS	Basic Science Courses	24
3.	ES	Engineering Science Courses	15
4.	PC	Program Core Courses (Branch specific)	61
5.	DE	Professional Elective Courses (Branch specific) – Department Elective	15
6.	NE	Open Elective Courses (Cross Discipline Subjects) – Non Department Elective	12
7.	EEC	Employment Enhancement Courses (Project/ Summer Internship/ Seminar)	22
		TOTAL	**165**

CURRICULUM COURSE DISTRIBUTION (BASED ON CREDITS)

Semester	HS	BS	ES	PC	DE	NE	EEC	Total Credits per semester
1	6	8	4	4				**22**
2	5	8	5	4				**22**
3	1	4	2	10	3		2	**22**
4	1	4		10	3	3	1	**22**
5	1		2	10	3	3	2	**21**
6	1			13	3	3	1	**21**
7	1		2	10	3	3	3	**22**
8							13	**13**
Total Credits	**16**	**24**	**15**	**61**	**15**	**12**	**22**	**165**

CURRICULUM COURSE DISTRIBUTION (BASED ON COURSE COUNT)

Semester	HS	BS	ES	PC	DE	NE	EEC	MC	Total Courses per semester
1	4	2	2	1					**9**
2	3	2	2	1				**1**	**9**
3	1	1	1	3	1		2	**1**	**10**
4	1	1		3	1	1	1	**1**	**9**
5	1		1	3	1	1	2		**9**
6	1			4	1	1	1		**8**
7	1		1	3	1	1	1		**8**
8							1		**1**
Total Courses	**12**	**6**	**7**	**18**	**5**	**4**	**8**	**3**	**63**

MC : Mandatory Course

CREDIT COUNT

Semester	Credit Count
1	22
2	22
3	22
4	22
5	21
6	21
7	22
8	13
	165

HINDUSTAN
INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)

B. TECH. MECHATRONICS

CURRICULUM FRAMEWORK FOR SEMESTERS I TO VIII

B.TECH - MECHATRONICS CURRICULUM - 2023-24 (NEP R2022 A)											
Semester-I											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	I	BS	TP	EMA51001	Matrices and Calculus	3	0	2	4	2	5
2	I	BS	TP	**Any one course to be opted**		3	0	2	4	2	5
				EPH51001	Engineering Physics						
				ECT51001	Engineering Materials						
3	I	HS	TP	**Any one course to be opted**		2	0	1	2	1	3
				GLS51001	Communication Skills						
				GLS51002	Personality Development and Soft Skills						
4	I	ES	TP	**Any one course to be opted**		2	0	2	3	2	4
				ECS51009	Programming Fundamentals using C						
				ECS51010	Programming in Python						
				OR							
				EME51001	Engineering Graphics and Computer Aided Design						
5	I	ES	TP	EGE51002	Design Thinking	2	0	2	3	2	4
6	I	ES	PR	**Any one course to be opted**		0	0	4	2	2	4
				EGE51406	Engineering Practices Lab						
				EGE51408	Fab Lab for Core Engineering						
7	I	HS	PR	**Any one course to be opted (Outreach)**		0	0	2	1	4	2
				GGE51401	Outreach (NCC)– Level I #						
				GGE51402	Outreach (NSS, Y's Men, Rotaract) – Level I #						
8	I	HS	TH	**Any one course to be opted (Indian or Foreign Language)**		2	0	0	2	2	2
				GLS51008	Tamil						
				GLS51009	Hindi						
				GLS51010	Telugu						
				GLS51011	French						
				GLS51012	German						
				GLS51013	Spanish						
				GLS51014	Korean						
				GLS51015	Mandarin						
				GLS51016	Japanese						
				OR							
				GGE51001	Universal Human Values						

9	I	HS	TH	GLS51017	Tamil Culture and Technology	1	0	0	1	2	1
					Total	**15**	**0**	**15**	**22**	**19**	**30**
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
# - Students should choose Level – I and Level - II of same outreach course in the semester 1 and 2 respectively											

Semester-II											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	II	BS	TP	EMA51002	Analytical Mathematics	3	0	2	4	2	5
2	II	BS	TP	**Any one course to be opted**		3	0	2	4	2	5
				EPH51001	Engineering Physics						
				ECT51001	Engineering Materials						
3	II	HS	TP	**Any one course to be opted**		2	0	1	2	1	3
				GLS51001	Communication Skills						
				GLS51002	Personality Development and Soft Skills						
4	II	PC	TP	EMD51001	Mechatronic Systems Engineering	3	0	2	4	2	5
5	II	ES	TP	**Any one course to be opted**		2	0	2	3	2	4
				ECS51009	Programming Fundamentals using C						
				ECS51010	Programming in Python						
				OR							
				EME51001	Engineering Graphics and Computer Aided Design						
6	II	ES	PR	**Any one course to be opted**		0	0	4	2	2	4
				EGE51406	Engineering Practices Lab						
				EGE51408	Fab Lab for Core Engineering						
7	II	HS	PR	**Any one course to be opted(Outreach)**		0	0	2	1	4	2
				GGE51403	Outreach (NCC) – Level II #						
				GGE51404	Outreach (NSS, Y's Men, Rotaract) – Level II #						
8	II	HS	TH	**Any one course to be opted (Indian or Foreign Language)**		2	0	0	2	2	2
				GLS51008	Tamil						
				GLS51009	Hindi						
				GLS51010	Telugu						
				GLS51011	French						
				GLS51012	German						
				GLS51013	Spanish						

				GLS51014	Korean						
				GLS51015	Mandarin						
				GLS51016	Japanese						
				OR							
				GGE51001	Universal Human Values						
9	II	MC	TH	xxxxxxxx	Mandatory Course I is a Non-credit course (Student shall select one course from the list given under Mandatory Course I)	3	0	0	*	2	3
					Total	18	0	15	22	19	33
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
*** – Non Credit Course # - Students should choose Level – I and Level - II of same outreach course in the semester 1 and 2 respectively**											

SEMESTER - III											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	III	BS	TH	EMA51004	Applied Mathematics and Transforms	3	1	0	4	2	4
2	III	HS	TP	GLS51003	Advanced Academic Writing	1	0	1	1	1	2
3	III	PC	TP	EMD51002	Embedded Systems for Mechatronics	2	0	2	3	2	4
4	III	PC	TP	EMD51003	Applied Mechanics	2	1	2	4	2	5
5	III	PC	TH	EMD51004	Manufacturing Technology	3	0	0	3	2	3
6	III	DE	TP	EMD515xx	Department Elective - 1	2	0	2	3	2	4
7	III	ES	TH	GGE51003	Environmental Science and Sustainable Development	2	0	0	2	2	2
8	III	EEC	DP	EMD51800	Design Project – 1	0	0	2	1	6	2
9	III	EEC	IN	EMD51801	Internship -1 (To be carried out in summer after 2nd semester and evaluated in 3rd semester)	#			1	2	0
10	III	MC	TH	********	Mandatory Course- II is a Non-credit course (Student shall select one course from the list given under Mandatory Course II)	3	0	0	*	2	3
					Total	**18**	**2**	**9**	**22**	**23**	**29**
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
*** – Non Credit Course # - 15 Days Minimum**											

SEMESTER - IV											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	IV	BS	TH	EMA51010	Statistics and Data Analytics	3	1	0	4	2	4
2	IV	HS	TP	GLS51004	Professional Editing and Project Writing	1	0	1	1	1	2
3	IV	PC	TP	EMD51005	Solid and Fluid Mechanics	3	0	2	4	2	5
4	IV	PC	TP	EMD51006	Electrical Machines and Drives	2	0	2	3	2	4
5	IV	PC	TP	EMD51007	Fluid Power Automation (Industry Collaborated Course)	2	0	2	3	2	4
6	IV	DE	TP	EMD515xx	Department Elective - 2	2	0	2	3	2	4
7	IV	NE	TP	Exx517xx	Non-Department Elective - 1	2	0	2	3	2	4
8	IV	EEC	DP	EMD51802	Design Project – 2	0	0	2	1	6	2
9	IV	MC	TH	********	Mandatory Course-III is a Non-credit course (Student shall select one course from the list given under Mandatory Course III)	3	0	0	*	2	3
					Total	**18**	**1**	**13**	**22**	**21**	**32**
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
*** Non Credit Course**											

SEMESTER - V											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	V	HS	TP	GLS51005	Public Speaking	1	0	1	1	1	2
2	V	PC	TP	EMD51008	Control Systems	3	0	2	4	2	5
3	V	PC	TH	EMD51009	Industrial Automation	2	1	0	3	2	3
4	V	PC	TH	EMD51010	Design of Mechanical Elements	2	1	0	3	2	3
5	V	DE	TP	EMD515xx	Department Elective - 3	2	0	2	3	2	4
6	V	NE	TP	Exx517xx	Non-Department Elective - 2	2	0	2	3	2	4
7	V	EEC	DP	EMD51804	Design Project – 3	0	0	2	1	6	2
8	V	ES	TH	EGE51004	Entrepreneurship	2	0	0	2	6	2
9	V	EEC	IN	EMD51803	Internship -2 (to be evaluated in 5th semester. To be carried out in	#			1	0	0

					summer after 4th semester)						
					Total	**14**	**2**	**9**	**21**	**23**	**25**
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
*** – Non Credit Course # - 15 Days Minimum**											

SEMESTER - VI											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VI	HS	TP	GLS51006	English for Competitive Examinations	1	0	1	1	1	2
2	VI	PC	TP	EMD51011	Motion Control	3	0	2	4	2	5
3	VI	PC	TP	EMD51012	Industrial Electronics	2	0	2	3	2	4
4	VI	PC	TP	EMD51013	CNC Engineering	2	0	2	3	2	4
5	VI	DE	TP	EMD515xx	Department Elective - 4	2	0	2	3	2	4
6	VI	NE	TP	Exx517xx	Non-Department Elective - 3	2	0	2	3	2	4
7	VI	PC	TP	EMD51014	Industry 4.0 (Case Study / Field Study / Product study)	2	0	2	3	6	4
8	VI	EEC	DP	EMD51805	Design Project – 4	0	0	2	1	6	2
					Total	**14**	**0**	**15**	**21**	**23**	**29**
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

SEMESTER - VII											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VII	HS	TP	GLS51007	Verbal Reasoning and Interview Skills	1	0	1	1	1	2
2	VII	PC	TP	EMD51015	Principles of Robotics	2	1	2	4	2	5
3	VII	PC	TP	EMD51016	Artificial Intelligence for Mechatronics	2	0	2	3	2	4
4	VII	PC	TP	EMD51017	Design of Mechatronics System	2	0	2	3	2	4
5	VII	DE	TP	EMD515xx	Department Elective - 5	2	0	2	3	2	4
6	VII	NE	TP	Exx517xx	Non-Department Elective - 4	2	0	2	3	2	4

7	VII	ES	TH	EGE51005	Research Methodology & IPR	2	0	0	2	2	2
8	VII	EEC	PJ	EMD51806	Project Phase 1	0	0	6	3	6	6
					Total	**13**	**1**	**17**	**22**	**19**	**31**
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

SEMESTER - VIII											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VIII	EEC	PJ	EMD51807	Project Phase - 2	0	0	26	13	10	26
					Total	**0**	**0**	**26**	**13**	**10**	**26**
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

Mandatory Course-I											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	II	MC	TH	GGE51011	Introduction to Women and Gender Studies	3	0	0	Non credit Course	2	3
2	II	MC	TH	GGE51012	Public and Personal Administration	3	0	0	Non credit Course	2	3
3	II	MC	TH	GGE51013	Constitution of India	3	0	0	Non credit Course	2	3
4	II	MC	TH	EGE51006	Law for Engineers	3	0	0	Non credit Course	2	3
5	II	MC	TH	GGE51015	Indian Knowledge System (IKS)	3	0	0	Non credit Course	2	3
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

Mandatory Course-II											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	III	MC	TH	GGE51021	Traditional Indian Systems of Medicine and Therapies	3	0	0	Non credit Course	2	3
2	III	MC	TH	GGE51022	History of Science and Technology in India	3	0	0	Non credit Course	2	3
3	III	MC	TH	GGE51023	Political and Economic Thought for a Humane Society	3	0	0	Non credit Course	2	3
4	III	MC	TH	GGE51024	State, Nation-Building and Politics in India	3	0	0	Non credit Course	2	3
5	III	MC	TH	GGE51025	Industrial Safety	3	0	0	Non credit Course	2	3
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

Mandatory Course-III											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	IV	MC	TH	GGE51031	Principles of Management	3	0	0	Non credit Course	2	3
2	IV	MC	TH	GGE51032	Human Resource Management	3	0	0	Non credit Course	2	3
3	IV	MC	TH	GGE51033	Green Technology	3	0	0	Non credit Course	2	3
4	IV	MC	TH	GGE51034	Industrial Management	3	0	0	Non credit Course	2	3
5	IV	MC	TH	GGE51035	Fintech and Financing new Business	3	0	0	Non credit Course	2	3
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

LIST OF DEPARTMENT ELECTIVES											
DEPARTMENTAL ELECTIVE - 1											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	III	DE	TP	EMD51500	Mobile Robots[1]	2	0	2	3	2	4
2	III	DE	TP	EMD51501	Industrial Measurements[2]	2	0	2	3	2	4
3	III	DE	TP	EMD51502	Modern Manufacturing Systems[3]	2	0	2	3	2	4
4	III	DE	TP	EMD51503	Sensor Signal Processing and Signal Conditioning[4]	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
[1]Intelligent Robotics, [2]Intelligent Automation, [3]Modern Manufacturing, [4]Industrial Systems & IOT											

LIST OF DEPARTMENT ELECTIVES											
DEPARTMENTAL ELECTIVE - 2											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	IV	DE	TP	EMD51504	Industrial Robotics[1]	2	0	2	3	2	4
2	IV	DE	TP	EMD51505	Process Automation[2]	2	0	2	3	2	4
3	IV	DE	TP	EMD51506	Industrial Practices[3]	2	0	2	3	2	4
4	IV	DE	TP	EMD51507	Programming for Microcontrollers[4]	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
[1]Intelligent Robotics, [2]Intelligent Automation, [3]Modern Manufacturing, [4]Industrial Systems & IOT											

LIST OF DEPARTMENT ELECTIVES											
DEPARTMENTAL ELECTIVE - 3											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	V	DE	TP	EMD51508	Robotic Operating System[1]	2	0	2	3	2	4
2	V	DE	TP	EMD51509	Factory Automation[2]	2	0	2	3	2	4
3	V	DE	TP	EMD51510	Design for Manufacturing[3]	2	0	2	3	2	4
4	V	DE	TP	EMD51511	Machine Vision[4]	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
[1]Intelligent Robotics, [2]Intelligent Automation, [3]Modern Manufacturing, [4]Industrial Systems & IOT											

LIST OF DEPARTMENT ELECTIVES											
DEPARTMENTAL ELECTIVE - 4											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VI	DE	TP	EMD51512	AI and Robotics[1]	2	0	2	3	2	4
2	VI	DE	TP	EMD51513	NDT and Condition Monitoring[2]	2	0	2	3	2	4
3	VI	DE	TP	EMD51514	Computer Integrated Manufacturing[3]	2	0	2	3	2	4
4	VI	DE	TP	EMD51515	Robotic Process Automation[4]	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
[1]Intelligent Robotics, [2]Intelligent Automation, [3]Modern Manufacturing, [4]Industrial Systems & IOT											

LIST OF DEPARTMENT ELECTIVES											
DEPARTMENTAL ELECTIVE - 5											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VII	DE	TP	EMD51516	Field and Aerial Robotics[1]	2	0	2	3	2	4
2	VII	DE	TP	EMD51517	Industrial IOT[2]	2	0	2	3	2	4
3	VII	DE	TP	EMD51518	Digital Manufacturing[3]	2	0	2	3	2	4
4	VII	DE	TP	EMD51519	Human Robot Interaction[4]	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											
[1]Intelligent Robotics, [2]Intelligent Automation, [3]Modern Manufacturing, [4]Industrial Systems & IOT											

LIST OF NON-DEPARTMENT ELECTIVES											
NON-DEPARTMENT ELECTIVE-1											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	IV	NE	TP	EMD51700	Applications of AI in Robotics	2	0	2	3	2	4
2	IV	NE	TP	EMD51701	New Product Development	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

NON-DEPARTMENT ELECTIVE-2											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	V	NE	TP	EMD51702	Building of Mobile Robots	2	0	2	3	2	4
2	V	NE	TP	EMD51703	Motion Control for Automation Industry	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

NON-DEPARTMENT ELECTIVE-3											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VI	NE	TP	EMD51704	Industry 4.0 for Engineers	2	0	2	3	2	4
2	VI	NE	TP	EMD51705	Virtual Reality	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

NON-DEPARTMENT ELECTIVE-4											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VII	NE	TP	EMD51706	Robotic Process Automation	2	0	2	3	2	4
2	VII	NE	TP	EMD51707	Mechatronic System Design	2	0	2	3	2	4
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

LIST OF HONORS COURSES											
HONORS IN DIGITAL MANUFACTURING											
SL.NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	VI	HN	TH	EMD51900	Automation in Manufacturing	3	0	0	3	0	3
2	VI	HN	TH	EMD51901	Engineering Project Management - I	3	0	0	3	0	3
3	VII	HN	TH	EMD51902	Advanced Manufacturing	3	0	0	3	0	3
4	VII	HN	TH	EMD51903	Engineering Project Management - II	3	0	0	3	0	3
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

LIST OF MINOR COURSES											
MINOR IN MANUFACTURING & DESIGN TECHNOLOGY											
SL. NO	**SEM**	**COURSE CATEGORY**	**COURSE TYPE**	**COURSE CODE**	**NAME OF THE COURSE**	**L**	**T**	**P**	**C**	**S**	**TCH**
1	III	MN	TH	EMD51951	Digital Manufacturing	3	0	0	3	0	3
2	IV	MN	TH	EMD51952	Intelligent Machining	3	0	0	3	0	3
3	V	MN	TH	EMD51953	Mechatronic Systems Design	3	0	0	3	0	3
L – Lecture T – Tutorial P – Practical C – Credit S – Self Study TCH – Total Contact Hours											

S. No.	Course Category	Course Category	Credits
1	HS	Humanities & Social Science Courses	16
2	BS	Basic Science Courses	24
3	ES	Engineering Science Courses	16
4	PC	Programme Core Courses	60
5	DE	Department Elective Courses	15
6	NE	Non Department Elective Courses	12
7	EEC	Employment Enhancement Courses	22
8	MC	Mandatory Courses	*
		TOTAL	**165**
9	HN	Honors Courses	12
10	MN	Minors Courses	9
* Non Credit Course			

COURSE TYPE	
TP	Theory with Practical Course
TH	Theory Course
PR	Practical Course
DP	Design Project
PJ	Project Phase - 1 & Phase - 2
IN	Internship

SEMESTER - I

COURSE TITLE	MATRICES AND CALCULUS (Common to ALL B. Tech)			CREDITS		4
COURSE CODE	EMA5100 1	COURSE CATEGORY		BS	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL		BTL-3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / Lab records as approved by the Department Examination Committee "DEC"	Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%	5%	25%	25%

Course Description	To make the student understand the basic concepts of matrices and calculus using MATLAB
Course Objective	1. To perform some simple operations on matrices 2. To give a strong foundation on the basic concepts of differentiation and integration. 3. To demonstrate the fundamental understanding of integrals 4. To classify ordinary differential equations. 5. To impart the knowledge of sequences and summation of series.
Course Outcome	Upon completion of this course, the students will be able to 1. Calculate the inverse of the matrix using Cayley Hamilton theorem and diagonalize the matrix 2. Determine the derivative and higher derivatives of a given function explicitly and integrate the standard functions using suitable differentiation and integration formulae 3. Evaluate surface area and volume using multiple integrals 4. Compute the solution of second order the differential equations 5. Determine the convergence and divergence of the sequence using the appropriate tests.

Prerequisites: Knowledge in calculus at high secondary level.

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO-12	PS O-1	PS O-2
CO-1	3	3	1	2	2	-	-	-	-	-	-	1	2	1
CO-2	2	3	2	1	1	-	-	-	-	-	-	1	1	2
CO-3	3	2	1	2	2	-	-	-	-	-	-	2	2	1
CO-4	3	2	2	1	1	-	-	-	-	-	-	2	1	2
CO-5	3	3	2	1	2	-	-	-	-	-	-	1	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: MATRICES (9L+6P)

Characteristic equation – Eigen values and Eigenvectors – Properties – Cayley Hamilton theorem (Statement only) – Verification and inverse of the matrix using Cayley Hamilton theorem- Diagonalization of matrices using similarity transformation Suggested Reading: Basics of Matrices **Lab: Eigen values and Eigenvectors, Verification and inverse using Cayley Hamilton**	**CO-1 BTL-3**

theorem- Diagonalization	
MODULE 2: DIFFERENTIAL AND INTEGRAL CALCULUS	**(9L+6P)**
Basic Concepts and Simple Problems in Differentiation and Integration-Partial differentiation – Total differentiation- Taylor's series – Maxima and minima of functions of two variables. Integration – Methods of integration – Substitution method – Integration by parts – Integration using partial fraction – Bernoulli's formula. Suggested Reading: Basics of differentiation and integration. **Lab: Taylor's series – Maxima and minima of functions of two variables, Integration using partial fraction**	**CO-2** **BTL-3**
MODULE 3: MULTIPLE INTEGRAL	**(9L+6P)**
Double integration – Cartesian and polar co-ordinates – Change of order of integration. Area as a double integral – Triple integration in Cartesian coordinates – Volume as a triple integral - Change of variables between Cartesian and polar coordinates. Suggested Reading: Line Integrals **Lab: Area and Volume of double integration and triple integration.**	**CO-3** **BTL-3**
MODULE 4: ORDINARY DIFFERENTIAL EQUATIONS	**(9L+6P)**
Second order differential equations with constant coefficients – Particular integrals – e^{ax}, $cosax$, $\sin ax$, x^m, $e^{ax}cosbx$, $e^{ax}sinbx$, Solutions of homogeneous differential equations with variable coefficients – Variation of parameters. Suggested Reading: Basics of Differential Equations. **Lab: Solution of Second order differential equations.**	**CO-4** **BTL-3**
MODULE 5: SEQUENCE AND SERIES	**(9L+6P)**
Definition of Sequence and series with examples, Convergence, divergence and Oscillation of sequence and series, properties, Tests for convergence of series (Comparison test, Limit Comparison test, Integral test, Ratio test, D' Alembert's test, Alternating Series). Suggested Reading: Basics of sequence and series. **Lab: Test the convergence and divergence.**	**CO-5** **BTL-3**

TEXT BOOKS	
1.	A. Chandrasekaran, G Kavitha (2019), *Matrices and Calculus*, Dhanam Publications, 1st Edition, Chennai.
2.	B.S. Grewal (2017), *Higher Engineering Mathematics*, Khanna Publishers, 43rd Edition, New Delhi.
3.	A. P. Santhakumaran, P. Titus P (2017), *Engineering Mathematics – II*, NiMeric Publications, 2nd Edition, Nagercoil, India.
REFERENCE BOOKS	
1.	D. G. Duffy (2021), *Advanced Engineering Mathematics with MATLAB (Advances in Applied Mathematics)*, Chapman and Hall Publisher, 5th Edition, CRC Press, USA.
2.	M. D. Weir, Joel Hass, Thomas (2016), *Calculus*, Pearson Publication, 12th Edition, India.
3.	Srimantha Pal and S.C. Bhunia (2015), *Engineering Mathematics*, Oxford University Press, 1st Edition, New Delhi, India.
E BOOKS	

1.	https://www.elsevier.com/books/matrix-calculus/bodewig/978-1-4832-3214-0
2.	https://www.ebooks.com/en-er/book/209983367/matrix-calculus-kronecker-product-and-tensor-product-a-practical-approach-to-linear-algebra-multilinear-algebra-and-tensor-calculus-with-software-implementations-third-edition/yorick-hardy/
MOOC	
1.	https://www.coursera.org/learn/introduction-to-calculus
2.	https://nptel.ac.in/courses/111105035

COURSE TITLE	**ENGINEERING PHYSICS (Common to ALL branches of Engineering)**			**CREDITS**	**4**
COURSE CODE	**EPH51001**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**3-0-2-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL3**

ASSESSMENT SCHEME

First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	End Semester Examination
15%	15%	10%	5%	5%	Theory 25% Practical 25%

Course Description	This course is based on the developing areas of physics integrating both the theoretical and practical training for engineering students. Application of the concepts to solve engineering problems, to acquire practical thinking and logical reasoning.
Course Objective	1. To evaluate various types of modulus of elasticity and impart knowledge on production and application of ultrasonic wave in SONAR and NDT. 2. To provide a strong foundation on the concepts of crystal physics and thermal conductivity. 3. To illustrate theoretically and experimentally the wave – particle duality. 4. To evaluate the material properties based on energy band gap and magnetic moment. 5. To make the students understand the production of lasers and propagation of light through an optical fiber.
Course Outcome	Upon completion of this course, the students will be able to 1. Evaluate the elastic properties of materials and apply the properties of ultrasonic waves for industrial applications 2. Evaluate the characteristics of crystal structure and the thermal conductivity of good and bad conductors. 3. Solve the Schrodinger's wave equations and derive energy density based on Planck's hypothesis 4. Apply the fundamental concepts to classify magnetic and semiconducting materials and thereby, illustrate their applications. 5. Apply lasers and optical fibers as engineering tools
Prerequisites: Knowledge in fundamentals of Physics at higher secondary level	

CO, PO AND PSO MAPPING

CO	PO	PO	PO	PO	PO	PO	PO	PO8	PO	PO1	PO	PO1	PS	PS

	1	2	3	4	5	6	7		9	0	11	2	O1	O2
CO1	3	3	1	1	1	-	-	-	2	-	-	2	1	2
CO2	3	3	2	2	3	-	-	-	3	-	-	3	2	1
CO3	3	3	1	1	1	-	-	-	2	-	-	2	1	2
CO4	3	3	1	2	1	-	-	-	3	-	-	1	1	3
CO5	3	3	2	1	3	-	-	-	3	-	-	3	2	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: PROPERTIES OF MATTER AND ULTRASONICS	**(9L + 6P)**
Elasticity – Hooke's law – Elastic Moduli – Young's modulus of elasticity – Rigidity modulus - Bulk modulus – Twisting couple on a wire – Torsional pendulum – Determination of rigidity modulus of a wire – Depression of a cantilever – Non-uniform bending – Uniform bending – I shape girder. Introduction – Production of ultrasonic waves (Magnetostriction and Piezoelectric methods) – Properties of ultrasonic – Applications in SONAR and NDT. **Practical component:** Torsional pendulum – Determination of rigidity modulus of thin wire and moment of inertia of regular objects Non-uniform bending – Determination of Young's modulus of wooden beam	**CO1** **BTL3**
MODULE 2: CRYSTALLOGRAPHY AND THERMAL PHYSICS	**(9L + 6P)**
Amorphous and crystalline solids – Unit cell – Lattice parameters – Crystal system and Bravais lattices (Qualitative) – Miller indices – Interplanar spacing for cubic crystal system – Crystal structures SCC, BCC, FCC, HCP (no. of atoms, coordination number, atomic packing fraction calculations) – Bragg's law – X-ray diffractometer. Thermal conductivity – Experimental determination of thermal conductivities of good and bad conductors – Forbe's method (Theory and experiment) – Lee's disc method for bad conductors. **Practical component:** Lee's disc experiment – Determination of thermal conductivity of bad conductor	**CO2** **BTL3**
MODULE 3: QUANTUM PHYSICS	**(9L + 6P)**
Black body radiation – Planck's hypothesis – Photoelectric effect – Compton effect – Theory and experimental verification Physical significance of wave function – Schrodinger's wave equation – Time independent and time dependent equations – Particle in a 1D box – Quantum Well (no derivation) **Practical component:** Photoelectric effect – To plot the KE as a function of frequency for different metals.	**CO3** **BTL3**
MODULE 4: MAGNETISM AND SEMICONDUCTORS	**(9L + 6P)**
Magnetic moment – Classification of magnetic materials (Dia, para, ferro, anti-ferro) – Domain theory of ferromagnetism – Hysteresis – Hard and soft magnetic materials – Memory applications. Classification of semiconductors – Direct and in-direct bandgap – Fermi energy level – Intrinsic and extrinsic semiconductors – *n*-type and *p*-type semiconductors (Qualitative) – Hall effect – Determination of Hall voltage (Theory and experiment) – Applications of Hall effect. **Practical component:** Current – Voltage (IV) characteristics of semiconductor diode	**CO4** **BTL3**
MODULE 5: MODERN OPTICS	**(9L + 6P)**
Principles of laser – Stimulated absorption – Spontaneous emission – Stimulated emission – Population inversion – Pumping action – Active medium – Laser characteristics – Nd-YAG laser – CO_2 laser – Dye laser – Laser in Industrial applications. Optical fiber – Principle and propagation of light in optical fibers – Numerical aperture and	**CO5** **BTL3**

acceptance angle – Types of optical fibers – Optical fiber as temperature sensors. **Practical component:** Laser – Determination of the wavelength of the laser using grating Laser – Particle size determination using lycopodium powder	

TEXT BOOKS	
1	Rajendran V. (2017), *Engineering Physics*, Tata McGraw Hill Publications, 3rd Edition, US.
2	Gaur R. K. and Gupta S.L. (2014). *Engineering Physics*, 8th edition, Dhanpat Rai publications (P) Ltd., New Delhi
3	Mani P. (2016), *Engineering Physics*, Dhanam Publications, 13th Edition, Chennai.
REFERENCE BOOKS	
1.	Arthur Beiser (2017), *Concepts of Modern Physics*, Tata McGraw Hill Publications, 7th Edition, US.
2.	Halliday, Resnick and Walker (2021), *Fundamental of Physics Extended*, Wiley & Sons, 12th Edition, US.
3	Shaikh I. A, Kulkarni H. R, Mohril, S. F. and Khairnar (2018), *Engineering Physics*, Nirali Prakashan Publishers, 5th Edition, Pune.
E BOOKS	
1.	https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/042-Fundamentals-of-Physics-II-Electromagnetism-Optics-and-Quantum-Mechanics-R.-Shankar-Edisi-1-2016.pdf
2.	https://zenodo.org/record/243407#.Y0EfilxBzIU
3.	https://salmanisaleh.files.wordpress.com/2019/02/physics-for-scientists-7th-ed.pdf
MOOC	
1.	http://nptel.ac.in/courses/115106061
2.	http://nptel.ac.in/courses/117101054/12

COURSE TITLE	**ENGINEERING MATERIALS (Common to ALL B.Tech.)**			**CREDITS**	**4**
COURSE CODE	**ECT51001**	**COURSE CATEGORY**	**BS**	**L-T-P-S**	**3-0-2-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**Theory 25%** **Practical 25%**

Course Description	To expose the students to the basics of Engineering Materials and their applications**.**
Course Objective	1. To make the students understand the basics of crystal structure and phase rule. 2. To provide a knowledge on the theoretical basis of the chemical composition, properties and applications of abrasives, adhesives, lubricants and refractories. 3. To give a strong foundation on the basic concepts of nanomaterials, the general synthetic methods with emphasis on their applications. 4. To provide an exposure on the fundamentals and applications of polymeric materials and composites. **5.** To illustrate the applications of energy materials, liquid crystals and conducting polymers

	with a good exposure on their basic terminologies.
Course Outcome	Upon completion of this course, the students will be able to 1. Propose and justify suitable metals/materials for alloying. 2. Distinguish and select a suitable material as abrasives / adhesives / lubricants / refractories based on its properties and applications. 3. Select an appropriate technique for nanomaterial synthesis and characterization. 4. State and select a suitable polymeric / composite material for industrial applications. 5. Develop the suitable organic/inorganic materials that can be employed in energy storage / production and electronic devices.

Prerequisites: Knowledge in fundamentals of chemistry at higher secondary level.

CO, PO AND PSO MAPPING

CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	-	-	-	1	-	-	-	-	1	1	2
CO-2	3	2	1	-	-	-	2	-	-	-	-	2	2	2
CO-3	3	2	2	-	-	-	1	-	-	-	-	3	1	1
CO-4	3	2	1	-	-	-	2	-	-	-	-	2	2	2
CO-5	3	2	1	-	-	-	2	-	-	-	-	2	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: CRYSTAL STRUCTURE AND PHASE RULE	**(9L + 6P)**
Basic crystal systems – Types, characteristics, examples – Space lattice, Unit cell – types – X-ray diffraction and crystal structure. Phase rule: Basic terminology - Derivation of Gibbs Phase rule- Phase diagrams: One component system (water), Two component system –- Reduced phase rule: Simple Eutectic system, examples, Phase diagram: Ag-Pb system, Pb-Sn system – Applications of phase rule. **Practical components**: Construction of phenol-water phase diagram - Determination of apparent density of porous solids.	**CO-1** **BTL-3**
MODULE 2: ABRASIVES, ADHESIVES, LUBRICANTS AND REFRACTORIES	**(9L + 6P)**
Abrasives – Classification, Properties, Uses – Adhesives – Development of Adhesive strength, Physical and Chemical factors influencing adhesive action, Classification of Adhesives – Epoxy Resin (Preparation, Properties and Applications) – Lubricants – Mechanism of Lubrication, Classification and Properties, Semi Solid Lubricants, Solid Lubricants, MoS_2 and Graphite - Refractories – Classification, Properties, Applications. **Practical components:** Preparation of urea-formaldehyde resin - Determination of porosity of a refractory	**CO-2** **BTL-3**
MODULE 3: NANOMATERIALS	**(9L + 6P)**
Introduction – Scope of nanomaterials - Types of nanomaterials - Synthesis of Nanomaterials - Bottom-up and Top-down approaches – Methods of preparation – Laser ablation, Sol-gel process, Gas-phase condensation, Chemical Vapour Deposition. Properties **–** Optical, Electrical, Magnetic, Chemical properties (introduction only). Characterization **–** UV-Visible spectroscopy, FE-SEM and TEM (Principle and Applications only). **Practical components:** Preparation of ZnO nanoparticles by wet chemical method – Verification of Beer-Lambert's law using silver nanoparticles.	**CO-3** **BTL-3**
MODULE 4: POLYMERS AND COMPOSITES	**(9L + 6P)**
Introduction – Basic definitions – Classification of polymers – Structure and property relationship of polymers – Plastics – Synthesis, properties and applications of polycarbonates and phenol-formaldehyde - Biodegradable Polymers, examples and applications. Composites - Introduction -	**CO-4** **BTL-3**

Definition – Constituents – Classification - Fiber-reinforced Composites –Types and Applications. **Practical components:** Determination of molecular weight / viscosity of polymer using Ostwald Viscometer.	
MODULE 5: MATERIALS FOR ENERGY AND ELECTRONIC APPLICATIONS	**(9L + 6P)**
Energy storage materials – Metal-hydride batteries, Li-batteries - Materials for solar cells: Semi-conductors - Materials for hydrogen technology - production (electrolysis), storage (hydrides), fuel cells. Liquid Crystals - Introduction –Characteristics – Optical properties- Classification – Chemical constitution and liquid crystalline behaviour - Applications. Conducting Polymers: Classification, Intrinsic Conducting Polymers, Extrinsic Conducting Polymers, Applications. **Practical components:** Preparation of polyaniline / Polypyrrole.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Jain, P.C., Jain, M. (2018). *Engineering Chemistry*, Dhanpat Raj Publishing Company (P) Ltd, New Delhi, 17th Edition.
2.	Puri, B. R., Sharma, L. R., Pathania, M. S. (2020). *Principles of Physical Chemistry*, Vishal Publishing Co. Jalandhar, 47th Edition.
3.	Rangwala. (2017). *Engineering Materials*, Charotar Publishing House Pvt. Ltd, 43rd Edition.
REFERENCE BOOKS	
1.	Clyne, T. W., Hull, D. (2019). *An introduction to composite materials*, Cambridge University Press, 3rd Edition.
2.	Shah, M. A., Ahmad, T. (2021). *Nano Science & Technology*, Dreamtech Press, 2021 Edition.
3.	Palanna, O. G. (2018). *Engineering Chemistry*, Mc Graw Hill Education (India) Pvt. Ltd, 2nd Edition.
E BOOKS	
1.	http://www.erforum.net/2016/01/engineering-chemistry-by-jain-and-jain-pdf-free-ebook.html
2.	https://abmpk.files.wordpress.com/2014/02/book_maretial-science-callister.pdf`
MOOC	
1.	https://www.edx.org/course/materials-science-engineering-misisx-mse1x
2.	https://www.mooc-list.com/tags/materials-science

COURSE TITLE	**COMMUNICATION SKILLS**			**CREDITS**	**2**
COURSE CODE	**GLS51001**	**COURSE CATEGORY**	**HS**	**L - T – P – S**	**2 – 0 – 1 – 1**
Version	**1.0**	**Approval Details**	**35th ACM**	**LEARNING LEVEL**	**BTL 4**

ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**	**Theory**	**Practical**
15 %	**15 %**	**10 %**	**5 %**	**5 %**	**25 %**	**25 %**

Course Description	The course has been designed to improve the communication competency of the students. The course builds on students' English language skills by engaging them in listening, speaking and grammar learning activities (LSRW) that are relevant to authentic contexts. This course trains the students how to communicate accurately, appropriately and fluently in professional and social situations. The course is framed so that the students can appear for Cambridge B1 Preliminary exams and also enable them to get a certification.
Course Objective	1. To acquire self-confidence by which the learner can improve upon their informative listening skills by an enhanced acquisition of the English language. 2. To provide an environment to Speak in English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate. 3. To equip the students to Read, comprehend and answer questions based on literary, scientific and technological texts. 4. To enhance the writing skills of the students via training in instructions, recommendations, checklists, process-description, letter-writing and report writing. 5. To equip the learners in analyzing and applying creative thinking skills and participate in brainstorming, mind-mapping, audiovisual activities and excel in employability skills.
Course Outcome	Upon completion of this course, the students will be able to 1. Acquire the accuracy through the knowledge of Syntax. 2. Demonstrate the skill of using the vocabulary and use it in sentences appropriately. 3. Infer texts and improvise its usage. 4. Illustrate language acquisition skills through formal correspondence. 5. Analyse and transcode the data and interpret it in text format.

Prerequisites: Plus Two English-Intermediate Level

CO AND PO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	1	-	3	1	2	1	1
CO2	-	-	-	-	-	-	-	1	-	3	2	2	1	2
CO3	-	-	-	-	-	-	-	2	-	3	1	2	2	1
CO4	-	-	-	-	-	-	-	2	2	3	2	2	1	2
CO5	-	-	-	-	-	-	-	1	-	3	3	2	1	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : English for Employability	**(6L+3P)**
Grammar : 1. Parts of Speech – Identification and Transformation 2. Kinds of Sentences – Identification and Transformation 3. Sentence Pattern – Framing Sentences 4. Tenses – Rules & its usage – Present simple and present continuous; time expressions; state verbs – Past simple ; regular and irregular verbs and spelling of past simple forms ; past continuous. **Vocabulary :** 1. Job titles and describing jobs ; names of company departments 2. Computer terms; email and website terms. 3. Headings for CVs Describing application Procedures **Writing :** 1. Writing emails – formal and informal – phrases for emails & letters. 2. Writing a covering letter with a resume for a job application. **Reading :** Reading about Job and Company : 1. Changing places : job swapping at work. 2. The power of word of mouse : an article on the power of online customer options 3. Haier : an article about the history of a Chinese Company. 4. What kind of company Culture would suit you ? reading answering a quiz. **Lab Activities(Speaking) :** 1.Self Introduction. 2. Describing jobs ; asking other people about their jobs. 3. Asking about the history of a company ; past simple questions 4. Asking questions about companies and jobs. **Lab Activities(Listening) :** 1. Being a PA 2. Growing Pains : an interview with a business consultant about company's Growth. 3. Describing changes in a company : a Conversation on the phone.	**CO-1 BTL-2**
MODULE 2 : English for Marketing	**(6L+3P)**
Grammar: 1. Concord - Understanding Subject Verb agreement – Identifying the error and Correcting 2. Active and Passive Voice – Identifying the voices and Transforming Active to passive and passive to active 3. Modal Verbs – Using to express modalities – in active and passive voices 4. Words to Describe causes and effects. 5. Prepositions	**CO-2 BTL-3**

Vocabulary : 1. Vocabulary to describe objects; component parts, shapes, dimensions, materials Describing problems with equipment 2. Verbs to Describe process 3. Vocabulary to talk about advertising and marketing, Language to describe cause and effect. **Writing :** 1. Topic Sentence 2. Paragraph Writing 3. Developing a story with the hints 4. Promotional letter(Email) **Reading :** Product Description and Advertisement : 1. Problems with equipment : emails and headings on a form. 2. Waratah : an article on an Australian clothing company. , Short Texts : Notices, Notes and messages 3. Selling your product abroad; an article , Workplace signs and notices 4. Descriptions of advertising media, Singapore airlines; an article on the branding of an airline. **Lab Activities(Speaking) :** 1.Role Play – Telephone call to a supplier, 2. Describing Objects **Lab Activities(Listening) :** 1. Describing dimensions of products : Conversations with colleagues and suppliers. – The Gizmo game : listening to the uses of a gadget. 2. Channel No.5 : an interview about a production process 3. Telephone conversations : information about orders and deliveries. 4. Descriptions of how a product is advertised.	
MODULE 3 : Business Correspondence	**(6L+3P)**
Grammar : 1. Tenses – Present continuous for future arrangements; will and going to future forms 2. Using discourse markers ; Sentence starters - Contrast & similarity words, 3. Degrees of Comparison – Framing sentences with appropriate adjectives and adverts – transformation from one degree to another degree. 4. Infinitives and gerunds – using infinitives and gerunds in sentences as different elements. 5. Conditionals – Three types of conditionals **Vocabulary :** 1.Vocabulary for travel 2. Synonyms and Antonyms 3. Employment Vocabulary **Writing :** 1. A letter(Email) of invitation – Accepting the invitation and declining the invitation. **Reading :** Transport, Working Holidays and Conferences : Travel Arrangements : notices and short messages : Eurostar : an article on train travel. 2. Netflix : an article about a company's holiday policy; thinking outside the box: an article on offsite meetings 3. Short Texts : Feedback on conferences **Lab Activities(Speaking) :** Discussion: How to make decisions **Lab Activities(Listening) :** 1. Making and changing appointments : Voicemail messages and phone conversations ; Future intentions and predictions : Short Extracts. 2. A travel Anecdote 3. Half Holidays: a conversations between two employees. 4. Discussing possible venues for a conference : a conversation between colleagues; a welcome speech at a conference.	**CO-3** **BTL-3**
MODULE 4 : English for Business Relationships	**(6L+3P)**
Grammar : 1. Writing Instructions and Recommendations – Transforming instruction to recommendation and recommendation to instruction 2. Expressions of quantity – semi-negative words 3. Present Perfect : time expressions : present perfect versus Past simple. 4. Reported Speech – Direct and Indirect Speeches – Identification and Transformation **Vocabulary :** 1. Affixes 2. Countable and Uncountable nouns 3. Global Management **Writing :** 1.Memo 2. Notice with agenda 3. Email : Requesting information **Reading :** Corporate gift-giving, New places, New people, Team Building and Thinking globally : 1. Career Advice : letters to an advice column 2. Promotional gifts : an article 3. Descriptions of team building events; Kaizen : an article 4. Global HR management : an Article. **Lab Activities(Speaking):** Role Play : 1. Interviewing someone about a job change 2. Discussion : Planning a team building event 3. Promoting a city : giving a speech. **Lab Activities(Listening) :** 1. An interview with someone who has changed career 2. An interview about corporate gift giving 3. Creating good teams : a Presentation 4. Working an international Team : short Extracts.	**CO-4** **BTL-3**
MODULE 5 : English for Presentation	**(6L+3P)**
Grammar : 1. Adjectives and adverbs 2. Pronouns and Reference Words 3. Types of Sentences – Simple, Compound and complex Sentences – Identification and transformation. **Vocabulary :** 1. Describing Trends 2. Finance Vocabulary 3. Stocks and Shares 4. Collocation - sets and money **Writing** : 1. Transcoding – Converting an image (Linegraph, piechart, bar chart, flowchart tree diagram etc.,) into a paragraph – Converting a paragraph into an image(Linegraph, piechart, bar chart, flowchart tree diagram etc.,) 2. Summary writing **Reading :** Describing Statistics, Company finances, investments and starting up : 1. Interpreting bar charts 2. Café Coffee day : an article on the growth of the Indian coffee shop. 3. Shares and the stock exchange: a web page; short articles from the financial news; men and women	**CO-5** **BTL-4**

investments : an article 4. Teenage entrepreneus : reading and comparing two articles; Kalido: an article on funding. **Lab Activities(Speaking) :** 1. Describing figures and trends 2. Discussing qualities needed in candidates for a job vacancy **Lab Activities(Listening) :** 1. Listening to statistical information : short extracts 2. An interview with the employee of a company that helps failing business 3. An interview with someone who works in investor relations. 4. Radio interview : marketing director of a business support service.	

TEXT BOOK	
1	Whitby, Norman (2019). Cambridge English Business Benchmark, Pre-intermediate and Intermediate. Cambridge University Press. India (Pages 208)
REFERENCE BOOKS	
1.	Murphy, Raymond(2021). Essential English Grammar, Cambridge University Press. India (Pages 300)
2.	Redman, Stuart(2020).English Vocabulary In Use: Pre - Intermediate And Intermediate. Cambridge University Press. India (Pages 264)
3.	Bikram K. Das. et al.,(2019) An Introduction to Professional English and Soft Skills with audio CD, Cambridge University Press. India (Pages 272)
4.	John, Dolly., (2018), English for Life and the Workplace Through LSRW&T Skills, Pearson Publications.India (Pages 263)
E BOOKS	
1.	https://www.cambridge.org/gb/files/9116/4138/4615/A1_Student_Book.pdf
2.	https://www.cambridge.org/gb/files/1416/4138/4681/A1_Workbook.pdf
3.	https://www.cambridge.org/gb/files/7216/4138/1999/A2_Student_Book.pdf
4.	https://www.cambridge.org/gb/files/6816/4138/2072/A2_Workbook.pdf
MOOC	
1.	https://www.edx.org/professional-certificate/tsinghuax-english-communication-skills
2.	https://www.britishcouncil.org.tr/en/english/mooc/english-for-the-workplace

COURSE TITLE		**PERSONALITY DEVELOPMENT & SOFT SKILLS**			**CREDITS**	**2**
COURSE CODE		**GLS51002**	**COURSE CATEGORY**	**HS**	**L - T – P – S**	**2 – 0 – 1 – 1**
Version	**1.0**	**Approval Details**	**35th ACM**		**LEARNING LEVEL**	**BTL – 4**

ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**	**Theory**	**Practical**
15 %	**15 %**	**10 %**	**5 %**	**5 %**	**25 %**	**25 %**

Course Description	This course teaches the learners LSRW Skills which is needed in today's global workplace together with essential business vocabulary & grammar. It equips them to communicate effectively and at professional and social scenario which in turn makes them confident individuals. This course would help them to appear for Cambridge Certification and add value to their profile and validate their language proficiency.

Course Objective	1. To acquire self-confidence by which the learner can improve upon their informative listening skills by an enhanced acquisition of the English language. 2. To provide an environment to Speak in English at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate. 3. To equip the students to Read, comprehend and answer questions based on literary, scientific and technological texts. 4. To enhance the writing skills of the students via training in instructions, recommendations, checklists, process-description, letter-writing and report writing. 5. To equip the learners in analyzing and applying creative thinking skills and participate in brainstorming, mind-mapping, audio visual activities and excel in employability skills.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the ability to construct the grammatically correct sentences with accuracy and syntax structures. 2. Integrating various components of English Language and determining it through reading and listening. 3. Analyze and transcode data, construct different types of written essays, read complex passages and summarize ideas, create personal profiles in the form of a resume. 4. Organize and articulate ideas, concepts, and perceptions in a comprehensive manner in written business correspondence, and speaking in formal and informal situations. 5. Infer details about presentation skills and implementing it in various professional situations.

Prerequisites: Plus Two English-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9	PO 10	PO11	PO12	PS O1	PS O2
CO1	-	-	-	-	-	-	-	1	0	3	1	2	1	1
CO2	-	-	-	-	-	-	-	1	0	3	2	2	1	2
CO3	-	-	-	-	-	-	-	2	0	2	1	2	2	1
CO4	-	-	-	-	-	-	-	2	2	3	2	2	1	2
CO5	-	-	-	-	-	-	-	1	0	3	3	2	1	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : ATTITUDE	**(6L+3P)**
Grammar : 1. Countable and uncountable nouns 2. Asking questions 3. Expressing likes 4. Introducing reasons 4. Talking about large and small differences. 5. Expressing Results **Vocabulary :** 1. Recruitment Brochure : ability, certificate, course, etc., 2. Work, job, training course. 3. Job Responsibilities 4. Staff, Employee, member of Staff. 5. Phrases expressing enthusiasm 6. Adjective Forms **Writing :** 1. Report Writing – Staff Training Report 2. A Website entry 3. A short Email and an Email of a job application. **Reading :** Articles on Human Resources **Soft Skills And Employability Skills (LAB) : ATTITUDE :** The power of positive thinking – Positive self talk – self-esteem and positive attitude who Am I ? Attitude in the workplace – Building a positive attitude – Testing your attitude – Adaptability	**CO-1 BTL-2**
MODULE 2 : GOAL SETTING	**(6L+3P)**
Grammar: 1. Infinitive or verb + ing, 2. Prepositions in phrases describing trends 3. Formal requests 4. First and Second conditionals. 5. Phrases followed by a Verb + ing. **Vocabulary :** 1. Word related to marketing (Launch, Play, Find out, Learn, Know, etc.,) 2. Revenue outcome 3. Adjective – noun collocations, 3. Last and latest **Writing :** 1. A marketing Report 2. Email giving information – making an enquiry – answering enquiries – correcting information – confirming terms 3 Memo Writing **Reading :** Articles on Marketing **Soft Skills And Employability Skills (LAB): GOAL SETTING:** What is goal ? - What are SMART goals? - How does SMART goal setting work? - Goals as commitment – Useful Guideline for goal setting – Trying personal and professional goals – Goals at the workplace – Cascading goals – Types of goals	**CO-2 BTL-3**
MODULE 3 : TIME MANAGEMENT	**(6L+3P)**

Grammar : 1. Prepositions in time phrases 2. Making recommendations 3. Phrases signaling parts of a presentation 4. Can and could **Vocabulary :** 1. Financial Terms 2. Rising finance 3. Noun Phrases connected with starting companies 4. Assets, collateral etc., **Writing :** Formal Letter : 1. A letter of enquiry 2. Proposal Writing **Reading :**Articles on Entrepreneurship **Soft Skills And Employability Skills (LAB): TIME MANAGEMENT** : What is time management? Prioritization – Time stressors – Time stealers – Time management - Eisenhower Matrix– Strategies for effective time management – productivity pyramid – The four Ds of time management	**CO-3** **BTL-3**
MODULE 4 : EMOTIONAL INTELLIGENCE	**(6L+3P)**
Grammar : 1. Referencing 2. Using the Passives to express opinions and ideas. 3. Relative Clauses **Vocabulary :** 1. Collocations describing reasons for meetings, 2. Collocations with meeting 3. Crucial, priceless, etc., **Writing :** Arranging to travel; an email agreeing to a request and making suggestions – giving instructions – about a business trip – announcing a job opportunity. . 2. A letter informaing about a new service – complaint, **Reading :** Articles on Business abroad **Soft Skills And Employability Skills (LAB): EMOTIONAL INTELLIGENCE :** What is Emotional Intelligence ? Enhancing your emotional self-awareness, - Emotional intelligence and change management – unfreezing the old, re-freezing the new – change and stress – emotional intelligence and crisis management.	**CO-4** **BTL-3**
MODULE 5 : LEADERSHIP	**(6L+3P)**
Grammar : 1. Using the Definite Article 2. Expressing Causes 3. Reporting verbs and reported speech 4 Third Conditional(Imaginary) **Vocabulary :** 1. Verb – Noun collocations 2. Issues, impact, etc., 3. Way or method 4. Words and phrases expressing numbers. **Writing** : Mail arranging a meeting , introducing a company and asking for information – giving suggestions 2. A memo asking for suggestions 3. A proposal for out sourcing. **Reading :** Articles on Change in Business **Soft Skills And Employability Skills (LAB): LEADERSHIP :** Qualities of a leader – Leadership and assertiveness – problem –solving and decision-making – Approaches to problem – solving and decision-making – Brainstorming – Cause-and-effect analysis	**CO-5** **BTL-4**

TEXT BOOKS	
1	Brook-Hart, Guy (2019). Cambridge English Business Benchmark, Upper Intermediate. Cambridge University Press. India (Pages 208)
2.	Pillai, Sabina. Fernandez, Agna (2018). Soft Skills and Employability Skills. Cambridge University Press. India. (Pages 208)
REFERENCE BOOKS	
1.	Murphy, Raymond (2019). Intermediate English Grammar. Cambridge University Press. India. (Pages 350)
2.	Barnes, D., (2020). Exploratory talk for learning in Mercer, N. and Hodgkinson, S. (eds) Exploring Talk in School. London: Sage Publications. (Pages 208)
3.	Dhanavel. S P (2018). English and Soft Skills. Orient BlackSwan. India. (Pages 136)
4.	Goldsmith, Marshall & M.S. Rao (2020) Soft Skills: Enhancing Employability. Dreamtech Press. India (Pages 256)
E Books	
1	https://www.pdfdrive.com/basic-english-grammar-with-exercises-e12486779.html
2	http://dspace.vnbrims.org:13000/jspui/bitstream/123456789/4733/1/Leadership%20The%20Power%20of%20Emotional%20Intellegence.pdf
MOOC Courses	
1	https://www.edx.org/professional-certificate/ritx-communication-skills
2	https://www.coursera.org/specializations/people-and-soft-skills-for-professional-success

COURSE TITLE	PROGRAMMING FUNDAMENTALS USING C			CREDITS	3	
COURSE CODE	ECS51009	COURSE CATEGORY	ES	L-T-P-S	2- 0- 2- 2	
VERSION	1.0	APPROVAL DETAILS	36th ACM	LEARNING LEVEL	BTL-5	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	To introduce computers and programming in C and also explore the power of computational techniques that are currently used by engineers and scientists and to develop programming skills with reasonable complexity.
Course Objective	1. To acquire the basic knowledge in computer hardware, programming languages and Problem-solving techniques. 2. To learn the fundamentals of C programming. 3. To gain knowledge in Functions, arrays and strings in C programming. 4. To understand the pointers, Structures and Union in C programming 5. To gain knowledge on Embedded Programming and real time applications of C Programming.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basics of digital computer and programming languages. 2. Demonstrate problem solving techniques using flowchart, algorithm/pseudo code to solve the given problem. 3. Design and Implement C program using Control Statements and Functions. 4. Design and Implement C program using Pointers and File operations. 5. Identify the need for embedded C and C Programming in real-time applications.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	2	2	-	-	2	-	2	-	-	1	2	2	1
CO-2	3	3	3	2	2	1	-	2	2	1	-	1	1	2
CO-3	3	3	3	2	2	2	-	1	3	3	2	1	2	1
CO-4	3	3	3	2	-	-	-	-	-	-	1	-	2	2
CO-5	1	1	1	-	1	2	-	1	-	-	-	2	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: PROGRAMMING LANGUAGES AND PROBLEM-SOLVING TECHNIQUES (6L+ 6P)

Introduction – Fundamentals of digital computers - Programming languages -Programming Paradigms – Types of Programming Languages – Language Translators – Problem Solving Techniques: Algorithm – Flow Chart - Pseudo code. **Practical Component** Draw Flowcharts using E- Chart & Write pseudo code for the following problems 1. Greatest of three numbers 2. Sum of N numbers 3.Computation of nCr	**CO-1** **BTL-4**

Software Required: GCC **Suggested Readings:** https://www.simplilearn.com/tutorials/programming-tutorial/problem-solving-in-programming	
MODULE 2: FUNDAMENTALS OF C	**(6 L+ 6 P)**
Evolution of C -Why C language - Applications of C language - Data Types in C – Operators and Expressions – Input and Output statements in C – Decision Statements – Loop Control Statements. **Practical Component** 1. Program to illustrate arithmetic and logical operators 2. Program to read and print data of different types 3. Program to calculate area and volume of various geometrical shapes 4. Program to compute biggest of three numbers 5. Program to print multiplication table 6. Program to convert days to years, months and days 7.Program to find sum of the digits of an integer **Software Required**: GCC **Suggested Readings:** https://www.w3schools.com/c/c_intro.php	**CO-2** **BTL-4**
MODULE 3: FUNCTIONS, ARRAYS, STRINGS	**(6 L+ 6 P)**
Functions – Storage Class – Arrays – Strings and standard functions - Pre-processor Statements. **Practical Component:** 1. Program to compute Factorial, Fibonacci series and sum of n numbers using recursion 2. Program to compute sum and average of N Numbers stored in an array 3. Program to sort the given n numbers stored in an array 4. Program to search for the given element in an array 5. Program to do word count 6. Program to insert a substring in a string 7. Program to concatenate and compare two strings 8.Program using pre-processor statements **Software Required**: GCC **Suggested Readings:** https://cppguide.readthedocs.io/en/latest/cpp/array.html	**CO-3** **BTL-4**
MODULE 4: POINTERS, STRUCTURES AND UNION	**(6 L+ 6 P)**
Pointers – Dynamic Memory allocation – Structure and Union – Files. **Practical Component** 1. Program to compute sum of integers stored in a 1-D array using pointers and dynamic memory allocation 2. Program to read and print records of a student/payroll database using structures 3. Program to simulate file copy 4. Program to illustrate sequential access file 5.Program to illustrate random access file **Software Required**: GCC **Suggested Readings:** https://www.ibm.com/docs/en/zos/2.4.0?topic=types-structures-unions	**CO-4** **BTL-4**
MODULE 5: APPLICATIONS OF C	**(6L+ 6P)**
Structure of embedded C program - Data Types - Operators - Statements - Functions - Keil C Compiler. Game development using c - Analysing the environment - Snake game - Tic-Tac-Toe - flappy bird. **Practical component**: Simple programs using embedded C-Game Development using C **Software Required**: GCC **Suggested Readings:** https://www.interviewbit.com/blog/applications-of-c-programming-language/	**CO-5** **BTL-4**

TEXT BOOKS	
1.	Ashok Kamthane, “Computer Programming”, Pearson Education, 7th Edition, Inc 2017.
2.	Mark Siegesmund, "Embedded C Programming", first edition, Elsevier publications, 2014.

3.	Robert Marmelstein, “Programming Games in C”
REFERENCE BOOKS	
1.	Jeyapoovan T, “Fundamentals of Computing and Programming in C”, Vikas Publishing house, 2015.
2	Yashavant Kanetkar, “Let us C”, 15th edition, BPP publication, 2016.
3	S. Sathyalakshmi, S.Dinakar, “Computer Programming Practicals – Computer Lab Manual”, Dhanam Publication, First Edition, July 2013.
E BOOKS	
1.	https://en.wikibooks.org/wiki/C_Programming
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc18-cs10/preview
2.	http://nptel.ac.in/courses/106105085/2
3.	https://www.udemy.com/c-programming-for-beginners/
4.	https://www.coursera.org/specializations/c-programming

COURSE TITLE	**PROGRAMMING IN PYTHON**				**CREDITS**	**3**
COURSE CODE	**ECS51010**	**COURSE CATEGORY**		**ES**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**		**36th ACM**	**LEARNING LEVEL**	**BTL- 5**
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee “DEC”**	**Attendance**	**Theory**	**Practical**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	Computer programming skills are now becoming part of basic education as these skills are increasingly of vital importance for future job and career prospects. The Python programming language which is one of the most popular programming languages worldwide. The course shows how to use the free open-source Python to write basic programs and high-level applications. This course is offered as a Theory Integrated Practical course by practicing Project Based Learning (PBL), emphasizing learning by doing, where the objective is to provide the students with the required hands-on exercises / projects that complements the theoretical understanding of the subject matters. The assessment is through the combination of written tests as well as practical through projects.					
Course Objective	**The course should enable the students** 1. To introduce basic concepts of Python programming language as well as common packages and libraries. 2. To generate an ability to design, analyze and perform experiments on real life problems using python.					
Course Outcome	**Upon completion of this course, the students will be able to** 1. Comprehend basic concepts in python. 2. Write python program to solve scientific, mathematical problems 3. Develop modular programs using functions and use data structures					

	4. Use toolboxes/ libraries and design simple algorithms using Python to solve real time applications

Prerequisites:

CO, PO AND PSO MAPPING

CO - PO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	-	2	-	3	-	-	-	-	-	-	2	1	-
CO-2	3	3	3	-	3	-	-	-	-	-	-	2	-	1
CO-3	3	3	3	-	3	-	-	-	-	-	-	2	1	-
CO-4	3	3	3	3	3	-	-	1	2	2	2	2	-	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: PYTHON FUNDAMENTALS	**(6L+ 6P)**
Introduction to python and its applications. Installation of Python and setting up a programming environment such as Anaconda and Spyder Python Basics: Variable and variable types, Booleans, Numbers: integers, floats, fractions, complex numbers, basic operators (arithmetic, relational, logical, membership, identity) **Practical component:** • Solve simple mathematical expressions using python • Perform type conversion **Suggested Readings:** • 10 Reasons to Learn Python Programming Language in 2022 • Learning Python: From Zero to Hero	**CO-1** **BTL-3**
MODULE 2: STRINGS, LISTS, TUPLES	**(6L+ 6P)**
Strings, lists, tuples, sets, dictionaries. bytes and byte arrays, manipulating variables, indexing, slicing, String methods, list methods, list slicing, set methods, in built python functions, input and output functions **Practical component:** • Perform string manipulation • Data sorting using lists • Write functions for data handling **Suggested Readings:** • Python programming for beginners	**CO-2** **BTL-5**
MODULE 3: CONTROL STATEMENTS, LOOP AND FILE HANDLING	**(6L+ 6P)**
If, else, else if statements, for loops, range function, while loops, List comprehensions, functions in python. Introduction to OOP, Classes, Objects, Reading and writing files **Practical component:** • Write a python program using control statements • Develop objects and classes in python • Work with files for specific applications **Suggested Readings:** • Python programming for beginners	**CO-2** **BTL-5**
MODULE 4: PYTHON LIBRARIES	**(6L+ 6P)**
Installing of different libraries, packages or modules. Basic concepts of the following libraries: NumPy, Matplotlib, Pandas, SciPy libraries **Practical component:** • Python programming using libraries **Suggested Readings:** • The Python Bible	**CO-4** **BTL-5**

MODULE 5: CASE STUDIES	(6L+ 6P)
Case Studies using Python: 1. Solving a linear differential equation using SciKit and plotting the result in matplotlib. 2. Image processing and manipulation and auto detection of any object based on color. 3. Python programming for an Arduino/ Raspberry PI 4. Machine Learning application using python 4. Case study that uses Python to solve department specific problems. **Practical component:** • Mini Project / Case studies **Suggested Readings:** • Python at Netflix	**CO-4** **BTL- 5**

TEXTBOOKS	
1	Dr. R. NageswaraRao (2018). *Core Python Programming*, Dreamtech Press, Second Edition
2	M.T. Savaliya and R.K. Maurya (2018). Programming through Python, StarEdu Solutions
REFERENCE BOOKS	
1	Python Crash Course: A Hands-On, Project-Based Introduction to Programming (2nd Edition)
2	Head-First Python: A Brain-Friendly Guide (2nd Edition)
E BOOKS	
1	https://devfreebooks.github.io/python/
MOOC	
1	"The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/

COURSE TITLE	**ENGINEERING GRAPHICS AND COMPUTER AIDED DESIGN**			**CREDITS**	**3**
COURSE CODE	**EME51001**	**COURSE CATEGORY**	**ES**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/Observation / lab records and viva as approved by the DEC**	**Surprise Test/ Quiz etc., as approved by the DEC**	**Attendance**	**ESE (Theory + Practical)**
15%	**15%**	**10%**	**5%**	**5%**	**25% + 25%**
Course Description	This course broadly introduces the mechanical design using computer aided design tools and fundamentals of free hand sketching. It prepares the students to learn the basic concepts involved in technical drawing and computer graphics. It also emphasis on the principles of projections and visualization of part drawing.				
Course Objective	1. To demonstrate the concepts of Engineering graphics and projection of straight lines using CAD software 2. To visualize the solids in various orientations and to draw its projections 3. To comprehend the concepts of isometric projections 4. To draw the development of solid surfaces and to generate associated views of civil drawings. 5. To visualize and draw views of the object by free hand sketch and to transform 3D models to 2D drawings using CAD tools				

Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the concepts of Engineering graphics and projection of straight lines using CAD software. 2. Apply the acquired knowledge to solve simple problems of regular solids. 3. Create solid objects in isometric view using CAD software 4. Develop the simple solids and to sketch the plan and elevation of the building drawings. 5. Visualize the objects and to draw by free hand sketching.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PS O-1	PS O-2
CO-1	2	1	-	-	1	-	-	1	1	1	-	2	2	1
CO-2	2	1	-	-	2	-	-	1	1	2	-	2	1	-
CO-3	2	2	2	-	2	-	-	2	2	2	-	2	1	2
CO-4	3	2	2	-	3	-	-	2	2	2	-	2	1	-
CO-5	3	1	2	-	-	-	-	1	2	2	-	2	-	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BASICS OF ENGINEERING GRAPHICS	**(6L + 6P)**
Relevance of Graphics in Industry - BIS conventions and specifications - drawing sheet sizes - Lettering – Dimensioning - Scales. Drafting methods - Introduction to Computer Aided Drafting –Exposure to Solid Modelling software – Printer and Plotter – 3D printer. Introduction to Orthographic projections - Naming views as per BIS - First angle projection method. Projection of points and projection of Straight lines. ***Suggested Reading:*** *Solid modelling Software commands*	**CO-1** **BTL-2**
MODULE 2: PROJECTION OF SOLIDS	**(6L + 6P)**
Projections of solids. Solids in simple positions and axis inclined to one plane only. Section of solids. Section planes inclined to Horizontal Plane only. True shape of the section. (Manual and CAD Drawing) ***Suggested Reading:*** *Solids inclined to both the planes. Section of solids with sectional planes inclined to VP.*	**CO-2** **BTL-2**
MODULE 3: ISOMETRIC PROJECTION	**(6L + 6P)**
Concepts of isometric projection. Isometric scale, Isometric view of simple solids with sectional planes. (Manual and CAD Drawing) ***Suggested Reading:*** Isometric view of solids with multiple sectional planes.	**CO-3** **BTL-3**
MODULE 4: DEVELOPMENT OF SURFACES AND CIVIL DRAWING	**(6L + 6P)**
Development of Surfaces of simple solids with simple sectional planes. Parallel line method and Radial line method only. (Manual and CAD Drawing) Civil Drawing: PLAN and ELEVATION of Simple residential building. (Manual and CAD Drawing) ***Suggested Reading:*** *Development of Sphere, Sectional elevation of building drawing*	**CO-4** **BTL-2**
MODULE 5: FREE HAND SKETCHING	**(6L + 6P)**
Visualization concepts and Free Hand sketching: Visualization principles —Representation of Three-Dimensional objects — Pictorial Projection methods - Layout of views- Conversion of pictorial views to orthographic view. ***Suggested Reading:*** *Orthographic views to pictorial views*	**CO-5** **BTL-3**

TEXT BOOKS

1.	Jeyapoovan, T., Engineering Graphics and Design, Vikas Publishing House Pvt Ltd., New Delhi, 8th Edition, 2022.
2.	P. Kannaiah, K. L. Narayana, K. Venkata Reddy, A Textbook on Engineering Drawing, BS Pub, 2016.
REFERENCE BOOKS	
1.	Alf Yarwood, Introduction to AutoCAD – 2D and 3D Design, Newnes Elsevier, 2011
2.	Bhatt N.D and Panchal V.M, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House, 2019.
3.	Kirstie Plantenberg, Engineering Graphics Essentials, SDC Publications., fifth Edition, 2016.
E - Books	
1.	https://www.amazon.in/Technical-Drawing-Engineering-Graphics-International-ebook/dp/B00IZ0FZHA
MOOC	
1.	http://nptel.ac.in/courses/112103019/
2.	https://nptel.ac.in/courses/112102304/

COURSE TITLE	**DESIGN THINKING**			**CREDITS**	**3**
COURSE CODE	**EGE51002**	**COURSE CATEGORY**	**ES**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment	**Second Periodical Assessment**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	***Design***, in a typical engineering context refers to the ***detailed plans & schemes*** developed through the application of best engineering practices for creating new products and systems. ***Design thinking, in this relevance, is the systematic methodology currently being adopted in industries and organizations for evolving optimal designs with innovative design approaches and strategies.*** In essence, it is truly about understanding a problem in an overall perspective taking into consideration of the customer needs, technology, businesses, environmental impact, safety and developing solutions. The design thinking methodology is essentially an iterative approach with cross-functional teams and adopted to wide ranging organizations right from engineering industries to service sectors. Hence this methodology is universal, holistic and non-domain centric. It opens a new world of

	problem-solving possibilities and helps the organizations to create new and innovative products, services, and processes. The design thinking course offered at our university is well structured with good numbers of case studies and projects which makes the new and innovative concepts discussed in lecture hours get assimilated in the minds of students. This course is intentionally offered in the very first semester for all undergraduate engineering branches to make the students understand this new philosophy of the design thinking process and adopt the guidelines for their project works they take up in subsequent semesters including start-up projects.
Course Objective	1. Inculcate the fundamental concepts of design thinking in students 2. Learn the different phases of design thinking 3. Use design thinking methods in every stage of the problem 4. Apply various methods of design thinking to different problems
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the critical methods of design, systems thinking and key concepts of design thinking. 2. Understand the diverse methods employed in design thinking and establish a workable design thinking framework to use in their practices 3. Practice design thinking in all stages of problem solving. 4. Apply design thinking approach to real world problems 5. Conceive, organize, lead and implement projects in interdisciplinary domain and address social concerns with innovative approaches

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	1	1	2	1	2	2	2	1	1	-	2	1	1
CO-2	1	1	1	1	2	3	3	2	2	2	-	2	2	3
CO-3	1	1	2	1	2	3	3	2	3	3	2	2	3	3
CO-4	2	2	2	2	2	3	3	2	3	3	-	2	3	3
CO-5	2	1	2	2	2	3	3	2	3	3	2	2	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(6L + 6P)**
Design process: Traditional design, Design Requirements, Design approach and Strategies. Design Thinking Concept for Innovative Design - Breaking of patterns, Reframe existing design problems, Principles of creativity. Elements of Design Thinking - Design Thinking Phases: Empathize (Customer Needs), Define, Ideate, Prototype, Testing and Implementation. Design Thinking Frameworks. Design Thinking Team. **Practical Case Studies:** Enhancing the User Experience of a Digital Platform: Choose a popular digital platform or application and ask students to analyze its strengths and weaknesses from a user experience perspective. ***Examples: Redesigning the platform's interface, functionality, or features to enhance usability, accessibility, and overall user satisfaction***.	**CO-1 BTL-3**
MODULE 2: UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM	**(6L + 6P)**
Search field determination - Problem clarification - Understanding of the problem – Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs. **Practical Case Studies:** Redesigning a Medical Device: Focus on medical engineering by selecting a specific medical device or equipment used in healthcare settings. Students can explore	**CO-2 BTL-3**

opportunities to improve its functionality, ergonomics, ease of use, and patient experience through innovative design solutions. ***Examples: (i) Hand held Blood Glucose Testing Machine (ii) Blood Pressure Monitor***	
MODULE 3: IDEATION	**(6L + 6P)**
Ideation Phase - The creative process and creative principles - Principles of Decomposition, Association, Analogy & Confrontation, Abstraction & Imagination. Guide team - Personas with wide range of professional experiences, stronger collaboration dynamics. Creativity techniques – Intuitive creative techniques – brainstorming, Systematic Analytical techniques - SWOT Analysis, The 5 Whys iterative interrogative technique - Valuation of ideas. **Practical Case Studies:** Redesigning an Educational Environment: Focus on improving the learning experience within a specific educational institution or classroom. Students can explore innovative design solutions that enhance collaboration, engagement, and personalized learning while considering factors such as classroom layout, educational technology, and accessibility. ***Examples: (i) case study of Educational ERP (ii) Case study of Digital Learning Platform etc.***	**CO-3** **BTL-4**
MODULE 4: PROTOTYPING AND VISULIZATION	**(6L + 6P)**
Prototype Phase - Lean Startup Method for Prototype Development. Minimum Viable Product (MVP) – creation of MVPs, drawing and design models, wireframe, mockups, 3D Rapid prototyping. Visualization and presentation techniques. Visualization types – bar chart, pie chart, radar char, mind mapping, affinity diagram, force field analysis, semantic differential (polarity analysis). Presentation Techniques – story telling, creative collages, design scenarios. **Practical Case Studies:** Designing an Eco-Friendly Packaging Solution: With a growing concern for environmental sustainability, challenge students to design an eco-friendly packaging solution for a consumer product. They can explore alternatives to single-use plastics, optimize packaging materials and design for efficient production, transportation, and disposal. ***Examples: City Waste Segregation and consolidation Device (ii) Used Car Destruction and consolidation Device etc..***	**CO-4** **BTL-4**
MODULE 5: TESTING AND IMPLEMENTATION	**(6L + 6P)**
Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking. Design Activism – Designing tomorrow. Entrepreneurship/business ideas. Technology Reediness Level (TRL) – 9 Levels. **Practical Case Studies:** Designing Assistive Technologies for People with Disabilities: Encourage students to develop innovative solutions to improve the quality of life for individuals with disabilities. They can focus on designing assistive technologies such as prosthetics, mobility aids, communication devices, or sensory enhancements to address specific challenges faced by this user group. ***Examples: (i) Case study of patient assist mobile Robot (ii) Designing automated level control of overhead water tank etc.***	**CO-5** **BTL-4**

TEXT BOOKS

1.	Christian Mueller Roterberg, Handbook of Design Thinking, 2018.
2.	Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media Inc, 2017.

REFERENCE BOOKS

1	Idris Mootee, “Design Thinking for Strategic Innovation”, Wiley, 2013
2	Jeanne Liedtka and Tim Ogilvie, Designing for Growth: A design thinking tool kit for managers, Columbia university Press, 2011
3.	Hasso Plattner, Christoph Meinel and Larry Leifer, "Design Thinking: Understand – Improve – Apply", Springer, 2010

4	Tim Brown, “Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation”, Harper Collins, 2009
5	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press , 2009.
E RESOURCES FOR REFERENCE	
1	https://www.design-thinking-association.org/explore-design-thinking-topics/design-thinking-case-studies
2	https://makeiterate.com/design-thinking-case-studies/
3	https://www.toptal.com/project-managers/digital/a-design-thinking-case-study
4	https://venturewell.org/class-exercises
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc19_mg60/preview
2.	https://onlinecourses.swayam2.ac.in/aic19_de02/preview

COURSE TITLE	**ENGINEERING PRACTICE LAB (Common to All Branches)**			**CREDITS**	**2**
COURSE CODE	**EGE51406**	**COURSE CATEGORY**	**ES**	**L-T-P-S**	**0-0-4-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/ Observation / lab records and viva as approved by the DEC**	**Surprise Test/ Quiz etc., as approved by the DEC**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This course is specifically designed to give the students a clear understanding of the mechanical engineering design and its process.
Course Objective	**The course should enable the students to** 1. To Relate theory and practice of basic Mechanical and Civil Engineering. 2. To Learn basic concepts in Aeronautical and Automobile Engineering. 3. To Learn basic concepts in Electrical, Electronics, mechatronics and Computer Science.
Course Outcome	**Upon completion of this course, the students will be able to** 1. Identify the tools, and types of joints used in welding, carpentry and plumbing. 2. Perform basic fabrication in welding, carpentry and plumbing, to make simple joints/connections. 3. Make simple electrical and electronic circuit connections, and may assemble the hardware of a desktop computer. 4. Demonstrate the working of a mechatronics systems like CNC machine, Robot, Pneumatic circuits. 5. Demonstrate the working of a 3D printer and list its applications.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	-	2	-	1	-	-	-	-	-	-	2	1
CO-2	3	2	-	2	-	1	-	-	-	-	-	-	3	2
CO-3	3	2	-	2	-	1	-	-	-	-	-	-	2	1
CO-4	3	2	-	2	-	1	-	-	-	-	-	-	2	1
CO-5	3	2	-	2	-	1	-	-	-	-	-	-	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

LIST OF EXPERIMENTS with expected Learning outcome

Exp. No.	Experiment Name	CO / BTL
1	To Perform a Fillet/Groove weld in a Welding Simulator	CO 1 & BTL 3
2	To Fabricate a Butt joint/Lap Joint using Arc Welding	CO 1 & BTL 3
3	To make basic pipe connections in Plumbing using valves, couplings and elbows	CO 1 & BTL 3
4	To make a common joint using Carpentry	CO 1 & BTL 3
5	Assembling and Dismantling of a gasoline/Diesel Engine	CO 2 & BTL 3
6	Measurement of Force using a spring balance	CO 2 & BTL 3
7	To make an Electrical Wiring for extension box	CO 3 & BTL 3
8	Study of Active and Passive Components	CO 3 & BTL 3
9	To make simple circuit using Electronic Components	CO 3 & BTL 3
10	To Assemble a Desktop computer	CO 3 & BTL 3
11	To study the key elements of a Mechatronics system	CO 3 & BTL 3
12	Demo on linear actuator, using pneumatic circuit	CO 3 & BTL 3
13	Demo on Computerized Numerical Control (CNC) machine	CO 3 & BTL 3
14	Demo on a pick and place Robot	CO 3 & BTL 3
15	Demo on a 3D Printer	CO 3 & BTL 3

LIST OF EXPERIMENTS/TOOLS for 30 Students

1	Welding Rectifier – 5 Nos
2	Welding Simulator – 1 No.
3	Two Stroke Gasoline Engine – 1 No.
4	Spring balance – 5 Nos
5	PVC Pipes and its accessories – 5 sets
6	Saw, Planner, Chisel and its accessories – 5 sets
7	Extension box and its accessories – 5 sets
8	Electronic boards and its accessories – 5 sets
9	Active components – 5 sets
10	Passive components – 5 sets

11	Desktop Computer – 5 Nos
12	Linear Actuators and Pneumatic Kit– 1 Nos
13	Rotary Actuators and Pneumatic Kit– 1 Nos
14	CNC Machine – 1 No.
15	6 Axis Robot – 1 No.
16	3D Printer – 1 No.
REFERENCE	
1	Jeyapoovan T and Saravanapandian M., (2015),Engineering practices lab manual, Vikas publishing House, New Delhi, 4th Edition.
2	Hajra Choudhury S.K., Hajra Choudhury A.K. and Nirjhar Roy S.K.,(2008), "Elements of Workshop Technology", Vol.I ,Media promoters and publishers private limited, Mumbai.
3	Ibrahim Zeid (2011), CAD/CAM Theory and Practice, Tata McGraw-Hill Publishing Company Ltd., New Delhi.

COURSE TITLE	**FAB LAB FOR CORE ENGINEERING (Auto, Bio-Tech, Civil, Mech and Mechatronics)**			**CREDITS**	**2**
COURSE CODE	**EGE51408**	**COURSE CATEGORY**	**ES**	**L-T-P-S**	**0-0-4-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/Observation / lab records and viva as approved by the DEC**	**Surprise Test/ Quiz etc., as approved by the DEC**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	The Fab Lab is intended to promote 'Do It Yourself' (DIY) concept through various manufacturing/ prototyping methods to provide a comprehensive idea to the students about the product development and fabrication
Course Objective	**The course should enable the students to** 1. Introduce the concepts of innovation in engineering design 2. Introduce tools, equipment and methods of various fabrication techniques 3. Familiarize the 3D Printing 4. Hands on experience in design and fabrication
Course Outcome	**Upon completion of this course, the students will be able to** 1. Create different types of joints using welding and soldering process 2. Handle power tools for wood and metal fabrication process 3. Do 3D printing of simple objects 4. Use the Laser Cutting machine to fabricate the required shapes 5. Develop simple automation in pneumatics

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	1	2	1	-	-	-	-	-	-	1	2	2
CO-2	2	1	2	1	2	-	-	-	-	-	-	2	1	1
CO-3	1	1	2	2	1	-	-	-	-	-	-	1	2	2
CO-4	1	2	1	1	1	-	-	-	-	-	-	2	1	1
CO-5	2	1	2	2	2	-	-	-	-	-	-	1	2	2

1: Weakly related, 2: Moderately related and 3: Strongly related

LIST OF EXPERIMENTS with expected Learning outcome

Exp. No.	Experiment Name	CO / BTL
1	**Welding:** Create a BUTT Joint using Welding Process. **Software/Equipment Required:** Arc/MIG/TIG Welding Equipment Setup	CO 1 & BTL 3
2	**Welding:** Create a LAP Joint using Welding Process. **Software/Equipment Required:** Arc/MIG/TIG Welding Equipment Setup	CO 1 & BTL 3
3	**Welding:** Create a T Joint using Welding Process. **Software/Equipment Required:** Arc/MIG/TIG Welding Equipment Setup	CO 1 & BTL 3
4	**Soldering:** Prepare a simple voltage regulator circuit in general purpose PCB using soldering process **Software/Equipment Required:** Solder and basic electronic Components	CO 1 & BTL 3
5	**Power Tools:** Study of Power Tools available for fabrication process. **Software/Equipment Required:** Power tools for Mechanical operations like wood cutting tools, metal cutting tools, grinding machine, drilling machine and polishing machine– jig saw, hand held machine saw, angle grinder, drilling machine and polishing machine.	CO 2 & BTL 3
6	**Power Tools:** Make a wooden panel/wood frame using wood cutting tools **Software/Equipment Required:** Wood Cutting Tools	CO 2 & BTL 3
7	**Power Tools:** Make a Metal fabrications using power tools like grinding etc., **Software/Equipment Required:** Grinding Machine	CO 2 & BTL 3
8	**Drilling:** Make the design in metal plates using drilling process **Software/Equipment Required:** Drilling Machine with accessories	CO 2 & BTL 3
9	**3D Printer:** Generate a simple 3D model in CAD and 3D print the part. **Software/Equipment Required:** 3D Printer	CO 3 & BTL 3
10	**Laser Cutting:** Make a unique design and fabricate in acrylic sheets using laser cutting Process. **Software/Equipment Required:** Laser Cutting Machine	CO 4 & BTL 3
11	**Pneumatics:** Assemble the pneumatic components to activate a single acting cylinder. **Software/Equipment Required:** SMC Pneumatic Kit	CO 5 & BTL 3
12	**Pneumatics:** Assemble the pneumatic components to activate a Double acting cylinder. **Software/Equipment Required:** SMC Pneumatic Kit	CO 5 & BTL 3

TEXT BOOKS

1	Julia Walter-Herrmann, Corinne Büching, (2017). Fab Lab: Of Machines, Makers and Inventors, Transcript Verlag.

COURSE TITLE	OUTREACH (NCC)-LEVEL 1 (ARMY WING)			CREDITS	1
COURSE CODE	GGE51401	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4

Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.
Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets' immediate environment, and thereby enabling them for a brighter and progressive future.
Course Outcome	1. To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. 2. To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. 3. To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-2	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-3	1	2	1	1	-	2	1	3	2	3	3	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: NCC GENERAL	(6P)
NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2	**CO-1** **BTL-3**

MODULE 2: NATIONAL INTEGRATION AND AWARNESS	(6P)
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1	**CO-2** **BTL-3**

MODULE 3: PERSONALITY DEVELOPMENT.	(6P)
PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2	**CO-3** **BTL-3**
MODULE 4: LEADERSHIP	**(6P)**
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2	**CO-4** **BTL-3**
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	**(6P)**
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8 SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1	**CO-5** BTL-3

TEXT BOOKS	
1.	**NCC COMMON SUBJECT BOOK**
2.	**RED BOOK (ARMY SPECIAL SUBJECTS)**

COURSE TITLE	**OUTREACH (NCC)- LEVEL 1 (AIR WING)**			**CREDITS**	**1**	
COURSE CODE	**GGE51401**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**0-0-2-4**	
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**Theory**	**Practical**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.					

Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets' immediate environment, and thereby enabling them for a brighter and progressive future.
Course Outcome	1. To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. 2. To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. 3. To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-2	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-3	1	2	1	1	-	2	1	3	2	3	3	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: NCC GENERAL	**(6P)**
NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2	**CO-1** **BTL-3**
MODULE 2: NATIONAL INTEGRATION AND AWARNESS	**(6P)**
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1	**CO-2** **BTL-3**
MODULE 3: PERSONALITY DEVELOPMENT.	**(6P)**
PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2	**CO-3** **BTL-3**
MODULE 4: LEADERSHIP	**(6P)**
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2	**CO-4** **BTL-3**
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	**(6P)**
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8 SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1	**CO-5** BTL-3

TEXT BOOKS	
1.	NCC COMMON SUBJECT BOOK
2.	RED BOOK (ARMY SPECIAL SUBJECTS)

COURSE TITLE	OUTREACH (NCC)- LEVEL 1 (NAVY WING)			CREDITS	1
COURSE CODE	GGE51401	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.
Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets' immediate environment, and thereby enabling them for a brighter and progressive future.
Course Outcome	1. To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. 2. To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. 3. To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-2	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-3	1	2	1	1	-	2	1	3	2	3	3	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: NCC GENERAL (6P)

NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2	**CO-1** **BTL-3**
MODULE 2: NATIONAL INTEGRATION AND AWARNESS	**(6P)**
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1	**CO-2** **BTL-3**
MODULE 3: PERSONALITY DEVELOPMENT.	**(6P)**
PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2	**CO-3** **BTL-3**
MODULE 4: LEADERSHIP	**(6P)**
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2	**CO-4** **BTL-3**
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	**(6P)**
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8 SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1	**CO-5** BTL-3

TEXT BOOKS	
1.	**NCC COMMON SUBJECT BOOK**
2.	**RED BOOK (ARMY SPECIAL SUBJECTS)**

COURSE TITLE	**OUTREACH (NSS, Y's Men, Rotract)- LEVEL I**			**CREDITS**	**1**
COURSE CODE	**GGE51402**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**0-0-2-4**
Version	**1.0**	**Approval Details**		**LEARNING LEVEL**	**-**
ASSESSMENT SCHEME					
CIA					**ESE**
Volunteering	**Events attended**	**Awareness Programs attended**		**Attendance**	**Report Submission**

5%	25%	15%	5%	50%

Course Description	This course is designed to introduce students to the principles and practices of community service, social development, and active citizenship. The course aims to instill a sense of social responsibility and promote civic engagement among the participants. Through a combination of theoretical knowledge and practical experiences, students will develop essential skills and qualities required to make a positive impact on the community and society. Pre requisite: There are no specific prerequisites for enrolling in the NSS Semester 1 course. However, a genuine interest in community service, social development, and willingness to actively engage with diverse communities are essential.
Course Objective	1. To familiarize students with the objectives, history, and importance of the National Service Scheme (NSS) in community development, emphasizing the significance of social responsibility and civic engagement. 2. To develop essential leadership skills, teamwork, and effective project management techniques, preparing students to organize and execute community service projects successfully. 3. To cultivate empathy, compassion, and cultural sensitivity, enabling students to engage respectfully and effectively with diverse communities during their community service activities. 4. To promote environmental awareness and sustainable practices, encouraging students to integrate eco-friendly approaches into their community service initiatives. 5. To enhance students' communication, problem-solving, and decision-making skills, equipping them to engage with community members, stakeholders, and address challenges effectively.
Course Outcome	1. students will gain a comprehensive understanding of the objectives, history, and significance of the National Service Scheme (NSS) in promoting community development and social responsibility. 2. Participants will demonstrate the ability to identify and assess prevalent social issues and challenges in the community, laying the groundwork for effective community service initiatives. 3. Through practical experiences and workshops, students will develop essential leadership skills, teamwork, and project management techniques necessary for organizing and executing successful community service projects. 4. By engaging with diverse communities, students will cultivate empathy, compassion, and cultural sensitivity, fostering meaningful and respectful interactions during their service activities. 5. Upon completion of Semester 1, students will have improved their communication, problem-solving, and decision-making skills, empowering them to actively and effectively engage in community development and service projects.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-2	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-3	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-4	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-5	1	2	1	1	-	2	1	3	2	3	3	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related	
TOPICS TO BE COVERED	
1. Introduction to National Service Scheme (NSS) and its Objectives 2. Understanding Social Issues and Needs Assessment in the Community 3. Project Planning and Management for Community Service 4. Leadership Development and Teamwork 5. Cultural Sensitivity and Interacting with Diverse Communities 6. Communication and Problem-Solving Skills for Community Engagement 7. Environmental Conservation and Sustainable Practices 8. Health, Hygiene, and Community Well-being 9. The Role of Arts and Culture in Community Development 10. Reflecting on Community Service Experiences and Personal Growth **Suggest Activities** 1. **Community Cleanliness Drive:** Organize a cleanliness drive in the local community, involving students and residents in cleaning public spaces and creating awareness about cleanliness and waste management. 2. **Health Awareness Camp:** Conduct a health awareness camp where participants can provide basic health check-ups, distribute health-related information, and promote the importance of hygiene and sanitation. 3. **Environmental Conservation Project:** Initiate an environmental conservation project, such as tree planting, creating green spaces, or implementing recycling programs, to raise awareness about environmental issues. 4. **Teaching Assistance in Local Schools:** Collaborate with local schools to provide teaching assistance, conduct educational workshops, and help students with their studies. 5. **Empowerment Workshops:** Organize workshops for women, youth, or other marginalized groups to empower them with skills and knowledge relevant to their needs, such as vocational training or financial literacy. 6. **Cultural Exchange Program:** Arrange a cultural exchange event where NSS participants and local community members can share their traditions, dances, music, and food, fostering mutual understanding and appreciation. 7. **Blood Donation Camp:** Partner with local healthcare institutions to organize a blood donation camp to address blood shortages and raise awareness about the importance of donating blood. 8. **Community Survey and Needs Assessment:** Conduct a comprehensive community survey to understand the needs and priorities of the local residents, guiding the selection of future service projects. 9. **Awareness Campaigns:** Create awareness campaigns on critical social issues like gender equality, education, or substance abuse through street plays, posters, and interactive sessions. 10. **Disaster Preparedness Workshop:** Conduct workshops on disaster preparedness, including first aid training and emergency response, to equip the community with necessary skills. 11. **Senior Citizens' Engagement:** Plan activities and events to engage and support senior citizens, such as organizing social gatherings or providing assistance with daily chores. 12. **Digital Literacy Initiatives:** Set up digital literacy workshops to help community members, especially elders and underserved individuals, to learn basic computer and internet skills. 13. **Community Sports Event:** Organize a community sports event to promote fitness, teamwork, and community bonding. 14. **Skill Development Sessions:** Arrange skill development workshops in collaboration with local experts to teach practical skills like tailoring, painting, or handicrafts.	**(30P)**

15. **Awareness on Government Schemes:** Educate the community about various government schemes and programs that they may be eligible for, to ensure they can avail themselves of the benefits.	

REFERENCE BOOKS	
1	National Service Scheme Manual, Government of India.
2	Orientation Courses for N.S.S. Programme officers, TISS.
3	Case material as Training Aid for field workers, Gurmeet Hans.
4	National Service Scheme Manual, Government of India.
5	Training Programme on National Programme scheme, TISS.
6	Social Problems in India, Ram Ahuja
7	Social service opportunities in Hospitals, Kapil K. Krishan,TISS.

COURSE TITLE		**TAMIL**			**CREDITS**	**2**
COURSE CODE		**GLS51008**	**COURSE CATEGORY**	**HS**	**L - T – P – S**	**2 – 0 – 0 – 2**
Version	**1.0**	**Approval Details**	**36th ACM**		**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance	End Semester Examination ESE
15%	15%	10%	5%	5%	50%

Course Description	This Tamil course improves Tamil language skills of the students' Tamil letters and Grammar are included. This course provides an opportunity not only to get interest in learning Tamil Language but also, they can learn to converse easily.
Course Objective	1. By studying this course, students will be able to write and speak Tamil easily in any situation, daily life and daily conversations. 2. Develops language and interest in learning in students. 3. Facilitates students to create opportunities for themselves in the society. 4. Students also learn Tamil literature by developing interest in language department. 5. This lesson plan helps the students to learn about the culture by learning the Tamil language.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the Letters and basic words of Tamil Language which are in daily use 2. Develops the listening skills of Tamil language 3. Utilize the letters and common words of the language for communication 4. Develop the conversational skills 5.Demonstrate the skill of reading and writing

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-

CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-
CO5	-	-	-	-	-	-	-	-	2	3	2	3	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

அலகு - 1 தமிழ் எழுத்துக்கள் **(6 L)**	
தமிழ் எழுத்துகள் – ஓசைகள் - எண்கள் – வண்ணங்கள் – வடிவங்கள் - ஓர் எழுத்துச் சொற்கள் - பழங்கள் மற்றும் காய்கறிகள் – மலர்கள் – இயற்கை - மாதங்கள் சொற்கள் - பெயர்சொற்கள் – உரிச்சொற்கள் – வினைச்சொற்கள் – காலங்கள் - வாழ்த்துகள். வகுப்பறை செயல்முறைகள் : 1. வார்த்தைகளை வட்டமிடுதல். 2. விடுபட்ட எழுத்துகளை நிரப்புக. 3. வடிவங்களுக்கு வண்ணம் தீட்டுக.	CO-1 BTL-2
அலகு – 2 கேட்டல் மற்றும் உச்சரித்தல் **(6L)**	
உயிரெழுத்துகள், மெய்யெழுத்துகள் மற்றும் உயிர்மெய் எழுத்துகளை உச்சரித்தல் - சிறுகதைகள் வாசித்தல் – எதிர்ச்சொற்கள் - பொருள்தருக – வாக்கியத்தில் அமைத்து எழுதுதல் – ஒரு சொல்லில் விடையளித்தல். வகுப்பறை செயல்முறைகள் : 1. சொற்களைக் கேட்டு உச்சரிக்க செய்தல். 2. குழுவிவாதம் செய்தல். 3. கோடிட்ட இடங்களைச் சரியான சொற்களைக் கூறுதல்.	CO-2 BTL-2
அலகு -3 எழுத்துப் பயிற்சி **(6 L)**	
தமிழ் எழுத்துகளை எழுத கற்பித்தல் - உயிர் எழுத்துகள் - மெய் எழுத்துகள் - உயிர்மெய் எழுத்துகள் - ஆயுத எழுத்து – சார்பெழுத்துகள் – ஒற்றெழுத்துகள் - ஒரு சொல் - இருசொல் எழுதுதல் – ஒருவரி, இருவரி எழுதுதல். வகுப்பறை செயல்முறைகள்: 1. கோடிட்ட இடங்களை நிரப்புக. 2. சரியான எழுத்துகளை வட்டமிடுதல். 3. ஒருவரி சொற்களை எழுதுதல்.	CO-3 BTL-3
அலகு - 4 உரையாடல்கள் கற்பித்தல் **(6L)**	
சிறு உரையாடல்கள் கற்பித்தல் – வாழ்த்துக்கள் - வங்கியில் பணம் செலுத்துதல் - சந்தையில் கடைகாரரிடம் உரையாடுதல், பொது இடங்களில் உரையாடுதல். வகுப்பறை செயல்முறைகள்: 1. குறு நாடகங்கள் நடித்து உரையாடல்கள் கற்பித்தல். 2. விண்ணப்ப படிவங்கள் பூர்த்தி செய்தல். 3. மின்னல் அட்டைகள் காண்பித்தல்.	CO-4 BTL-2
அலகு - 5 தமிழ் வாசிக்க மற்றும் எழுத கற்பித்தல் **(6 L)**	
கடிதங்கள் வாசித்தல் மற்றும் எழுதுதல் – விண்ணப்ப கடிதம், வங்கிகணக்கு படிவங்கள், இரயில் முன்பதிவு விண்ணப்ப படிவம் பூர்த்திசெய்தல் - கவிதை வாசித்தல் – செய்திதாள் வாசித்தல். வகுப்பறை செயல் முறைகள்: 1. விண்ணப்ப படிவங்கள் பூர்த்திசெய்தல். 2. கவிதை வாசித்தல் போட்டிகள் 3. வகுப்பறை தேர்வுகள்	CO-5 BTL-3

TEXT BOOK

1.	Saidhai. P. Sundaramurthy (2018). Learn Tamil Through english. Manimekalai Prasuram. Chennai - 17. Pages 1 to 84
2.	Pulavar Kulanthai (2020). Students Basic Tamil. Manimekalai Prasuram. Chennai -17. Pages1 to 84

REFERENCE BOOKS	
1.	Lena tamil vanan. (2017). Easy Tamil Grammar. Manimekalai Prasuram, Chennai -17, Pages 11 to 21
2.	Tamilnadu Board - NCERT/CBSE-Books Class – 6th TO 9th (2021-2022)
E-REFERENCES	
1	https://cbsetamil.com/cbse-tamil-book/,https://tamil.examsdaily.in/tnpsc-tamil-ilakkanam-material-pdf-download

COURSE TITLE	HINDI				CREDITS	2
COURSE CODE	GLS51009		COURSE CATEGORY	HS	L - T – P – S	2 – 0 – 0 – 2
VERSION	1.0	APROVAL DETAILS	36th ACM		BTL LEVEL	3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"etc.,	Attendance	End Semester Examination ESE
15%	15%	10%	5%	5%	50%

Course Description	This course has been designed to develop the regional language skills of the students. The course includes Hindi language, literature, vocabulary and grammar. This course teaches students how to communicate accurately, appropriately and fluently in regional language.
Course Objective	1. To provide an environment to Speak and write in Hindi at the formal and informal levels and use it for daily conversation, presentation, group discussion and debate. 2. To equip the students to Read, comprehend and answer questions based on literary texts. 3. To help student to become sensitive to the requirements of the society and respond to it in a constructive way. 4. To provide an environment to students to read and appreciate the literature.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the ability to write the grammatically correct sentences with accuracy. 2. Integrating various components of Hindi Language and determining it through reading and listening. 3. Organize and articulate ideas, concepts, and perceptions in a comprehensive manner in written correspondence, and speaking in formal and informal situations. 4. Infer details from after listening and reading and implement it in various professional situations. 5. Develop writing and speaking skills.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO -9	PO 10	PO 11	PO 12	PS O1	PS O2	
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-	
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-	
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-	
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-	
CO5	-	-	-	-	-	-	-	-	2	2	-	2	-	-	

1: Weakly related, 2: Moderately related and 3: Strongly related	
मॉड्यूल 1: **हिंदी पत्र और लिपि**	(6 L)
हिंदी स्वर और व्यंजन अक्षर - आश्रित स्वर सीखें - व्यंजन और व्यंजन समूह - अनुस्वर व्यंजन - संज्ञा - सर्वनाम - क्रिया (भविष्य) - संभावित विशेषण - काल - हिंदी के त्वरित नियम - अभिवादन - 2 अक्षर शब्द बनाना, 3 अक्षर शब्द - हर दिन शब्दावली - संख्याएं - रंग - परिवार - वस्त्र - बगीचा - घर - फल और सब्जियां - प्रकृति **सुझाई गई गतिविधियां:** देशी वक्ताओं द्वारा स्वर और व्यंजन का उच्चारण सुनना स्वर और व्यंजन के वीडियो, 2 अक्षर और 3 अक्षर के शब्द, और प्रतिदिन प्रयोगार्थ शब्दावली	CO-1 BTL-2
मॉड्यूल 2: सुनने का कौशल	(6 L)
स्वर और व्यंजन का उच्चारण सुनना - लघु कथाएँ सुनना - साक्षात्कार - भाषण - सामाजिक मुद्दों पर पॉड वार्ता - निर्धारित पाठों को सुनना: इकाई 1 सभ्यता का रहस्य, इकाई 2 - युवावों से - वार्तालापों को सुनना - जानकारी सुनना - सम्मेलनों के भाषण **सुझाई गई गतिविधियां**: सुनें और चुनें उम्मीदवार पाठ को सुनते हैं और तीन विकल्पों के साथ बहुविकल्पीय प्रश्न का उत्तर देते हैं। उम्मीदवार टीवी चैनलों में बातचीत - साक्षात्कार- अतिथि व्याख्यान, सम्मेलनों और कार्यशालाओं के दौरान विशेषज्ञों के भाषण सुनते हैं	CO-2 BTL-3
मॉड्यूल 3: बोलने का कौशल	(6 L)
औपचारिक संवाद - अनौपचारिक संवाद - लिंग रूपों के साथ बोलना - संख्या - काल - परिवार, शहर, त्योहारों, शौक आदि जैसे सामान्य विषयों पर बोलना - पसंद और नापसंद व्यक्त करना - ज़रूरतें और संपत्ति - भूमिका निभाना। **सुझाई गई गतिविधियां:** प्रस्तुति – कार्यक्रमों का संचालन - भाषण देना	CO-3 BTL-3
मॉड्यूल- 4 : पढ़ने का कौशल	(6 L)
नमूना पढ़ना - नकल पढ़ना - अक्षरों और शब्दों का सही उच्चारण करना - पढ़ने में प्रवाह - कहानियाँ पढ़ना- संपादकीय, समाचारपत्र के लेख पढ़ना। **सुझाई गई गतिविधियां**	CO-4 BTL-3

फ्लैशकार्ड का उपयोग - चार्ट - चित्रों की पहचान करना - शब्दों को पढ़ना	
मॉड्यूल-5 लेखन कौशल	(6 L)
सामान्य पत्राचार - पत्र लेखन: छुट्टी लेने पत्र, बैंक खाता खोलना, पुस्तकें मंगवाने के लिए पत्र, शिकायत पत्र - संकेत विकास - ज्ञापन - नोटिस **सुझाई गई गतिविधियां:** निर्धारित पाठ्यपुस्तक के अनुसार अभ्यास पूरा करना	CO-5 BTL-3

पाठ्य पुस्तक	
1.	Sashtri. S.R.(2019). Hindi Shikshak, Dakshina Bharat Hindi Prachar Sabha, Chennai (Pages 137)
संदर्भ पुस्तकें	
1.	Prathamatic Patya Pushthak. (2022), Dakshina Bharath Hindi Prachar Sabha, Chennai. (Pages 168)
2.	Madhyama Patya Pushthak. (2022) Dakshina Bharath Hindi prachar Sabha, Chennai (Pages 184)
ई-संदर्भ	
1.	https://www.hindipod101.com/

COURSE TITLE		**TELUGU**		**CREDITS**		**2**
COURSE CODE		**GLS51010**	**COURSE CATEGORY**	**HS**	**L - T – P – S**	**2 – 0 – 0 – 2**
Version	**1.0**	**Approval Details**	**36th ACM**	**BTL LEVEL**		**3**

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments / Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"etc.,	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course has been designed to meet students' current and future language and communication needs. It attempts to develop their proficiency in the four language skills and knowledge of grammar and vocabulary. This course teaches students how to communicate accurately, appropriately and fluently in professional and social situations.
Course Objectives	1. This course is aimed to teach the basic Telugu language speaking skills. 2. It will introduce basic skills of the Telugu Language: its alphabets, essential words and simple sentence construction methods. 3. The course intends to facilitate students in acquiring foundational skills of reading, writing and speaking Telugu along with synonyms to expand vocabulary.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the basic skills of Letters and sounds in Telugu. 2. Develop the basic vocabulary for every day's conversation. 3. Construct simple Telugu sentences with the simple words. 4. Utilize the words that have conjunct character, and can learn functional, everyday

	conversation. 5.Construct Simple sentences for delivering appropriate meaning.

Prerequisites: Plus Two Telugu-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO2	-	-	-	-	-	-	-	2	2	3	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	3	-	-	-	-
CO4	-	-	-	-	-	-	2	-	-	3	2	-	-	-
CO5	-	-	-	-	-	-	-	-	-	3	-	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

భాగము 1 : వినడం, చెప్పడం మరియు రాయడం (6L)	
తెలుగు అచ్చులు & హల్లులు శబ్దాలు ధ్వనిచిత్రంతో పాటు తెలుగు హల్లుల సంయోగాల పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసెస్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-1** **BTL-2**
భాగము 2 : పేర్ల పదాలకు, సంఖ్యలకు, మరియు వాటి గుణాల పరిచయం (6L)	
తెలుగు నామవాచకం పరిచయం తెలుగు సర్వనామం & దాని విషయం సంఖ్యలు దాని పరిచయం & తెలుగు విశేషణాలు పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసెస్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-2** **BTL-3**
భాగము 3 : పదాలను విడదీసి వాక్యాలను రాయడం (6L)	
తెలుగు పూర్వ పదాలు – సంయోగాలు మరియు దాని ఉపయోగం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసెస్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-3** **BTL-3**
భాగము 4 : పనులు, సమయం, క్రియ మరియు కాల వ్యవధుల పరిచయం (6L)	
వివిధ క్రియల యొక్క క్రియ & సమయం / కాల సంయోగాలనికి పరిచయం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసెస్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-4** **BTL-3**
భాగము 5 : తెలుగు చదవడం, రాయడం మరియు ప్రశ్నించడం (6L)	
తెలుగులో సరళమైన వాక్యాలను రూపొందించడం (ప్రాథమిక వాక్య నిర్మాణ నియామాలు) తెలుగులో ప్రతీకూల వాక్యాలును రూపొందించడం తెలుగు బోధన అభ్యాస ప్రక్రియలో ప్రశ్నార్థకవాక్యాలువాక్యాలను రూపొందించడం సూచించబడిన : కార్య కలాపాలు చర్చలు : 5 గంటలు . అసెస్‌మెంట్లు / ప్రెజెంటేషన్ - 5 గంటలు	**CO-5** **BTL-3**

TEXT BOOK

1.	Telugu Akademy. (2018). Sampradaya Telugu Vyakaranalu. Telugu Akademy. Vijayawada, Andhra

	Pradesh. India.
2.	Raghavendra. A. (2019). Telugu Vyakaranam. Prajasakti Book House. Tadepalli.
REFERENCE BOOKS	
1.	Ramarao, Chekuri. (2019). A Reference Grammar of Modern Telugu. Emesco Books. Hyderabad
2.	Vemuri, V. Rao. (2020). Learn Telugu with Its Grammar, Eco Foundation, Vijayawada.
E-References	
1	https://sarkarihelp.com/telugu-grammar-pdf-download/

COURSE TITLE		**FRENCH**			**CREDITS**	**2**
COURSE CODE		**GLS51011**	**COURSE CATEGORY**	**HS**	**L - T – P - S**	**2 – 0 – 0 - 2**
Version	**1.0**	**Approval Details**	**36th ACM**		**LEARNING LEVEL**	**BTL – 3**

ASSESSMENT SCHEME

CIA					
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**	**End Semester Examination (ESE) Theory**
15 %	**15 %**	**10 %**	**5 %**	**5 %**	**50%**

Course Description	Introduces students to the culture and language of the French-speaking world. Students develop an ability to communicate in real-life situations by acquiring reading, writing, listening, and speaking skills. The elementary courses prepare students to communicate successfully in some common basic social situations using the four language skills—listening, speaking, reading, and writing—within appropriate cultural contexts. The student will also acquire an understanding of cross-cultural awareness.
Course Objective	1. To discover basic elements of the language, such as the different phonemes, the alphabet and its pronunciation 2. To discover the foundation of the language such as conjugations, auxiliaries, numbers, etc. 3. To learn how to form simple sentences about personal topics such as one's family 4.To start interacting with others by asking and answering simple questions 5. Understand your learning style and be able to check your own progress.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate advanced proficiency in spoken and written French. 2. Demonstrate the ability to read critically, interpret analytically, speak persuasively, and write coherently about visual and literary texts produced in the French-speaking world. 3. Demonstrate familiarity with methodological approaches in the study of literary and cultural texts, such as close reading, socio-historical contextualization, and literary and cultural theory. 4. Demonstrate knowledge of literary and cultural traditions, such as major movements, writers, and works of the French-speaking world, focusing on at least one and ideally multiple traditions: European, African, Caribbean, Asian, North American, and other Francophone cultures. 5. Demonstrate the skills necessary for scholarly research and writing in the Humanities.

Prerequisites: Intermediate Level

CO, PO AND PSO MAPPING

CO	**PO 1**	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**PS O1**	**PS O2**

CO1	-	-	-	-	-	-	-	-	-	3	-	-		
CO2	-	-	-	-	-	-	-	2	2	3	-	-		
CO3	-	-	-	-	-	-	-	-	-	3	-	-		
CO4	-	-	-	-	-	-	2	-	-	3	2	-		
CO5	-	-	-	-	-	-	-	-	2	3	2	3		

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1: INTRODUCTION FRANÇAISE	**(6L)**
.1 Introduction au cours de français - 1hr 1.2 La France et ses clichés - 2hr 1.3 Première rencontre (saluer, prendre congé, parler de son humeur) - 1hr 1.4 Qui es-tu? (se présenter, les chiffres 1-20, *être* et *avoir*) - 2hrs 1.5 Activité fiche d'identité	**CO-1** **BTL-2**
MODULE – 2: LE MONDE QUI M'ENTOURE	**(6L)**
2.1 Quel temps fait-il? (la météo, les chiffres 20-49) - 1hr 2.2 Mes couleurs préférées (la possession, le genre des articles) - 2hrs 2.3 Introduction à la Révolution Française - 2hrs 2.4 Me repérer dans le temps 1: la date (mois, jours, années) - 2hr 2.5 Me repérer dans le temps 2: l'heure (chiffres 49-60) - 2hrs	**CO-2** **BTL-3**
MODULE – 3: MES GOÛTS	**(6L)**
3.1 La nourriture en France - 2hrs 3.2 Exprimer ses goûts (verbes du 1er groupe, négation verbale) - 2hrs 3.3 Manger et boire en France - 1hr 3.4 Ma famille extraordinaire - 2hrs 3.5 Activité "qui est qui?" - 2hrs	**CO-3** **BTL-3**
MODULE – 4: MON QUARTIER EST UN MONDE	**(6L)**
4.1 Mon quartier idéal (lieux de la ville, prépositions de lieu, *habiter* et *vivre*) - 2hrs 4.2 C'est par où? (verbe *aller*, les directions, l'impératif, donner des indications) - 2hrs 4.3 Activité "où vont-ils?" trouver l'itinéraire - 1hr 4.4 On y va comment? (les transports, *conduire* et *prendre*, la préposition en/à) - 2hr 4.5 Montmartre, un quartier pas comme les autres. 2hrs	**CO-4** **BTL-3**
MODULE – 5: JOUR APRES JOUR	**(6L)**
5.1 Une journée ordinaire (verbes pronominaux, routine, emploi du temps) - 2hrs 5.2 Mes petites habitudes (la fréquence définie et indéfinie) - 1hr 5.3 Une carte postale de vacances - 2hrs 5.4 La provenance et la destination (prépositions in, from, to, le genre des pays) - 1hr 5.5 Mes vacances idéales (adjectifs démonstratifs) -2hr	**CO-5** **BTL-4**

TEXT BOOKS

1	*1.Ego 1 Cahier d'Activités*, Annie BERTHET & Co, Hachette 2006 *2. Version Originale Cahier d'Exercices*, Monique DENYER & Co, ED. Maison des Langues, 2011

REFERENCE BOOKS

1.	1. *Alter Ego 1*
2.	2. *Version Originale 1*

E Books

1	1. www.lepointdufle.net 2. https://www.podcastfrancaisfacile.com/ 3. https://didierfle.com/ 4. https://lebaobabbleu.com/ 5. https://leszexpertsfle.com/ 6. https://www.ressourcesfle.fr/ 7. https://lecafedufle.fr/

COURSE TITLE		GERMAN			CREDITS	2
COURSE CODE		GLS51012	COURSE CATEGORY	HS	L - T – P - S	2 – 0 – 0 - 2
Version	1	Approval Details	36th ACM		LEARNING LEVEL	BTL – 3

ASSESSMENT SCHEME

CIA					End Semester Examination (ESE) Theory
First Periodical Assessment	Second Periodical Assessment	Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"	Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"	Attendance	
15 %	15 %	10 %	5 %	5 %	50%

Course Description	The students shall understand the basic German Language concepts and cultural difference. They can manage to understand and communicate in German when they travel to Germany.
Course Objective	1) This course aims to equip the students with a basic daily communication in German. 2) The students learn the spoken German required to communicate with native speakers 3) It helps them to understand the 4 different modules (Horen, Schreiben, Sprechen and Lesen) which is required to clear the A1 first level international certificate exam. 4) The students learn the concepts which is required for pursuing their PG or Job in Germany
Course Outcome	Upon completion of this course, the students will be able to 1. Recall and recognize the facts and use familiar, everyday expressions, create very simple sentences, which relate to the satisfying of concrete needs. 2. Understanding the texts and trying to communicate in a simple manner provided the person they are speaking to speaks slowly and clearly and is willing to help. 3. Understanding and recalling the basic German Vocabulary, Verb conjugations with pronouns, expressions and connecting the learned facts to communicate in simple German sentences 4. Applying the above learned facts and trying to create own sentences, E-mails etc. as per the basic level achieved 5. Understand the native speaker and apply the knowledge (at basic level) in writing and speaking parts.

Prerequisites: Intermediate Level

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO1 1	PO1 2	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO2	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO3	-	-	-	-	-	-	-	-	-	2	-	-	-	-
CO4	-	-	-	-	-	-	-	-	-	1	-	-	-	-
CO5	-	-	-	-	-	-	-	-	-	2	-	-	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : SUPER!	**(6L)**
Jemanden vorstellen - Eine Hitliste internationaler Wörter schreiben - Nach dem Namen und der Herkunft fragen - Eine kursliste schreiben **Grammatik:** regelmäßge verben – möchten, sprechen,sein - Personalpronomen – ich,du,er,sie. - Definiter Artikel im nominative der,die,das - W -Rragen, Ja/Nein Fragen - Präpositionen – aus, in	**CO-1 BTL-2**
MODULE 2 : Menschen	**(6L)**

Jemanden nach dem Befinden fragen - Sich verabschieden - **Interview:** Informationen über die Familie erfragen und darüber berichten - Über seine Freunde und die Freunde anderer schreiben und sprechen **Grammatik:** Indefiniter Artikel – ein/eine - Negativartikel – kein/keine... Possessiveartikel – mein,dein,sein..	**CO-2 BTL-3**
MODULE 3 : Essen und Trinken	**(6L)**
Lebensmittel vergliechen - Lieblingfarbe und Lebensmittel zuordnen - Umfrage: mein Lieblingsfrühstück - Eine Einkaufsliste für ein Lieblingsessen schreiben **Grammatik:** Verb Konjugation – sein,haben - Imperative! Verbposition im Satz - W -Rragen, Ja/Nein Fragen	**CO-3 BTL-3**
MODULE 4 : Mein Leben	**(6L)**
Sich über Leben, Beruf, Herkunft, etc..austauschen - Eine Visitenkarte schreiben **Interview:** sich über den Tagensablauf austauchen - Die zahlen bis 100 **Grammatik:** Trennbaren verbena - "man" und "negation nicht" benutzen - Akkusativ(definite/indefinite/negative Artikel) - Präpositionen – um, als, für,bei	**CO-4 BTL-3**
MODULE 5 : Freizeit	**(6L)**
Ein kursposter mit Hobbys schreiben - Welche Hobbys habe ich,welche nicht - Notieren und sprechen – Was man selbst und die Familie am - Wochenende gerne macht- Über seinen Sonntag schreiben **Grammatik:** Modalverben - Präpositionen – in,am	**CO-5 BTL-4**
TEXT BOOKS	
1	Rolf Bruseke , Starten Wir! (A1) ,Hueber Verlag,2018
REFERENCE BOOKS	
1.	Stefanie Dengler, "Netzwerk neu A1.1 [Kurs und Übungsbuch]" ,Klett, 2015
2.	Harmut Aufderstrasse,Heiko Bock, "Themen 1 aktuell kursbuch",Hueber,2003
E Books	
1.	https://www.learn-german-online.net/en/learning-german-resources/free-german-lessons-a1.htm

COURSE TITLE		**Spanish**			**CREDITS**	**2**
COURSE CODE		**GLS51013**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**2-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**		**BTL- 3**
ASSESSMENT SCHEME						
CIA						**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"**	**Attendance**		
15%	**15%**	**10%**	**5%**	**5%**		**50%**
Course Description	This Spanish language course has been programmed to meet the grammatical and conversation needs of the student. Its content is very comprehensive and will also assist in the professional and personal language requirement of the student					
Course Objective	1. To facilitate the student in reaching out to international clients across the globe. 2. To make an immediate connect by speaking to the prospective client/ company in their native language. 3. To improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. To provide survival skills to students relocating In countries where Spanish is spoken. This includes USA, all the Latin American countries and Spain.					

Course Outcome	1. Understand spoken Spanish and construction of basic sentences. 2. Creating conversations & oral understanding. 3. Enables the learners to decode a message and to give a suitable reply in the same manner. 4. Understanding the perceptions, phrases, and other vocabulary. 5. Understanding of not only the language but also culture, music, food and other aspects of the language.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

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

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Introduction to Language & Communication (Part 1)	**(6L)**
1. El Alfabeto – The Alphabets 2. Numeros – Numbers 3. Saludos - Salutations 4. La hora – The Time **Suggested Readings: USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-1** **BTL-1**
MODULE 2: Introduction to Language & Communication (Part 2)	**(6L)**
1. Los Meses, La Semana- The Month, The week and the days of the year 2. Los Estaciones Delan'o – the Seasons of the year 3. En el Aeropuerto, Cpger El Taxi – At the Airport, Booking tickets 4. Hola – Salutations and Greetings 5. Durante La Clase – During the class 6. Art'culos – Different Articles **Suggested Reading: USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-2** **BTL-2**
MODULE 3: Understanding of Basic verb and Introduction to Grammar	**(6L)**
1.Verbp ser : Presente – Present tense of Verb "to be" 2. Estar / Hay – Conjucations of the verb "to be" and the verb there is / There are 3. Verbos En Presente: Regulares – Introduction to regular verbs 4. Ser / Estar / Tener – Conjucation of Irregular Verbs **Suggested Reading: USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-3** **BTL-3**
MODULE 4: Grammar and introduction to basic Concept	**(6L)**
1.Posesivos – Possesive Adjectives and Nouns 2. Colores – Colours and Expressions 3. La Familia – The Family and its members 4. Nombres Y Adjetivos – Nouns and Adjectives Literary Readings: **USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-4** **BTL-2**
MODULE 5 :	**(6L)**

1.Los nombres de la famila – Name of the Family Members 2. Relaciones – relations 3. Identificación de la tabla de familia - identification of the family table 4. Repaso del semestre entero - Full semester revision Literary Readings: **USO (Basico)** **Dele Gramatica Epanola** **Author by Francisca Castro**	**CO-5** **BTL-3**

TEXT BOOK	
1.	Módulo Mind your Language Institute

E-REFERENCES	
1	Open.umn.edu
2	**Pdfdrive.com/francisa-castro**

COURSE TITLE		**Korean**			**CREDITS**	**2**
COURSE CODE		**GLS51014**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**2-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**		**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	Korean language will give you the opportunity to take a deep dive into Korean culture. The students will become more confident with their skills in communicating with their employers and potential customers. This course covers most basic grammatical structure and everyday vocabularies.
Course Objective	1. To make the students get an upper hand in the prime industries of the world and direct access to the Korean speaking community. 2. To enable the students to create a direct connect thereby eliminating the requirement of a translator. 3. To improve the overall personality of the student thereby making them more confident to communicate with global clients. 4. To provide survival skills to students relocating to countries where Korean is spoken.
Course Outcome	1. Develop the spoken Korean and construction of advanced sentences. 2. Enhance conversations & oral understanding of few communication concepts. 3. Create an idea to decode messages and enable a suitable reply in the same manner. 4. Identify and construct phrases, and other vocabulary. 5. Analyse their language, culture, music, food and other aspects of the Korean Language.

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

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

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 – Introduction: Language and Culture **(6L)**

What kind of language is Korean? Korea, philosophy of the Korean language & GangNam Style! In this module, students will learn Korean culture, philosophy of creating Korean scripts, and the Korean alphabet or Korean writing system called 'Hangeul'. After completing the lessons, students will be able to understand the principles how each letter was invented. Also, students will be able to understand Korean sign languages as well. **Suggested Activities:** Memory game	**CO-1** **BTL-1**
MODULE 2 – HANGEUL	**(6L)**
Greetings and Introducing phonics, the character system, Noun, Pronoun Basic Verb and Greetings & Introducing. In this module, Students will learn how to greet, ask someone's nationalities / jobs and answer those questions in Korean. After completing the lessons, students will be able to introduce themselves, greet a person and talk about someone's nationalities and occupations. **Suggested activities**: Introducing, Game with song, Flash cards game	**CO-2** **BTL-2**
MODULE – 3 : Restaurant & Shopping	**(6L)**
Reading simple sentence - to be able to comprehend sign board and name, ordering at a restaurant, counting units, Interrogative sentence. In this module, students will learn how to order food and make requests at a restaurant in Korean. After completing the lesson, students will be able to inquire about restaurant menus, order a specific portion of food at a restaurant, and order a drink at a café. After completing the lesson, you will be able to express prices per item, purchase a product from a store, and make a specific request while shopping. **Suggested Activities**: Playing in the condition of restaurant and Shop, Dictation	**CO-3** **BTL-3**
MODULE – 4 : Daily Life & Time	**(6L)**
Talking about daily life, expressing movement, memo, simple message, object marker, expression of negation, & writing. In this module, students will learn various Korean vocabulary regarding your daily lives. After completing the lessons, students will be able to utilize informal sentence endings, ask and answer about their everyday life. Students will learn about time and date in Korean. And students will also say the days of the week as well. After completing the lessons, students will be able to ask and respond time & date using Korean numbers. **Suggested activities:** Songs about numbers and family	**CO-4** **BTL-2**
MODULE 5 : MODULE - 5 : Speaking and interaction with Natives	**(6L)**
Self–Introduction, conversations, finding out information about friends, talk with Korean, visit aKorean market or company. K-POP! Students are able to successfully handle a limited number of uncomplicated communicativetasks related to predictable topics for survival in Korea. **Suggested Activities:** Talk with Native Korean	**CO-5** **BTL-3**

TEXT BOOK	
1.	세종한국어 1 The National Institute of The Korean Language

REFERENCE BOOKS		
1	[Active Korean 1] ,	
2	[Practical Korean 1]	Darakwon, Korea, Korea
3	[Korean Language for a Good Job],	Darakwon (2007), Korea

E-REFERENCES	
1	https://www.amazon.in/Korean-Made-Simple-beginners-learning- ebook/dp/B00JHT4PCE
2	http://www.twoponds.co.kr/en/snu
3	https://www.koreantopik.com/2017/10/1-8-sejong-korean-textbook-pdfaudio69.html

COURSE TITLE	**MANDARIN**	**CREDITS**	**2**

COURSE CODE	GLS51015	COURSE CATEGORY	HS	L-T-P-C	2-0-0-2
Version	2.0	Approval Details	36th ACM	LEARNING LEVEL	BTL - 3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This level of Mandarin language course has been programmed to understand more symbols and grammatical concepts. It simplifies the construction of sentences, making it easy to converse basic sentences. The student will be able to translate texts and also speak relating to weather, climate and self-introduction. An introduction to 'My family' and description using adjectives.
Course Objectives	1. As Mandarin tops all global languages, the students get an upper hand in the prime industries of the world and direct access to the Chinese speaking community. 2. He/she will be able to create a direct connect thereby eliminating the requirement of a translator. 3. This will improve the overall personality of the student thereby making him/her more confident to communicate with global clients. 4. The course will provide survival skills to students relocating to countries where Mandarin is spoken.
Course Outcomes	1. Learning the rules of Hanyu pinyin, pronunciation, Mandarin Chinese tones, character-based common vocabulary, fundamental grammar, and oral and writing practices. 2. Being able to differentiate the major tones of Chinese characters; Being able to differentiate the similar pronunciation of different vocabularies. 3. Practicing basic communicative skills in Mandarin Chinese; through repetition practices in class, students are to learn commonly usedChinese vocabulary, sentences structure and oral communicative skills. 4. Through in-class assignments, students are to recognize easy and basic Mandarin characters; in addition, students are to learn the regulation of expressing Mandarin Chinese in PinYin system and understand the specificadoption of borrowing from Alphabetic symbols. 5. 5. Through in-class assignments, students are to practice the drawing ofMandarin Chinese strokes order and characters

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

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

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1 Mandarin Chinese Character and Tones (6L)

Basic strokes in Chinese - commonly used radicals - formation of vocabulary -pictograms - ideograms - compound ideographs - phono-semantic compounds - derivative cognates - phonetic loans - 4 tones introduction - consonants -single vowel - double vowels - initial, medial and vowels **Suggested activities:** Direct lecturing, repeated themes lecturing	**CO-1BT-2**
MODULE - 2 Listening Skills	**(6L)**
Listening to native speaker's pronunciation of scripts, vocabularies. Tones differentiating trainings, one character with different pronunciation or tones, different characters with the same pronunciation or tones **Suggested activities:** Listening to native speaker's pronunciation and translate it into English.	**CO-2BT-3**
MODULE - 3 Speaking Skills	**(6L)**
Imitating native speaker's pronunciations, tones and intonations to speaknaturally **Suggested activities:** Reverse teaching, presentation, formal and informal conversations, singingChinese songs, cultural activities, describing things	**CO-3BT-3**
MODULE - 4 Reading Skills.	**(6L)**
50 vocabularies - easy to difficult - important and commonly used - **Suggested activities:** Flashcards to practice, word recognition competition	**CO-4 BT-3**
MODULE 5 Writing Skills	**(6L)**
15 vocabularies - easy to difficult - important and commonly used - ChineseCalligraphy **Suggested activities:** Only practiced in assignments, not tested in any exams, composition practice(optional)	**CO-5BT-3**

TEXT BOOK

1.	National Taiwan Normal University Mandarin Training Center (2015). Linkingpublishing company. A Course in Contemporary Chinese (Textbook) 1

REFERENCE BOOK

1.	National Taiwan Normal University Mandarin Training Center (2017). Linking publishing company. Practical Audio-Visual Chinese Vol. 1, 3rd Edition

MOOC REFERENCE

1	http://chineseworksheetgenerator.org

COURSE TITLE		Japanese			CREDITS	2
COURSE CODE		GLS51016	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	1.0	Approval Details	36th ACM		LEARNING LEVEL	BTL- 3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance	
15%	15%	10%	5%	5%	50%

Course Description	This course has been designed to acquire grammar and be able to use Japanese to communicate in everyday simple and practical situations. The content of this course includes pronunciations speaking skills, listening practice and reading and writing.
Course Objective	1. To make the students to write and speak Japanese easily in any situation, daily life and daily conversations. 2. To develop language skills and interest in learning. 3. To facilitate students to create opportunities for themselves in the society. 4. To develop the spoken language fluently. 5. To help the students to learn about the uniqueness of the Japanese Language.
Course Outcome	Upon the completion of this course, the students will be able to 1. Demonstrate the letters and basic words of Japanese Language which are in daily use 2. Develops the listening skills of Japanese language 3. Utilize the letters and common words of the language for communication 4. Develop the conversational skills 5.Demonstrate the skill of reading and writing

Prerequisites: Plus Two -Intermediate Level

CO, PO AND PSO MAPPING

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

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 – LANGUAGE AND CULTURE	**(6L)**
Greetings - -Self-Introduction - Numbers and Alphabets – Names of countries & Continents-Telling the time-Professions-Introduction about the language and country - Context based learning –At the Café, City orientation, Family, Daily routine, Weather and Clothing 挨拶--自己紹介-数字とアルファベット-国と大陸の名前-時間を伝える-職業-言語と国についての紹介-コンテキストベースの学習-カフェで、都市オリエンテーション、家族、日常、天気と服装	**CO-1 BTL-1**
MODULE 2 : BASIC GRAMMAR	**(6L)**
Definite and indefinite articles - Simple verbs and conjugation – Pronouns-Possessive Pronoun-W Questions-Adjectives –Separable verbs 明確な冠詞と不定冠詞-単純な動詞と活用-代名詞-所有代名詞-W質問-形容詞-分離動詞	**CO-2 BTL-2**

MODULE 3 : READING & LISTENING SKILLS	(6L)
Reading simple passages - to be able to comprehend advertisements and short texts - Listening comprehension of real time situation based dialogues 簡単な文章を読む-広告や短いテキストを理解できるようにする-リアルタイムの状況に基づいた対話の理解を聞く	CO-3 BTL-3
MODULE 4 : WRITING SKILLS	**(6L)**
Small passages – Comprehension – Composition – Letter writing 小さな文章–理解–作文–手紙の書き方	CO-4 BTL-2
MODULE 5 : SPEAKING SKILLS	**(6L)**
Introducing self- describing daily routine – engaging in dialogues about family, city, orientation, ordering food at the café and weather 自己記述的な日常生活の紹介–家族、都市、オリエンテーション、カフェでの食事の注文、天気についての対話に参加する	CO-5 BTL-3

TEXT BOOK	
1.	Minna no Nihongo: main textbook and translation book. (second edition, Elementary level 1-1) Publisher: Goyal Publishers
REFERENCE BOOKS	
1.	Konomi,Emiko.Begginning Japanese for Professionals:Book 1, Portland State University,2015. https://www.academia.edu/81329400/Basic_japanese_A_grammar_and_workbook
E-REFERENCES	
1.	https://www.academia.edu/81329400/Basic_japanese_A_grammar_and_workbook

COURSE TITLE	UNIVERSAL HUMAN VALUES			CREDITS	2
COURSE CODE	GGE51001	COURSE CATEGORY	HS	L-T-P-S	2-0-0-2
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course if mandatory as per the AICTE for the UG students to motivate the students for focusing on the human values. The main aim is to focus on the sustainability of happiness with harmony and natural acceptance in the career. Lecture cum power points is provided as guidelines from AICTE.
Course Objective	1. To create awareness to students on themselves and their surroundings (family, society, nature). 2. To create responsibility among students on life in handling problems with sustainable solutions 3. To prepare the students with human relationships and human nature in mind. 4. To Prepare the students on critical ability and sensitive to their commitment. (Human

	values, human relationship and human society). 5. To Apply the learning to their real life.
Course Outcome	Upon completion of this course, the students will be able to 1. Demonstrate the necessity of relationship with family, society and nature. Familiarize with the challenges ahead and proposed solutions. 2. Formulate and design human cyber security policies, plans and procedures for organizations. 3. Apply standard security countermeasure tools to sustain human relationships and nature.es. 4. Recognize the necessity of human values and relationship. 5. Demonstrate the learning in their real life.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	1	1	1	1	2	2	3	2	2	1	3	-	-
CO-2	1	1	1	1	1	2	2	3	2	2	1	3	-	-
CO-3	1	1	1	1	1	2	2	3	2	2	1	3	-	-
CO-4	1	1	1	1	1	2	2	3	2	2	1	3	-	-
CO-5	1	1	1	1	1	2	2	3	2	2	1	3	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Introduction	**(6L)**
Need, Basic Guidelines, Content and Process for Value Education Purpose and motivation for the course, recapitulation from Universal Human Values-I Self-Exploration–what is it? - Its content and process; 'Natural Acceptance' and experiential Validation- as the process for self-exploration - Continuous Happiness and Prosperity- A look at basic Human Aspirations Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario - Method to fulfil the above human aspirations: understanding and living in harmony at various levels. **Practical component:** Include practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking **Suggested Readings:** Evolution of cyber security	**CO-1** **BTL-2**
MODULE 2: Understanding Harmony in the Human Being	**(6L)**
Harmony in Myself! Understanding human being as a co-existence of the sentient 'I' and the material 'Body' Understanding the needs of Self ('I') and 'Body' - happiness and physical facility Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer) Understanding the characteristics and activities of 'I' and harmony in 'I' - Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail -Programs to ensure Sanyam and Health. **Practical component:** Include practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease	**CO-2** **BTL-2**
MODULE 3: Understanding Harmony in the Family and Society	**(6L)**
Harmony in Human-Human Relationship- Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship - Understanding the meaning of Trust;	**CO-3** **BTL-3**

Difference between intention and competence Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals **Practical component:** Include practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives	
MODULE 4: Understanding Harmony in the Nature and Existence	**(6L)**
Whole existence as Coexistence - Understanding the harmony in the Nature -Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self-regulation in nature - Understanding Existence as Co-existence of mutually interacting units in all-pervasive space -Holistic perception of harmony at all levels of existence. **Practical component:** Include practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.	**CO-4** **BTL-2**
MODULE 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics	**(6L)**
Natural acceptance of human values, Definitiveness of Ethical Human Conduct Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order -Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems. - Case studies of typical holistic technologies, management models and production systems -Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations. Sum up. **Practical component:** Include practice exercises and case studies to discuss the conduct as an engineer or scientist etc.	**CO-5** **BTL-2**

TEXT BOOKS

1. P.R Gaur, R Asthana, G.P Bagaria, Human Values and Professional Ethics (2nd revised edition) Excel Books, New Delhi, 2019

2. A Nagaraj, Jeevan Vidya: Ek Parichaya, Jeevan Vidya Prakashan, Amarkantak, 1999.

3. A. N Tripathi, Human Values, New Age Intl. Publishers, New Delhi, 2004.

Lawrence, C. (2016). *Cyber security for Dummies*, John Wiley & Sons Inc., 2nd Edition, pp.213--432.

REFERENCE BOOKS

1.	AICTE STUDENT INDUCTION PROGRAM HANDBOOK-**https://fdp-si.aicte-india.org/download/Guidelines/G012%20SIP%20Hand%20Book%20v2.pdf**

E BOOKS

1.	https://fdp-si.aicte-india.org/download.php#1

COURSE TITLE	**தமிழ் கலாச்சாரமும் தொழில்நுட்பமும் (TAMIL CULTURE AND TECHNOLOGY)**			**CREDIT**	**1**
COURSE CODE	**GLS51017**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**1-0-0-2**
VERSION	**1.0**	**APPROVAL DETAILS**	**35th ACM**	**LEARNING LEVEL**	**BTL- 4**
ASSESSMENT SCHEME					

FRIST PERIODICAL ASSESSMENT	SECOND PERIODICAL ASSESSMENT	SEMINAR/ASSIGNMENTS LPROJECTS	SURPRISE TEST/QUIZ	ATTENDANCE	ESE
15%	15%	10%	5%	5%	50%

பாட விளக்கம்	தமிழர்களின் வரலாறு மற்றும் கலாச்சார மரபுகளைப் படிப்பதன் மூலம் மாணவர்களுக்கு மொழித்திறன் ஆற்றல் நன்கு வளர்ச்சி அடைகிறது. மேலும் மாணவர்களிடையே மொழிப்பற்று உருவாகி கற்றலில் ஆர்வம் அதிகரிக்கிறது. இப் பாடத்திட்டத்தில் செய்யுள், இலக்கிய வரலாறு, நாகரிகம், பண்பாடு, பண்டையத் தமிழர்களின் உணவு, உடை, உறையுள், அணிகலன், போர் முறை, பண்டையத் தமிழரின் மரபு பற்றிய செய்திகள் அடங்கியுள்ளன. களவு ஒழுக்கம், கற்பு ஒழுக்கம் ஆகியவற்றை மாணவர்கள் கற்பதன் மூலம் வாழ்க்கைக்குத் தேவையான ஒழுக்க நெறிமுறைகள் நன்கு வளர்ச்சியடையும்.
பாடத் திட்டத்தின் நோக்கம்	இப் பாடத்திட்டத்தின் மூலம் சமுதாயத்தில் தங்களுக்குத் தேவையான வாய்ப்புக்களை மாணவர்கள் உருவாக்கிக்கொள்ள வழிவகைச் செய்கிறது. அத்துடன் சமய வழிபாடு, விழாக்கள், சடங்குகள், நம்பிக்கைகள், மந்திரம், விளையாட்டுகள், தொழில்கள், வாணிகம் முதலியச் செய்திகளைக் கற்பதன் மூலமாக மாணவர்களிடையே பகுத்தாயும் திறன் நன்கு வளர்ச்சியடைகிறது. இப்பாடத்திட்டதினைக் கற்பதன் மூலம் மொழித்துறையில் ஆர்வம் ஏற்பட்டுத் தமிழ் இலக்கியங்களைப் பற்றியத் தேடல் மாணவர்களிடம் அதிகரிக்கிறது.
பாடத் திட்டத்தின் பயன்கள்	இந்தப் பாடத்திட்டத்தில் பண்டையத்தமிழரின் கட்டிடக்கலை, இசைக்கலை, சிற்பக்கலை, ஓவியக்கலை, நாடகக்கலை, அறிவியல், மருத்துவம், வானியல், வானூர்தியியல், கனிமவியல், உயிரியல், எண்ணியல் முதலிய தொழில்நுட்பம் சார்ந்த தகவல்கள் இணைக்க பட்டிருப்பதால் மாணவர்களிடம் உளவியல் ரீதியான நுண்ணறிவுத் தேடலை ஏற்படுத்தி எதிர்கால வேலை வாய்ப்பிற்கு உந்து சக்தியாக அமையும். பண்டையக் காலத் தொழில்நுட்பக் கருவிகள், தொழில்நுட்ப எந்திரங்கள், இன்றைய கணினித்தமிழ், இணையமும் தமிழும், தகவல் தொடர்பியல் மற்றும் ஊடகவியல் முதலியன இப்பாடத்திட்டத்தில் இணைக்கபட்டிருப்பது மாணவர்களிடையே தொழில்நுட்ப திறனை வளர்க்கும். மாணவர்கள் மொழித்திறனை வளர்த்துக்கொண்டு தெளிவான முறையில் கவிதை, கட்டுரை, சிறுகதைப் போன்றவைகளைப் படிப்பதிலும், படைப்பதிலும் ஆர்வம் செலுத்தி சிறந்த படைப்பாளராக உருவாகி சமுதாய வளர்சிக்குத் தேவையான பல நல்ல படைப்புக்களைக் கொடுக்கும் வகையில் பாடத்திட்டம் அமைக்கப்பட்டுள்ளன. மாணவர்கள் ஒழுக்க நெறியோடு தங்களின் வாழ்க்கைத் தரத்தை மேம்படுத்திக் கொள்ளவும், பண்டையத் தமிழர்களின் வாழ்கை முறை, பண்பாடு, கலாச்சாரம், நாகரிக வளர்ச்சி, தொழில்நுட்பம் ஆகியவற்றைக் கற்றுக்கொண்டு மாணவர்கள் தங்களின் வாழ்க்கை தரத்தை மேம்படுத்திக் கொள்ள இந்த பாடத்திட்டம் உறுதுணையாக அமைந்துள்ளது.

Prerequisites: Plus Two Tamil-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	-	-	-	-	-	-	-	-	-	3	-	-			
CO-2	-	-	-	-	-	-	-	2	2	3	-	-			
CO-3	-	-	-	-	-	-	-	-	-	3	-	-			
CO-4	-	-	-	-	-	-	2	-	-	3	2	-			
CO-5	-	-	-	-	-	-	-	-	2	3	2	3			

1: Weakly related, 2: Moderately related and 3: Strongly related	
அலகு - அலகு –1 மொழி மற்றும் இலக்கியம் (3L)	
மொழி - செம்மொழி - சங்க இலக்கியம் - பண்டைத் தமிழர்களின் உணவு - உடை - உறையுள் - அணிகலன் – போர்முறை – தமிழ் காப்பியங்கள் – பக்தி இலக்கியம் - நவீன இலக்கியத்தின் வளர்ச்சி – பாரதியார், பாரதிதாசன், கவிமணி, நா.முத்துக்குமார். வகுப்பறை செயல்முறைகள் : 1. விரிவுரை முறை 2. வினா - விடை முறை 3. குழுவிவாதம் 4. வகுப்பறை தேர்வு இதுப்போன்ற வகுப்பறை செயல்முறைகளைக் கொடுத்து மாணவர்களிடம் கற்றலில் ஆர்வத்தை ஏற்படுத்துதல்	CO-1 BTL-2
அலகு-2 கலைகள் (3L)	
நாடகக்கலை - (அறிமுகம்) - தெருக்கூத்து - தோல்பாவை – ஒயிலாட்டம் –மயிலாட்டம் - கரகாட்டம் - புலியாட்டம் - சிலம்பாட்டம் – இசைக்கலை – சிற்பக்கலை – ஓவியக்கலை. வகுப்பறை செயல்முறைகள்: 1. விளக்கவுரை 2. வினா எழுப்புதல் 3. பாடல்கள் அல்லது கவிதை சொல்லுதல் 4. கதைச் சொல்லுதல் 5. ஒப்படைப்பு கொடுத்தல் இதுப் போன்ற வகுப்பறை செயல்முறைகளைக் கொடுத்து மாணவர்களிடம் கற்றலில் ஆர்வத்தை ஏற்படுத்துதல்.	CO-2 BTL-3
அலகு – 3 உற்பத்தி தொழில்நுட்பம் (3L)	
உலோகவியல் - இரும்புத் தொழிற்சாலை - நாணயங்கள் - அச்சடித்தல் -மணிகள் உருவாகுதல் - தொல்லியல் சான்றுகள் - நெசவுத்தொழில் -மண்பாண்டங்கள் செய்தல் - ஐவகை நிலங்களின் தொழிகள் - (முதற்பொருள்-கருப்பொருள்). வகுப்பறை செயல்முறைகள்: 1. விளக்கவுரை அளித்தல் 2. வினா எழுப்புதல் 3. வகுப்பறை குழுவிவாதம் 4. வினாடி - வினா நிகழ்வு நடத்துதல் இதுப்போன்ற வகுப்பறை செயல்முறைகளைக் கொடுத்து மாணவர்களிடம் கற்றலில் ஆர்வத்தை ஏற்படுத்துதல்.	CO-3 BTL-3
அலகு -4 வேளாண்மை மற்றும் நீர்பாசனத் தொழில்நுட்பம் (3L)	
அருவி - ஆறு - ஏரி - அணை - குளங்கள் - கால்நடை பராமரிப்பு – மீன்வளம் - தொழில்சார் அறிவியல் சமுகம் - சொட்டுநீர் பாசனம் - தெளிப்புநீர் பாசனம். வகுப்பறை செயல் முறைகள்: 1.வினா எழுப்புதல் 2. மின்னல் அட்டைகள் காண்பித்தல் 3. வகுப்பறை குழுவிவாதம் 4. வகுப்பறை தேர்வு	CO-4 BTL-1
அலகு –5 அறிவியல் மற்றும் கணினித்தமிழ் (3L)	
கணினித்தமிழ் - தோற்றம் - வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்புச் செய்தல் - மென்பொருள் உருவாக்கம் – தமிழ் இணையக் கல்விக்கழகம் - தமிழ் மின்நூலகம் - இணையத்தமிழ் அகராதிகள் - சொற்குவை திட்டம். வகுப்பறை செயல் முறைகள்: 1. விளக்கவுரை அளித்தல் 2. காட்சி விளக்கப்படங்கள்	CO-5 BTL-2

3. பட்டிமன்றம் 4. கணினியில் தமிழ் செயல்முறைகள்	

பாடப்புத்தகம்	
	ண்டைத் தமிழ் நாகரிகமும் பண்பாடும், ஞா.தேவநேயபாவாணர், தமிழ்மண் பதிப்பகம், சென்னை. 2000. ழந்தமிழில் அறிவியல், க.பலராமன், உலகத் தமிழாராய்ச்சி நிறுவனம், சென்னை. 2009. மிழக வரலாறும் மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளீயீடு தமிழ்நாடு பாடநூல் மற்றும்) ணினித்தமிழ் - முனைவர் இல.சுந்தரம் (விகடன் பிரசுரம்)
பார்வை நூல்கள்	
	ஆ. , 2014, தமிழர் நாகரிகமும் பண்பாடும், யாழ் வெளியீடு, மேற்கு அண்ணா நகர், சென்னை-40, யிலை சீனி வேங்கடசாமி, 2014, நூண்கலைகள், பூம்புகார் பதிப்பகம், சென்னை-08,. .மங்கையர்க்கரசி , 2017,பழந்தமிழ் இலக்கியங்களில் அறிவியல் சிந்தனைகள், லாவண்யா பதிப்பகம், திருவல்லிக்கேணி, சென்னை-05, நுரை.மணிகண்டன் ,இணையமும் தமிழும், நன்னிலம் பதிப்பகம், சென்னை.
மின் நூல்கள்	1. www.tamilvu.org 2. www.projectmadurai.org 3. www.tamilnoolagam.in

COURSE TITLE	TAMIL CULTURE AND TECHNOLOGY தமிழ் கலாச்சாரமும் தொழில்நுட்பமும்			CREDIT	1
COURSE CODE	GLS51017	COURSE CATEGORY	HS	L-T-P -S	1-0-0-2
VERSION	1.0	APPROVAL DETAILS	35TH ACM	LEARNING LEVEL	BTL- 4

ASSESSMENT SCHEME					
FRIST PERIODICAL ASSESSMENT	SECOND PERIODICAL ASSESSMENT	SEMINAR/ASSIGNEMNTSLP ROJECTS	SURPRISE TEST/QUIZ	ATTENDANCE	ESE
15%	15%	10%	5%	5%	50%

Course Description	• By studying the history and cultural traditions of the Tamil, the language skills of the students are well developed. Also, the interest in learning increases and develops a passion for the language among the students. • This syllabus contains information about Literary History, Civilization, Culture, Ancient Tamil Food, Dress, Clothing, Ancient War System and Tamil Tradition. • By learning about theft and chastity, students will able to develop good moral values in life.
Course Objective	• Through this curriculum the students are empowered to create opportunities for themselves in the society. Also, by learning about religious worship, ceremonies, rituals, beliefs, mantra, sports, professions, commerce, etc., analytical skills are well developed among the students. • By learning this syllabus, the interest in the field of language and the search for learning about Tamil literature increases in the students.

Course Outcome	• In this syllabus, the technical information related to ancient Tamil architecture, music, sculpture, painting, dance, drama, ancient science thinking, are incorporated to develop the psychological intelligence skills of the students. It creates and becomes a driving force for future employment. • The inclusion of ancient technological tools and technological machines in present-day computer Tamil, Internet and Tamil, information communication and media studies in the curriculum develops technical skills among the students. • The curriculum has been set up so that the students develop their language skills and take interest in reading and writing poems, essays, short stories, etc. in a clear manner and develop into great creators and provide many good works needed for the development of society. • This curriculum helps the students to improve their quality of life with discipline and learn about the way of life, tradition, culture, civilization and technology of the ancient Tamil.

Prerequisites: Plus Two Tamil-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO -1	PSO -2
CO-1	-	-	-	-	-	-	-	-	-	3	-	-		
CO-2	-	-	-	-	-	-	-	2	2	3	-	-		
CO-3	-	-	-	-	-	-	-	-	-	3	-	-		
CO-4	-	-	-	-	-	-	2	-	-	3	2	-		
CO-5	-	-	-	-	-	-	-	-	2	3	2	3		

1: Weakly related, 2: Moderately related and 3: Strongly related

NI T – 1 LANGUAGE AND LITERATURE	**(3 Hours)**
Language - Classical - Sanga Literature - Ancient Tamils, Food – Costume – Clothiing – Martial Arts - Tamil Copies - Bhakti Literature - Development of Modern Literature - Bharathiyar and Bharathidasan – Kavimani - N.Muthukumar. Classroom Procedures: **1.** Lecture Method **2.** Question-Answer Method **3.** Group discussion **4.** Classroom test	**CO-1** **BTL-2**
Unit - 2 Tamil Arts	**(3 Hours)**
Drama - (Introduction) – Terukoothu - Dholpavai – Violatam – Karakatam – Mayilatam – Puliyatam – Silambatam – Music – Sculpture – Painting Classroom Procedures: **1.** Explanation **2.** Questioning **3.** Recitation of songs or poetry **4.** Story telling Insists interest in learning among students by giving such classroom processes.	**CO-2** **BTL-3**
Unit –3 Manufacturing Technology	**(3 Hours)**

Metallurgy - Iron industry – Coins – Printing - Bead making - Archaeological Evidence - Weaving – Carpentry - Industries of five types of lands - (Primary material - Theme). Classroom Procedures: **1.** Presentation **2.** Questioning **3.** Classroom group discussion **4.** Conduct a quiz event Instill interest in learning among students by giving such classroom processes.	**CO-3** **BTL-3**
Unit - 4 Agriculture and Irrigation Technology	**(3 Hours)**
Dam – lake – ponds - livestock maintenance – fisheries - knowledge community - drip irrigation Classroom Activities: 1. Questioning 2. Displaying lightning cards 3. Classroom group discussion 4. Classroom test	**CO-4** **BTL-1**
Unit – 5 Science Tamil and C Tamil Computing	**(3 Hours)**
Computerized Tamil Development – E- Printing of Tamil Texts - Software Development – Tamil Internet Education Institute - Tamil e – Library - Internet Tamil Dictionaries -Vocabulary Project Classroom Activities: 1. Presentation 2. Visual charts 3. projector show in the class room 4. Tamil processes in computer	**CO-5** **BTL-2**
TEXT BOOK	
	ncient Tamil Civilization and Culture, J. Devaneyapa Bhavanar, A. Nakkiran (P.A.), Tamilman Publishing House, Chennai. 2000. alantamil Science, K. Balaraman, World Tamil Research Institute, Chennai. 2009. amil History-People-Culture-KKPillai (Exhibit Tamil Nadu Textbook and) omputer Tamil-PhD I. Sundaram (Vikatan Publications)
Reference books	
	. Dakshinamurthy ,2014, Tamil Civilization and Culture, Jaffna Publication, West Anna Nagar, Chennai-40. Mailai Seeni Venkatasamy, 2014, Fine Arts, Boombukar Publishing House, Chennai-08. . Mangaiyarkaras, Scientific, 2017, Thoughts in Ancient Tamil Literature, Lavanya Publishing House, Thiruvallikeni, Chennai-05. urai. Manikandan. Sundaram Internet and Tamil, 2014, Computer TamilL Nannilam Publishing House, Chennai.
E-BOOKS	1. www.tamilvu.org 2. www.projectmadurai.org 3. www.tamilnoolagam.in

SEMESTER - II

COURSE TITLE	ANALYTICAL MATHEMATICS				CREDITS	4	
COURSE CODE	EMA51002	COURSE CATEGORY		BS	L-T-P-S	3-0-2-2	
Version	1.0	Approval Details	36th ACM		LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME							
CIA						ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / Lab records as approved by the Department Examination Committee "DEC"		Attendance	End Semester Examination (Theory)	End Semester Examination (Practical)
15%	15%	10%	5%		5%	25%	25%
Course Description	To make the student understand the basic analytical mathematical skills that is imperative for effective understanding of engineering subject using MATLAB.						
Course Objective	1. To implement problem solving skills using vectors 2. To provide an exposure on the concepts of complex variables, conformal mapping and bilinear transformation.						

	3. To comprehend integrals using Cauchy's integral and residue theorem. 4. To illustrate the applications of Laplace Transforms 5. To make the students understand the concept of Fourier series
Course Outcome	Upon completion of this course, the students will be able to 1. Verify the standard theorems in Vector Calculus and apply them to evaluate surface area and volume. 2. Construct an analytic function when real and imaginary parts are given. 3. Evaluate finite integrals using Cauchy's theorem. 4. Solve the system of ordinary differential equations using Laplace Transform 5. Expand the Fourier series for the given function.
Prerequisites: Knowledge in single-variable calculus**.**	

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	-	1	-	-	-	-	-	-	1	2	1
CO-2	3	2	1	-	2	-	-	-	-	-	-	1	1	1
CO-3	3	2	1	2	1	-	-	-	-	-	-	1	2	2
CO-4	3	3	2	1	1	-	-	-	-	-	-	2	1	1
CO-5	3	3	2	-	1	-	-	-	-	-	-	2	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: VECTOR CALCULUS	**(9L+6P)**
Gradient, Divergence and Curl – Unit normal vector, Directional derivative – angle between surfaces- Irrotational and Solenoidal vector fields. Green's theorem - Gauss divergence theorem and Stoke's theorem (without proof) – Verification and evaluation of the above theorems - Simple applications to regions such as square, rectangle, triangle, cuboids and rectangular parallelopipeds. Suggested Reading: Basics of Vectors **Lab: Gradient, Divergence, Curl, Irrotational and Solenoidal vector fields**	**CO-1** **BTL-3**
MODULE 2: COMPLEX VARIABLES	**(9L+6P)**
Functions of a complex variable – Analytic function - Cauchy - Riemann equations – Properties of analytic function (Statement Only) – Construction of Analytic functions by Milne – Thomson method – Conformal Mapping – Mapping by functions $w = z + c, w = cz, w = 1/z$, Bilinear transformation. Suggested Reading: Complex Numbers **Lab: Verification of Analytic Function**	**CO-2** **BTL-3**
MODULE 3: COMPLEX INTEGRATION	**(9L+6P)**
Statement and Application of Cauchy's Integral theorem and integral formula (without proof)-Evaluation of integrals using the above theorem-Taylor and Laurent series expansions-Singularities-Classification. Residues-Cauchy's residue theorem (without proof)-Contour integration over unit circle and semi-circular contours (excluding poles on boundaries) Suggested Reading: Types of integration	**CO-3** **BTL-3**

Lab: Evaluation of integrals using Cauchy's Integral formula and Cauchy's residue theorem.	
MODULE 4: LAPLACE TRANSFORMS	**(9L+6P)**
Laplace transform – Conditions of existence – Transform of elementary functions – properties – Transforms of derivatives – Initial and final value theorems – Transform of periodic functions. Inverse Laplace transforms using partial fraction and convolution theorem. Solution of linear ODE of second order with constant coefficients. Suggested Reading: Basics of Transform **Lab: Solutions of differential equations using Laplace transform**	**CO-4** **BTL-3**
MODULE 5: FOURIER SERIES	**(9L+6P)**
Dirichlet's Conditions – General Fourier Series – Odd and even functions – Half range sine and cosine series –Harmonic Analysis. Suggested Reading: Basics of series **Lab: Finding Fourier Series**	**CO-5** **BTL-3**

TEXT BOOKS	
1.	A. Chandrasekaran, G. Kavitha (2022), *Analytical Mathematics*, Dhanam Publications, 1st Edition, Chennai.
2.	T. Veerarajan (2016), *Engineering Mathematics-II*, McGraw Hill Education (India), Private Limited, 4th Edition, New Delhi.
3.	Raj Kumar Bansal, Ashok Kumar Goel, Manoj Kumar Sharma (2016), *MATLAB and its Applications in Engineering*, Pearson Publication, 2nd Edition, New Delhi.
4.	D. G. Duffy (2021), *Advanced Engineering Mathematics With MATLAB (Advances in Applied Mathematics)*, Chapman and Hall Publisher, 5th Edition, CRC Press, USA.
REFERENCE BOOKS	
1.	P. Sivarama Krishna Das, C. Vijayakumari (2017), *Engineering Mathematics*, 1st Edition, Pearson Publishing, Chennai.
2.	A. P. Santhakumaran, P. Titus P (2017), *Engineering Mathematics – II*, NiMeric Publications, 2nd Edition, Nagercoil, India.
3.	Kreyszig Erwin (2016) *Advanced Engineering Mathematics*, John Wiley and Sons, 10th Edition, New Delhi.
4.	S.S. Sastry (2015), *Engineering Mathematics*, Vol. I & II, PHI Learning Pvt. Ltd, 4th Edition, New Delhi.
E BOOKS	
1. 2. 3. 4.	http://ggn.dronacharya.info/APSDept/Downloads/QuestionBank/Mathematics-I/SectionD.pdf. https://people.math.sc.edu/girardi/m7034/book/AshComplexVariablesWithHyperlinks.pdf https://ocw.mit.edu/courses/18-03sc-differential-equations-fall-2011/pages/unit-iii-fourier-series-and-laplace-transform/ https://www.pdfdrive.com/calculus-ii-sequences-and-series-e11676778.html
MOOC	
1.	https://www.edx.org/course/introduction-engineering-mathematics-utarlingtonx-engr3-0x

COURSE TITLE	MECHATRONIC SYSTEMS ENGINEERING			CREDITS	4
COURSE CODE	EMD51001	COURSE CATEGORY	PC	L-T-P-S	3-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL- 5

ASSESSMENT SCHEME

First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / Lab records as approved by the Department Examination Committee "DEC"	Attendance	End Semester Examination	
					Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	In modern-day practices, the role of Mechatronic systems engineers is to integrate and interface precision mechanical, electrical, and computing elements, as well as math and physics, to design high-performance and sophisticated products ranging from commercial appliances to Industrial equipment demanded by the competitive marketplace. Therefore, this course introduces graduate students to the basic mechatronic system elements such as sensors, actuators, and digital electronic control as well as the design principles to meet the functional requirements of products, processes, and systems. This course is offered as a Theory Integrated Practical course by practicing Project Based Learning (PBL), emphasizing learning by doing, where the objective is to provide the students with the required hands-on exercises/projects that complement the theoretical understanding of the subject matters. **The assessment is through the combination of written tests as well as practical projects**.
Course Objective	**The course should enable the students to** 1. Learn the difference between the mechatronics and conventional design of systems 2. Learn about the basic elements of systems such as sensors and actuators 3. Study the principles of electronic devices and their uses in the system design 4. Learn the Boolean algebra, combinational circuits, and Sequential circuits and use them in digital circuit design 5. Design a simple mechatronic system.
Course Outcome	**Upon completion of this course, the students will be able to** 1. Differentiate traditional with concurrent mechatronics system design approach. 2. Explain the construction, working principle, and applications of various sensors and actuators used in the system design 3. Recognize and recall the principles of basic electronic devices that are used in the system design. 4. Realize and design simple combinational and sequential circuits that are used in the system design. 5. Develop a simple mechatronic system.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO - 3	PO- 4	PO-5	PO- 6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2
CO -1	3	3	-	-	-	-	-	-	-	-	-	1	1	-
CO -2	3	3	2	-	-	-	-	1	-	-	-	1	1	-

CO -3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**-**
CO -4	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**1**	**1**	**-**
CO -5	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**1**	**2**	**2**	**2**

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: INTRODUCTION TO MECHATRONICS SYSTEM ENGINEERING	**(6L=6)**
Introduction - Definition of System - Mechatronic Systems - elements of mechatronic systems - Mechanical, Electrical, Computing, and Control. Comparison of the Mechatronic system design approach with the traditional approach of system design. **Self-Study** 1. Applications of Mechatronic systems: Manufacturing, CNC machine, Robotic Cell, and Automotive industries.	**CO-1** **BTL-2**
MODULE 2: SENSORS AND ACTUATORS FOR SYSTEMS ENGINEERING	**(12L+ 6P=18)**
Introduction to sensors and actuators - definition - classification - Performance terminology - displacement, position and proximity sensors - temperature sensors - velocity and motion sensors. Actuators - Mechanical actuators - Electric actuators - Solenoids, relays, DC Motor, AC Motor, and Stepper Motor - Pneumatic - Hydraulic actuators and their applications in system design. **Self-Study / Practical Component:** 1. Displacement measurement using Potentiometer 2. Study of Single-Acting and Double Acting Cylinder	**CO-2** **BTL-3**
MODULE 3: ELECTRONIC CONTROL ELEMENTS AND DISPLAY SYSTEMS	**(9L+ 8P=17)**
Introduction - Need of Control - Analog and Digital Control - Elements of Control - Resistors, Capacitors, Inductors, Diodes, Transistors, Series and Parallel circuits - Signal Conditioning - Wheatstone bridge - ADC and DAC - Data loggers. **Self-Study / Practical Component:** *To be done in a Simulation environment tinkercad* 1. Realisation of Series and Parallel Circuits 2. Realization of Wheat Stone bridge	**CO-3** **BTL-3**
MODULE 4: DIGITAL SYSTEMS AND COMBINATIONAL CIRCUITS	**(9L+ 8P=17)**
Introduction to Digital systems – Number systems - Boolean theorems – Basic Logic Gates, Minimization – Karnaugh Map, K map up to 4 variables. Design of Adder, Subtractor, Multiplexer, De-multiplexer, Comparator, Decoder, and Encoder circuits. **Self-Study / Practical Component:** *To be done in a Simulation environment tinkercad* 1. Analysis and Synthesis of Boolean Expressions using Basic Logic Gates 2. Design of Adder, Subtractor, Encoder, and Decoder circuits	**CO-4** **BTL-4**
MODULE 5: SEQUENTIAL CIRCUITS	**(9L+8P=17)**
Flip flops – SR, JK, T, D, Master/Slave FF – operation and excitation tables, synchronous - asynchronous - Hazards - circuit implementation – Design of Counters- Ripple Counters, Ring Counters, Shift registers. **Self-Study / Practical Component:** *To be done in a Simulation environment tinkercad* 1. Design and simulation of Flip Flops 2. Design and simulation of Counters 3. Design and simulation of shift registers	**CO-4** **BTL- 5**
MINI PROJECT (SELF STUDY) – INCLUDED IN THE ASSESSMENT	
The project should have a working model having the basic elements of mechatronics i.e., a simple sensor, actuator, and an analog or digital controller with a total cost should be less than Rs. 600.	**CO-5** **BTL- 5**

TEXTBOOKS

1	W Bolton. (2019). *Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering*, Pearson Education, Sixth Edition, pp. 1-682.

2	Thomas I. Floyd (2015). *Digital Fundamentals*, Pearson, 11th edition.
REFERENCE BOOKS	
1	D. Shetty & R. Kolk (2011). *Mechatronics System Design*, Global Engineering, 2nd edition.
2	David A. Bell (2018). *Electronic devices and circuits*, Oxford University higher education, 5th edition reprint.
3	Musa Jouaneh. (2015). Fundamentals of Mechatronics, Cenage Learning, 1st edition.
E BOOKS	
1	http://nptel.ac.in/courses/106108099/Digital%20Syste
2	https://www.philadelphia.edu.j o/academics/ttutunji/uploads/Book%20-%20MSD%20by%20 Shetty.pdf
MOOC	
1	https://onlinecourses.nptel.ac.in/noc18_ee33/preview
2	https://onlinecourses.nptel.ac.in/noc21_me27/preview

COURSE TITLE	**OUTREACH (NCC)- LEVEL II (ARMY WING)**			**CREDITS**	**1**
COURSE CODE	**GGE51403**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**0-0-2-4**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.				
Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets' immediate environment, and thereby enabling them for a brighter and progressive future.				
Course Outcome	1. To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. 2. To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. 3. To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.				
CO, PO AND PSO MAPPING					

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-2	1	2	1	1	-	2	1	3	2	3	3	2	-	-
CO-3	1	2	1	1	-	2	1	3	2	3	3	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: NCC GENERAL	**(6P)**
NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2	**CO-1** **BTL-3**
MODULE 2: NATIONAL INTEGRATION AND AWARNESS	**(6P)**
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1	**CO-2** **BTL-3**
MODULE 3: PERSONALITY DEVELOPMENT.	**(6P)**
PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2	**CO-3** **BTL-3**
MODULE 4: LEADERSHIP	**(6P)**
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2	**CO-4** **BTL-3**
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	**(6P)**
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8 SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1	**CO-5** BTL-3

TEXT BOOKS

1.	**NCC COMMON SUBJECT BOOK**
2.	**RED BOOK (ARMY SPECIAL SUBJECTS)**

COURSE TITLE	**OUTREACH (NCC)- LEVEL II (AIR WING)**			**CREDITS**	**1**
COURSE CODE	**GGE51403**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**0-0-2-4**

Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance	PRACTICAL
15%	15%	10%	5%	5%	50%

Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.
Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets' immediate environment, and thereby enabling them for a brighter and progressive future.
Course Outcome	1. To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. 2. To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. 3. To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-	
CO-2	1	2	1	1	-	2	1	3	2	3	3	2	-	-	
CO-3	1	2	1	1	-	2	1	3	2	3	3	2	-	-	

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: NCC GENERAL	(6P)
NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2	**CO-1** **BTL-3**
MODULE 2: NATIONAL INTEGRATION AND AWARNESS	**(6P)**
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1	**CO-2** **BTL-3**
MODULE 3: PERSONALITY DEVELOPMENT.	**(6P)**

PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2	**CO-3** **BTL-3**
MODULE 4: LEADERSHIP	**(6P)**
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2	**CO-4** **BTL-3**
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	**(6P)**
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8 SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1	**CO-5** BTL-3
TEXT BOOKS	
NCC COMMON SUBJECT BOOK	
RED BOOK (ARMY SPECIAL SUBJECTS)	

COURSE TITLE	**OUTREACH (NCC)- LEVEL II (NAVY WING)**			**CREDITS**	**1**
COURSE CODE	**GGE51403**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**0-0-2-4**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	The NCC provides exposure to the cadets in a wide range of activities., with a distinct emphasis on Social Services, Discipline and Adventure Training.				
Course Objective	The training curriculum of the NCC is primarily focused on character building, inculcating leadership qualities and skill enhancement through structured academic syllabi, practical training and opportunity for exposure/interaction beyond a cadets' immediate environment, and thereby enabling them for a brighter and progressive future.				

Course Outcome	1. To develop character, comradeship, discipline, secular outlook, spirit of adventure and the ideals of selfless service amongst the youth of the country. 2. To create a human resource of organized, trained and motivated youth to provide leadership in all walks of life and always available for the service of the nation. 3. To provide a suitable environment to motivate the youth to take up a career in the Armed Forces.

CO, PO AND PSO MAPPING

CO	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO -1	PSO -2	
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-	
CO-2	1	2	1	1	-	2	1	3	2	3	3	2	-	-	
CO-3	1	2	1	1	-	2	1	3	2	3	3	2	-	-	

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: NCC GENERAL	**(6P)**
NCC GENERAL: NCC 1 Aims, Objectives & Organization of NCC 1 NCC 2 Incentives 2 NCC 3 Duties of NCC Cadet 1 NCC 4 NCC Camps: Types & Conduct 2	**CO-1** **BTL-3**
MODULE 2: NATIONAL INTEGRATION AND AWARNESS	**(6P)**
NATIONAL INTEGRATION AND AWARENESS 4 NI 1 National Integration: Importance & Necessity 1 NI 2 Factors Affecting National Integration 1 NI 3 Unity in Diversity & Role of NCC in Nation Building 1 NI 4 Threats to National Security 1	**CO-2** **BTL-3**
MODULE 3: PERSONALITY DEVELOPMENT.	**(6P)**
PERSONALITY DEVELOPMENT 7 PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving 2 PD 2 Communication Skills 3 PD 3 Group Discussion: Stress & Emotions 2	**CO-3** **BTL-3**
MODULE 4: LEADERSHIP	**(6P)**
LEADERSHIP 5 L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour ' Code 3 L 2 Case Studies: Shivaji, Jhasi Ki Rani 2	**CO-4** **BTL-3**
MODULE 5: SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	**(6P)**
SOCIAL SERVICE AND COMMUNITY DEVELOPMENT 8 SS 1 Basics, Rural Development Programmes, NGOs, Contribution of Youth 3 SS 4 Protection of Children and Women Safety 1 SS 5 Road / Rail Travel Safety 1 SS 6 New Initiatives 2 SS 7 Cyber and Mobile Security Awareness 1	**CO-5** BTL-3

TEXT BOOKS

NCC COMMON SUBJECT BOOK

RED BOOK (ARMY SPECIAL SUBJECTS)

COURSE TITLE	OUTREACH (NSS,Y's Men, Rotract)- LEVEL II			CREDITS	1
COURSE CODE	GGE51404	COURSE CATEGORY	HS	L-T-P-S	0-0-2-4
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	-

ASSESSMENT SCHEME				
CIA				ESE
Volunteering	Events attended	Awareness Programs attended	Attendance	Report Submission
5	25	15	5%	50

Course Description	This course is designed to introduce students to the principles and practices of community service, social development, and active citizenship. The course aims to instill a sense of social responsibility and promote civic engagement among the participants. Through a combination of theoretical knowledge and practical experiences, students will develop essential skills and qualities required to make a positive impact on the community and society. Pre requisite: There are no specific prerequisites for enrolling in the NSS Semester 1 course. However, a genuine interest in community service, social development, and willingness to actively engage with diverse communities are essential.
Course Objective	1. To familiarize students with the objectives, history, and importance of the National Service Scheme (NSS) in community development, emphasizing the significance of social responsibility and civic engagement. 2. To develop essential leadership skills, teamwork, and effective project management techniques, preparing students to organize and execute community service projects successfully. 3. To cultivate empathy, compassion, and cultural sensitivity, enabling students to engage respectfully and effectively with diverse communities during their community service activities. 4. To promote environmental awareness and sustainable practices, encouraging students to integrate eco-friendly approaches into their community service initiatives. 5. To enhance students' communication, problem-solving, and decision-making skills, equipping them to engage with community members, stakeholders, and address challenges effectively.
Course Outcome	1. students will gain a comprehensive understanding of the objectives, history, and significance of the National Service Scheme (NSS) in promoting community development and social responsibility. 2. Participants will demonstrate the ability to identify and assess prevalent social issues and challenges in the community, laying the groundwork for effective community service initiatives. 3. Through practical experiences and workshops, students will develop essential leadership skills, teamwork, and project management techniques necessary for organizing and executing successful community service projects. 4. By engaging with diverse communities, students will cultivate empathy, compassion, and cultural sensitivity, fostering meaningful and respectful interactions during their service activities. 5. Upon completion of Semester 1, students will have improved their communication, problem-solving, and decision-making skills, empowering them to actively and effectively engage in community development and service projects.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	1	2	1	1	-	2	1	3	2	3	3	2	-	-	

CO-2	**1**	**2**	**1**	**1**	**-**	**2**	**1**	**3**	**2**	**3**	**3**	**2**	**-**	**-**	
CO-3	**1**	**2**	**1**	**1**	**-**	**2**	**1**	**3**	**2**	**3**	**3**	**2**	**-**	**-**	
CO-4	**1**	**2**	**1**	**1**	**-**	**2**	**1**	**3**	**2**	**3**	**3**	**2**	**-**	**-**	
CO-5	**1**	**2**	**1**	**1**	**-**	**2**	**1**	**3**	**2**	**3**	**3**	**2**	**-**	**-**	

1: Weakly related, 2: Moderately related and 3: Strongly related

TOPICS TO BE COVERED

1. Introduction to National Service Scheme (NSS) and its Objectives
2. Understanding Social Issues and Needs Assessment in the Community
3. Project Planning and Management for Community Service
4. Leadership Development and Teamwork
5. Cultural Sensitivity and Interacting with Diverse Communities
6. Communication and Problem-Solving Skills for Community Engagement
7. Environmental Conservation and Sustainable Practices
8. Health, Hygiene, and Community Well-being
9. The Role of Arts and Culture in Community Development
10. Reflecting on Community Service Experiences and Personal Growth

Suggest Activities

1. **Community Cleanliness Drive:** Organize a cleanliness drive in the local community, involving students and residents in cleaning public spaces and creating awareness about cleanliness and waste management.
2. **Health Awareness Camp:** Conduct a health awareness camp where participants can provide basic health check-ups, distribute health-related information, and promote the importance of hygiene and sanitation.
3. **Environmental Conservation Project:** Initiate an environmental conservation project, such as tree planting, creating green spaces, or implementing recycling programs, to raise awareness about environmental issues.
4. **Teaching Assistance in Local Schools:** Collaborate with local schools to provide teaching assistance, conduct educational workshops, and help students with their studies.
5. **Empowerment Workshops:** Organize workshops for women, youth, or other marginalized groups to empower them with skills and knowledge relevant to their needs, such as vocational training or financial literacy.
6. **Cultural Exchange Program:** Arrange a cultural exchange event where NSS participants and local community members can share their traditions, dances, music, and food, fostering mutual understanding and appreciation.
7. **Blood Donation Camp:** Partner with local healthcare institutions to organize a blood donation camp to address blood shortages and raise awareness about the importance of donating blood.
8. **Community Survey and Needs Assessment:** Conduct a comprehensive community survey to understand the needs and priorities of the local residents, guiding the selection of future service projects.
9. **Awareness Campaigns:** Create awareness campaigns on critical social issues like gender equality, education, or substance abuse through street plays, posters, and interactive sessions.
10. **Disaster Preparedness Workshop:** Conduct workshops on disaster preparedness, including first aid training and emergency response, to equip the community with necessary skills.
11. **Senior Citizens' Engagement:** Plan activities and events to engage and support senior citizens, such as organizing social gatherings or providing assistance with daily chores.
12. **Digital Literacy Initiatives:** Set up digital literacy workshops to help community members, especially elders and underserved individuals, to learn basic computer and internet skills.
13. **Community Sports Event:** Organize a community sports event to promote fitness, teamwork, and community bonding.
14. **Skill Development Sessions:** Arrange skill development workshops in collaboration with local experts to teach practical skills like tailoring, painting, or handicrafts.
15. **Awareness on Government Schemes:** Educate the community about various government schemes and programs that they may be eligible for, to ensure they can avail themselves of

(30P)

the benefits.	

REFERENCE BOOKS	
1	National Service Scheme Manual, Government of India.
2	Orientation Courses for N.S.S. Programme officers, TISS.
3	Case material as Training Aid for field workers, Gurmeet Hans.
4	National Service Scheme Manual, Government of India.
5	Training Programme on National Programme scheme, TISS.
6	Social Problems in India, Ram Ahuja
7	Social service opportunities in Hospitals, Kapil K. Krishan,TISS.

SEMESTER – III

COURSE TITLE	APPLIED MATHEMATICS AND TRANSFORMS			CREDITS	4
COURSE CODE	EMA51004	COURSE CATEGORY	BS	L-T-P-S	3-1-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance*	End Semester Examination
15%	15%	10%	5%	5%	50%

Course Description	To make the student understand the basic concepts of partial differential equations and transforms and its applications
Course Objective	1. To derive differential equations describing the motion of rigid bodies under the influence of gravitation. 2. To present the main results in the context of partial differential equations and to study numerical methods for the approximation of their solution 3. To introduce the partial differential equations for transverse vibration of cable structures 4. To understand the concept of Fourier transform 5. To understand the concept of Z-transform and its properties
Course Outcome	Upon completion of this course, the students will be able to 1. Obtain the solution for free fall and throw up of a solid 2. Formulate and solve standard types of partial differential equations 3. Solve the free vibration analysis of cable structures. 4. Apply Fourier transform to find the definite integrals. 5. Compute the solution of difference equation using Z-Transform.

Prerequisites: Basics in Differential Equations.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	2	-	-	-	-	-	-	2	-	-
CO-2	3	3	2	2	2	-	-	-	-	-	-	2	-	-
CO-3	3	3	2	2	2	-	-	-	-	-	-	2	-	-
CO-4	3	3	2	2	2	-	-	-	-	-	-	2	-	-
CO-5	3	3	2	2	2	-	-	-	-	-	-	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE1:APPLICATIONS OF FIRST ORDER DIFFERENTIAL EQUATIONS (9L+3T=12)	
Introduction – separable method for first order ODE – Solution of linear homogeneous and non-homogeneous equations – Applications – Rigid body dynamics under the influence of gravitation - Rigid body in vertical motion - Throw up of a solid with initial velocity v_0 – Free fall of a solid - Problems **Suggested Reading**: Differential equation	**CO-1 BTL-3**
MODULE 2: PARTIAL DIFFERENTIAL EQUATIONS (9L+3T=12)	
Formation of partial differential equations by elimination of arbitrary constants, arbitrary functions - Solution of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second order with constant coefficients. **Suggested Reading**: Partial Differentiation.	**CO-2 BTL-3**
MODULE 3:APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS (9L+3T=12)	
Classification of second order linear partial differential equations - Partial Differential Equations for Transverse vibration of cable structures – Derivation of PDE for free vibration of cable structures – Solution of PDE for free vibration analysis of cable structures - Problems **Suggested Reading**: Partial Differential Equations, Half range sine series	**CO-3 BTL-3**
MODULE 4: FOURIER TRANSFORM (9L+3T=12)	

Fourier Integral Theorem (without proof) - Fourier transform pair - Sine and Cosine transforms - Properties - Transforms of Simple functions - Convolution theorem – Case study **Suggested Reading**: Basic integration.	**CO-4** **BTL-3**
MODULE 5: Z-TRANSFORM AND DIFFERENCE EQUATIONS (9L+3T=12)	
Z-Transform - Inverse Z-Transform – Partial fraction method – Residue method - Convolution theorem - Formation of Difference equations - Solution of difference equations using Z-Transform **Suggested Reading**: Basic calculus	**CO-5** **BTL-3**

TEXT BOOKS	
1.	H. R. Tai (2018) Applied Engineering Analysis, Wiley, ISBN: 978-1-119-07119-8.
2.	P. Sivarama Krishna Das and C. Vijayakumari (2018) Transforms and partial differential equations, Pearson Publication.
3.	G. S. Grewal (2012) Higher Engineering Mathematics, 42nd Edition, Khanna Publishers, Delhi.
REFERENCE BOOKS	
1.	N. P. Bali and M. Goyal (2007) A Textbook of Engineering Mathematics, 7th Edition, Laxmi Publications Pvt Ltd ,.
2.	K. B. Datta (2013) Mathematical Methods of Science and Engineering, Cengage Learning India Pvt Ltd, Delhi.
3.	T. Veerarajan (2012) Transforms and Partial Differential Equations, Tata McGraw Hill Education Pvt. Ltd., Second reprint, New Delhi.
E BOOKS	
1.	https://link.springer.com/book/10.1007/978-1-4614-4809-9
2.	https://s2pnd-matematika.fkip.unpatti.ac.id/wp-content/uploads/2019/03/Walter-A-Strauss-Partial-differential-equations-_-an-introduction-Wiley-2009.pdf
MOOC	
1.	nptel.ac.in/courses/122107037/

COURSE TITLE	**ADVANCED ACADEMIC WRITING**			**CREDITS**	**1**
COURSE CODE	**GLS51003**	**COURSE CATEGORY**	**HS**	**L-T-P-S**	**1 – 0 – 1 – 1**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 4**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation/lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	Advanced Academic Writing is a course that focuses on developing writing skills for an academic setting. Students will write essays, research papers and take part in discussions on course topics. The course aims to help students understand the writing process, communicate their ideas more effectively and become more proficient in writing for academic purposes.
Course Objective	The course should enable the students to 1. Gain a comprehensive grasp of the foundational principles of academic writing, including the purpose, structure, and conventions specific to different genres through vocabulary skills. 2. Develop the ability to construct sentences and paragraphs that are clear, concise, and coherent. Students will demonstrate mastery in organizing and presenting information, thereby improving readability and comprehension for their intended readership. 3. Apply effective techniques for editing and revising their written work. Students will display the capacity to critically evaluate and enhance their writing by identifying and rectifying errors, inconsistencies, and areas in need of improvement. 4. Produce precise, well-structured documents that conform to established academic standards. This includes employing proper formatting, citation, and referencing practices to ensure the credibility and integrity of their scholarly contributions. 5. Employ a diverse array of writing techniques, such as employing logical progression, utilizing transition words, and effectively incorporating evidence and examples. These skills will enhance clarity, coherence, and overall persuasiveness in students' academic writing, resulting in more impactful and engaging scholarly discourse.
Course Outcome	Upon completion of this course, the students will be able to 1. Understand the fundamentals of academic writing, including the purpose, structure, and conventions of different genres through vocabulary enhancement. 2. Construct clear, concise, and cohesive sentences and paragraphs. 3. Demonstrate the ability to edit and revise written work. 4. Produce accurate and well-structured documents. 5. Utilize a range of writing techniques to enhance clarity and coherence.

Prerequisites: Plus Two English-Intermediate Level

CO, PO AND PSO MAPPING

CO	PO - 1	PO - 2	PO-3	PO - 4	PO - 5	PO-6	PO - 7	PO - 8	PO-9	PO -10	PO-11	PO -12	PSO -1	PSO-2
CO-1	-	-	2	2	-	-	-	3	2	3	-	3	-	-
CO-2	-	-	-	3	-	-	-	3	3	3	2	3	-	-
CO-3	-	-	2	3	2	-	-	3	2	3	3	3	-	-
CO-4	-	2	2	-	-	-	2	3	-	3	2	3	-	2
CO-5	-	-	3	-	-	-	-	-	2	3	2	3	-	-

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: Understanding the Fundamentals of Academic Writing (3L+3P)

Fundamental Aspects of Academic Writing –Introduction to Academic writing- purpose of Academic writing – Common types – Format of Long and Short Writing Tasks – Features of academic Writing – Simple and Complex Sentences **Practicum:** Vocabulary enhancement by learning new terms (Alphabets from A-E)	**CO-1** **BTL-2**
MODULE 2: Writing Skills **(3L+3P)**	
Constructing Clear, Concise, and Cohesive Sentences and Paragraphs- Introduction to Sentence Structure- Crafting Effective Sentences- Using Transitions for Cohesion- Developing Paragraph Structure-Effective communicative Skills in writing – visual information – working in groups- Developing Effective Topic Statement **Practicum:** Vocabulary enhancement by learning new terms (Alphabets from F-J)	**CO-2** **BTL-3**
MODULE 3: Writing Techniques **(3L+3P)**	
Introduction to Writing Techniques- Writing Models (Letter – Report – CV – Email) - Sentence Structure and Variety- Essay writing- Writing for technical and non-technical purposes, Note Making, Formal and Informal writings- Clarity and Consciousness and writing- Applying Advanced Academic Writing Techniques- Use of AI tools in academic writing-Formatting and Citation (MLA/APA/Chicago stylesheet) **Practicum:** Vocabulary enhancement by learning new terms (Alphabets from U-Z)	**CO-5** **BTL-4**
MODULE 4: Accuracy in Writing Skill **(3L+3P)**	
Introduction to accuracy in writing- Abbreviations – Academic Vocabulary - Understanding Document Structure- Research Techniques- Argumentation and Critical Thinking – Use of Transitional Words. **Practicum:** Vocabulary enhancement by learning new terms (Alphabets from P-T)	**CO-4** **BTL-3**
MODULE 5: Editing & Revising Written Work **(3L+3P)**	
Editing and Proofreading-Importance of Editing- Self-Editing Techniques- Revising for Clarity and Coherence- Enhancing Academic Style and Tone- Revising for Conciseness and Word Choice- Editing Grammar and Syntax -Identifying the common errors- Proof Reading symbols- Checking for Formatting and Citation Accuracy (MLA/APA) **Practicum:** Vocabulary enhancement by learning new terms (Alphabets from K-O)	**CO-3** **BTL-3**

TEXTBOOKS	
1.	Sherine, Akkara., et al. (2023). Advanced Academic writing: Cleverfox Publishing, Chennai.
REFERENCE BOOKS	
1.	Giltrow, Janet., et al (2017). Academic Writing: An Introduction. 3rd ed., Broadview Press, UK
2.	V Narayanaswami (2017). Strengthen Your Writing. Orient Blackswan Press, UK
3.	Audio Learn (2015). The 1000 Most Common SAT Words, Audio Learn Publishers, UK
4.	GR Pillai, K Rajeevan & PB Nair (2015). Written English for You. Emerald Publishers, India
E-RESOURCES FOR REFERENCE	
1.	https://edisciplinas.usp.br/pluginfile.php/3928474/mod_resource/content/1/Introduction%20to%20Academic%20Writing.pdf
2.	https://www.routledge.com/rsc/downloads/A_Practical_Guide_to_Academic_Writing_for_International_Students-A_Routledge_FreeBook-_FINAL_VERSION_.pdf
3.	https://joepucc.io/static_assets/projects/SAT-vocab.pdf
MOOC	
1.	https://www.coursera.org/specializations/academic-english
2	https://www.coursera.org/learn/introduction-to-academic-writing

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COURSE TITLE	EMBEDDED SYSTEMS FOR MECHATRONICS			CREDITS	3
COURSE CODE	EMD51002	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance *	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	Concept of embedded system introduces the design and use of single-purpose processors ("hardware") and general-purpose processors ("software"), memories and buses, illustrates hardware/software trade-offs and includes advanced computation models, control systems, chip technologies, and programming through modern design tools. In addition, this course enhances the problem solving and critical thinking skills making the students to design and develop solutions for real time mechatronic systems through projects. This course is practiced and offered as Project Based Learning course.
Course Objective	The course should enable the students to 1. Relate the concepts of an Embedded System, characteristics, applications 2. Comprehend the characteristics, design metrics and processor technologies of an Embedded system 3. Realize the underlying principle and applications of various peripheral devices and the communication standards 4. Program embedded controller – Arduino 5. Develop solutions for Real time Mechatronic applications
Course Outcome	Upon completion of this course, the students will be able to 1. Summarize the basic building blocks of embedded systems 2. Develop an Assembly Language Program using 8085 and 8051 for simple applications 3. Interface various peripherals to processors 4. Develop program for simple applications using Arduino 5. Design simple real time mechatronic systems using Arduino Embedded Controller

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO-2	3	3	3	2	2	-	-	-	-	-	-	2	3	1
CO-3	3	3	3	2	2	-	-	-	-	-	-	2	3	1
CO-4	3	3	3	2	2	-	-	-	-	-	-	2	3	1
CO-5	3	3	3	3	2	-	-	-	-	-	-	2	3	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO EMBEDDED SYSTEM & GENERAL-PURPOSE PROCESSOR (6L+ 6P)	
Embedded Systems - Design challenges, optimization of design metrics. Processor Technology: General purpose Processor, Single-purpose processor, Application specific processor. Introduction to microprocessor & microcontroller-8085 Architecture- 8051 Architecture **Suggested Readings:** Evolution of embedded system **Lab Experiments** • Case study of an embedded system **Software/Equipment Required** N/A	**CO - 1** **BTL - 2**
MODULE 2: INSTRUCTION SET & BASIC PROGRAMMING (6L+ 6P)	
8085 Instruction Set: Addressing modes; Data transfer, arithmetic, logical, branch, stack and machine control groups of instruction set, 8051 Instruction set, Addressing modes – Assembly language programming **Suggested Readings:** 8086 Microprocessor Programming **Lab Experiments** • Study of 8085 assembly language virtual simulator • Perform the arithmetic, logical and block transfer operations using 8085/8051 **Software/Equipment Required** 8085 Simulator	**CO-2** **BTL-3**
MODULE 3: MEMORY, PERIPHERALS AND INTERFACING (6L+ 6P)	
Introduction to Memory, Common Memory types, Composing Memory, Memory Hierarchy and Cache, Introduction to peripherals- Timers, Counters, LCD Controllers, Keypad Controllers, Stepper motor Controllers, A to D Converters, Real time clocks. Introduction to Interfacing- Communication Basics, Microprocessor interfacing, Arbitration. **Suggested Readings:** Study various peripheral devices interfacing concepts **Lab Experiments** • Stepper Motor Interfacing using 8085 **Software/Equipment Required** 8085 Training kit, Stepper motor, Interfacing board	**CO-3** **BTL-3**
MODULE 4: INTRODUCTION TO EMBEDDED CONTROLLER – ARDUINO (6L+ 6P)	
Introduction to Arduino-Arduino IDE, I/O ports, Capability of Arudino Uno- ADC & its features, Elementary Programming, - loading a simple program, writing a program to blink the onboard LED, timers, counters, analog and digital outputs. **Suggested Readings:**	**CO-4** **BTL-4**

• Study various peripheral devices interfacing concepts **for Arduino** • **Programming for Sensor Interfacing,** Reading Analog Value, Converting an Analog Value to Digital Value and vice versa. **Lab Experiments** • Arduino Programming – Blinking an LED, • ON and OFF an LED for a specific duration, • Counting the key press. **Software/Equipment Required** Arduino IDE Arduino UNO, LED, Resistor, Transistor	
MODULE 5: REAL TIME INTERFACING AND PROGRAMMING (6L+ 6P)	
Programming – Interfacing sensors and actuators, Control of DC Motor using PWM – Stepper Motor. System Design - Case Studies (Mini Project): Interfacing Arduino (Microcontroller) + Embedded C (Codding Language) + Sensors and Actuators (Peripherals). **Suggested Readings:** How to connect and work with different sensors, such as Humidity, Proximity, IR Motion, Accelerometer, Sound, Light Distance, Pressure, Thermal etc to ARDUINO Board **Lab Experiments** • Mini Project / Case studies – System design interfacing Sensor, Actuator and Programming using Arduino. • Example: 1. ARDUINO based home automation. 2. ARDUINO Based Solar Street Light system. 3. ARDUINO Based Alarm Clock. 4. ARDUINO Based Car Parking System, etc. **Software/Equipment Required** Arduino UNO, Sensors, Actuators	**CO-5** **BTL-5**

TEXT BOOKS	
1.	Frank Vahid., "Embedded System Design - A Unified hardware & Software Introduction", John Wiley, 2018.
2.	Ramesh Goankar, "Microprocessor Architecture, Programming and Applications with the 8085". 6/e. Penram, 2016.
3.	Massimo Banzi, "Getting Started with Arduino: The Open Source". Shroff Publishers & Distributors Pvt Ltd, 2016.
REFERENCE BOOKS	
1.	Simon Monk, "Programming Arduino: Getting Started with Sketches", McGraw-Hill Education, Second Edition, 2016.
2.	Margolis, "Arduino Cookbook", Shroff/O'Reilly Publication, 2nd edition, 2012.
E RESOURCES FOR REFERENCE	
1.	https://www.arduino.cc/
MOOC	
1.	https://www.edx.org/course/embedded-systems-shape-world-utaustinx-ut-6-10x
2.	https://www.mooc-list.com/course/introduction-embedded-systems-software-and-development-environments-coursera

COURSE TITLE	**APPLIED MECHANICS**			**CREDITS**	**4**
COURSE CODE	**EMD51003**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-1-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**
ASSESSMENT SCHEME					

CIA					ESE	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	The course aims at strengthening and applying the principles required solving engineering mechanics problems. And This course will deal with kinematic analysis of mechanisms and machines. It will include motion and force transmission analysis of linkage mechanisms, open and closed-chain planar robots, and geared transmission. The course will demonstrate various concepts by working out problems relevant to real life applications of mechanisms. The course is expected to help students in their basic understanding and use of kinematic analysis. At the end of the course students have a deep understanding of all the elements of mechanics that are fundamental for industrial automation, mastering design and construction principles that play a role in modern automatic machines.
Course Objective	**The course should enable the students to** 1. Explain the concepts of force systems. 2. Gaining knowledge on properties of solids and surfaces. 3. Explain the concepts of kinematic linkage of simple mechanisms. 4. Draw the velocity and acceleration diagram of simple mechanisms. 5. Analyse the various mechanical elements used in vibration systems
Course Outcome	**Upon completion of this course, the students will be able to** 1. Recall and solve the problems on various force systems. 2. Apply the concepts of geometrical properties such as centroid, CG and MOI. 3. Recall the concept of kinematic linkage of simple mechanisms. 4. Sketch the velocity and acceleration diagram of simple mechanisms. 5. Comprehend the various mechanical elements used in vibration systems

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO-4	PO -5	PO -6	PO-7	PO -8	PO -9	PO - 10	PO-11	PO -12	PSO -1	PSO-2
CO-1	3	3	2	-	-	-	-	2	1	-	-	2	2	-
CO-2	3	3	2	-	-	-	-	2	1	-	-	2	2	-
CO-3	3	3	2	-	1	-	-	2	1	1	-	2	2	-
CO-4	3	3	2	-	1	-	-	2	1	1	-	2	2	-
CO-5	3	3	2	-	1	-	-	2	1	1		2	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO MECHANICS AND FORCE SYSTEM (9L+ 6P)

Introduction-System of forces, Principle of Transmissibility; Co-planar forces-Parallelogram law of forces, Resolution of forces, Triangle law of forces, Polygon law of forces, Free body diagram. Moment of force and parallel forces- Varignon's theorem: Law of moments, Resultant of coplanar, Non-concurrent force system, Couple and General conditions for equilibrium. **Suggested Readings:** Concurrent forces in space **Lab Experiments:** • Translate these Laws into powerful tools of Engineering Mechanics **Software / Equipment Required:** • Linkage	**CO - 1** **BTL - 3**
MODULE 2: PROPERTIES OF SURFACES AND SOLIDS (9L+ 6P)	
Centre of Gravity and Centroid, Location of Centroid/Centre of Gravity, Pappus-Guldinus Theorems; Moment of Inertia: Area and Mass-Moment of Inertia and Radius of Gyration, MOI of Laminae of Different shapes, Mass moment of Inertia, Product of Inertia, Principal axis and Principal moment of Inertia **Suggested Readings:** Ladder friction and wedge friction **Lab Experiments:** • Translate these Laws into powerful tools of Engineering Mechanics **Software / Equipment Required:** • Linkage	**CO - 2** **BTL - 3**
MODULE 3: BASICS OF MECHANISMS (9L+ 6P)	
Terminology and Definitions-Degree of Freedom Mobility-Kutzbach criterion-Grashoff's law-Kinematic Inversions of 4-bar chain and slider crank chains-Mechanical Advantage-Transmission angle Description of common Mechanisms-Single, double and offset slider mechanisms. **Suggested Readings:** Difference between mechanism and structure **Lab Experiments:** • To study various types of Kinematic links, pairs, chains and Mechanisms. • To study inversions of 4 Bar Mechanisms, Single and double slider crank mechanisms. • Create various types of linkage mechanism in CAD and simulate their motions **Software / Equipment Required:** • Linkage	**CO - 3** **BTL - 3**
MODULE 4: KINEMATICS (9L+ 6P)	
Displacement, velocity and acceleration and analysis in simple mechanisms – Graphical Method velocity and acceleration polygons – Computer applications in the kinematic analysis of simple mechanisms-Coincident points. **Suggested Readings:** Analysis of simple mechanism **Lab Experiments:** • Analysis of velocity and acceleration for mechanical linkages of different mechanisms – Use of kinematics and dynamics simulation software like MATLAB **Software / Equipment Required:** • Linkage and MATLAB	**CO - 4** **BTL - 4**
MODULE 5: CONCEPTS OF VIBRATION AND FORCED VIBRATION (9L+ 6P)	
Introduction to Vibration, Types of vibration, Vibration model-Equation of motion – Free vibration of SDF system – Newton's method, Energy method, D'Alembert's Principle- Simple Problems in SDF systems. Introduction to free damped vibrations of SDF systems– Viscous damping,	**CO - 5** **BTL - 4**

Logarithmic Decrement- Problems. Sources of excitation-Forced vibrations of SDF systems, Equations of motion with Harmonic force- Response of a rotating and reciprocating unbalance system, support motion, vibration isolation, Transmissibility- Vibration Measuring instruments, frequency measuring device. **Suggested Readings:** • Vibration measuring instruments and Exciter machine **Lab Experiments:** • Measurement of vibration characteristics using vibration exciter and accelerometer. **Software / Equipment Required:** • MATLAB, SIMSCAPE, Exciter, Accelerometer, DAQ and LabVIEW Signal Express with Sound and Vibration Module	

TEXT BOOKS	
1	Rattan S.S., "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 5th Edition, 2019.
2	D. S. Kumar, "Engineering Mechanics", S. K. Kataria & Sons, New Delhi, 4th Edition, 2022.
REFERENCE BOOKS	
1	Thomas Bevan, "The theory of Machines", Pearson Education India, 3rd Edition, 2010.
2	R. S. Khurmi and J.K. Gupta, "Theory of Machines", S Chand publications, 14th Edition, 2020.
E RESOURCES FOR REFERENCE	
1	https://asmedigitalcollection.asme.org/ebooks/book/53/Fundamentals-of-Mechanical-Vibrations
MOOC	
1	http://nptel.ac.in/courses/112101096/
2	https://www.coursera.org/learn/engineering-mechanics-statics-2

COURSE TITLE	**MANUFACTURING TECHNOLOGY**			**CREDITS**	**3**
COURSE CODE	**EMD51004**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This course is designed to provide students with a comprehensive understanding of manufacturing processes and technologies. The course covers a wide range of topics, including metal cutting process, Drilling, Milling, Grinding and Computer Numerical Control.

Course Objective	**The course should enable the students to** 1**.** Explain the basic principles involved in metal cutting process. 2. Explain the metal cutting processes to manufacture a cylindrical part. 3. Perform metal cutting operations on a prismatic part using appropriate tools and equipment. 4. Describe the principles and techniques of various metal finishing processes. 5. Apply the principles and structure of a part program to controls CNC machine operations.
Course Outcome	**Upon completion of this course, the students will be able to** 1. Relate the basic principles involved in manufacturing a part by metal cutting process. 2. Choose the appropriate metal cutting processes to manufacture a cylindrical part which involve Lathe, Automat and Drilling machines. 3. Select an appropriate metal cutting operations to manufacture a prismatic a part which involves Milling operations. 4. Perform the metal finishing processes which involve grinding, honing, burnishing and lapping for the given design requirement 5. Develop part programme for producing a part using Computer Numerical Control machines.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	2	-	-	-	1	1	-	-	1	2	-
CO-2	3	3	2	2	-	-	-	1	1	-	-	1	2	-
CO-3	3	3	1	2	-	-	-	1	1	-	-	1	2	-
CO-4	3	3	1	-	-	-	-	1	1	-	-	1	2	-
CO-5	3	3	3	2	-	-	-	1	1	-	-	1	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: THEORY OF METAL CUTTING (9L)

Metal removal processes, Orthogonal cutting, Oblique cutting, cutting tools, Tool geometry of single point cutting tool, Types of chips, cutting tool – Characteristics, materials, Mechanics of orthogonal cutting, Machinability, Tool life using Taylors equation, Types of tool wear, Cutting fluids – Functions, types. **Suggested Readings:** Mechanical behavior and Manufacturing properties of materials	**CO-1 BTL-3**

MODULE 2- MACHINING CYLIDRICAL FEATURES LATHE and DRILLING (9L)

Centre lathe - Constructional Features, Parts, Operations performed, Attachments/Accessories, Process parameters, Capstan lathe and Turret lathe, Types of automatic lathes, Turret indexing mechanism, Bar feeding mechanism, semi-automatic and automatic lathes, Tooling layout. Drilling-Constructional features of drilling machine, upright drilling machine, radial drilling machine, Operations, Process parameters. **Suggested Readings:** Boring and Boring machines, Drilling and Drilling machines, Reaming and Reamers and Tapping and Taps.	**CO-2** **BTL-3**
MODULE 3: MACHINING PRISMATIC COMPONENTS WITH MILLING MACHINES (9L)	
Milling machines - Types, Constructional features. Milling cutter - Types, nomenclature. Up milling & Down milling, Operations performed in milling machine, Process parameters. **Suggested Readings:** Broaching and Broaching machines, Sawing, Filing and Gear Manufacturing by machining.	**CO-3** **BTL-3**
MODULE 4: METAL FINISHING PROCESSES (9L)	
Grinding: Types of grinding machines, Types of grinding wheels, grinding wheel designation, Classification of grinding machines and grinding wheels, Constructional features of cylindrical grinding machines, Surface grinding machines, Process parameters. Honing, Types of honing, Lapping, Types of lapping (Equalizing, form), Types of lapping machines, Burnishing, Polishing and Buffing. – Process and Application. **Suggested Readings:** Finishing operations: Buffing & Deburring operations	**CO-4** **BTL-3**
MODULE 5: CNC MACHINING (9L)	
CNC Machines- Fundamentals, Constructional features. Machining centre, Part programming fundamentals – manual part programming. **Suggested Readings:** CAD model development for Automotive components	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Rao P N, "Metal Cutting and Machine Tools", Tata McGraw Hill, 4th Edition, 2018.
2.	Serope Kalpakjian, Steven Schmid, "Manufacturing Engineering and Technology", Pearson Publications, 7th edition, 2018.
REFEREFERENCE BOOKS	
1	Rajput R K, "A Text Book of Manufacturing Technology", Laxmi Publications (P) Ltd, 2018.
2	"H.M.T. Production Technology – Handbook", Tata McGraw-Hill, 2000.
E Resources for Reference	
1.	https://books.google.co.in/books?id=FDIfTrE3BjUC&printsec=frontcover&dq=manufacturing+process&hl=en&sa=X&ved=0ahUKEwij1IXQ9u_ZAhUHM48KHZOiBcMQ6AEIJjAA#v=onepage&q=manufacturing%20process&f=false
2.	https://books.google.co.in/books?id=FfLpEgj5F_EC&printsec=frontcover&dq=manufacturing+process&hl=en&sa=X&ved=0ahUKEwij1IXQ9u_ZAhUHM48KHZOiBcMQ6AEILDAB#v=onepage&q=manufacturing%20process&f=false
MOOC	
1.	http://nptel.ac.in/courses/112105126/

2.	http://nptel.ac.in/courses/112105127/

COURSE TITLE	ENVIRONMENTAL SCIENCE AND SUSTAINABLE DEVELOPMENT			CREDITS	2
COURSE CODE	GGE51003	COURSE CATEGORY	ES	L-T-P-S	2-0-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC"	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	**To expose the students to the basics of environmental science and sustainable development.**
Course Objective	1. To make the students aware of the natural resources and to educate them to understand the need for preserving the resources. 2. To provide knowledge on the various aspects of environmental pollution and issues. 3. To provide basic knowledge and concepts of sustainability. 4. To educate the students about the concepts of sustainable habitat. 5. To give a broad knowledge on environmental management system.
Course Outcome	Upon completion of this course, the students will be able to 1. Recognise the effects of over exploitation of natural resources and their impact on day-to-day life on earth. 2. Apply the sustainable solutions for environmental pollution and issues. 3. Implement the concepts of sustainability in the product development. 4. Use appropriate methods for designing green house and maintaining sustainable cities, transport system, industries, etc. 5. Manage the environment for sustainable product development.

Prerequisites: Basic knowledge of science and environment.

CO, PO AND PSO MAPPING

CO	PO -1	PO-2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO-2
CO-1	2	2	2	-	-	1	3	-	-	-	-	2	To be marked by respective department	
CO-2	2	2	2	-	-	1	3	-	-	-	-	2		
CO-3	2	2	2	-	-	1	3	-	-	-	-	2		
CO-4	2	2	2	-	-	1	3	-	-	-	-	2		
CO-5	2	2	2	-	-	1	3	-	-	-	-	2		

1: Weakly related, 2: Moderately related and 3: Strongly related	
MODULE 1: NATURAL RESOURCES	**(6L)**
Introduction - Forest resources: Use and over-exploitation – Water resources: Use and over-utilization – Mineral resources: Use and exploitation – Food resources: World food problems, effects of modern agriculture – Energy resources: conventional and nonconventional, solar energy, fuel cells, wind energy, hydro plants, bio-fuels, Energy derived from oceans, geothermal energy – Land resources: Use and over-exploitation – Role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Field study – Documentation of nearby environmental assets – river / forest / grassland / hill / mountain.	**CO-1** **BTL-3**
MODULE 2: ENVIRONMENTAL POLLUTION AND ISSUES	**(6L)**
Air pollution, effects of air pollutions; Water pollution – sources, sustainable waste water treatment; Solid waste – sources, impacts, zero waste concept, 3R concept, Global environmental issues – Resource degradation, climate change, global warming, ozone layer depletion – Regional and local environmental issues – Carbon credits and carbon trading, carbon foot print. Field Study - Observe a pond nearby and analyze the different measures that can be adopted for its conservation.	**CO-2** **BTL-3**
MODULE 3: SUSTAINABILITY	**(6L)**
Introduction, need of sustainability – Social, environmental and economic sustainability concepts – sustainable development, Nexus between technology and sustainable development, challenges for sustainable development – multilateral environmental agreements and protocols – clean development mechanism (CDM) – Environmental legislations in India – water act, air act. Field Study - Assessment of sustainability in your neighbourhood in education / housing / water resources / energy resources / food supplies/ land use / environmental protection, etc.	**CO-3** **BTL-3**
MODULE 4: CONCEPTS OF SUSTAINABLE HABITAT	**(6L)**
Green buildings: material for sustainable design, green building certification, methods for increasing energy efficiency of buildings – sustainable urbanisation - sustainable transport – Industrialisation and poverty reduction – Industrial processes: material selection, pollution prevention, industrial ecology, industrial symbiosis. Assignment – Explore the different methods that can be adopted for maintaining a sustainable transport system in your city.	**CO-4** **BTL-3**
MODULE 5: ENVIRONMENTAL MANAGEMENT	**(6L)**
Environmental management: Principles and strategies, Indicators of environmental quality – economic valuation - environmental cost-benefit analysis – Fiscal incentives in pollution control and management – Environmental management system: ISO 14000, Life Cycle Analysis (LCA) – scope and goal, bio-mimicking – Environmental Impact Assessment (EIA) – Procedures of EIA in India. Assignment – Conducting an EIA study of a small project (example, construction of house, road, bridge, etc.) in your local area.	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Basu, M., Savarimuthu, X. (2017). *Fundamentals of Environmental Studies*, Cambridge University Press, 1st Edition.
2.	Bhavik R. Bakshi (2019). *Sustainable Engineering: Principles and Practice*, Cambridge University Press, 1st Edition.

3.	Mulligan, C. (2020). *Sustainable Engineering: Principles and Implementation*, CRC Press, 1st Edition.
REFERENCE BOOKS	
1.	Wasewar, K. L., Rao, S. N. (2022). *Sustainable Engineering, Energy, and the Environment Challenges and Opportunities*, CRC Press, 1st Edition.
2.	Singh, J.S., Singh, S.P., Gupta, S. R. (2017). *Ecology, Environmental Science and Conservation*. S. Chand Publishing Company, New Delhi,
E BOOKS	
1.	https://www.hzu.edu.in/bed/E%20V%20S.pdf
2.	https://library.oapen.org/handle/20.500.12657/33379
MOOC	
1.	https://www.my-mooc.com/en/categorie/environmental-science
2.	https://www.coursera.org/specializations/sustainable-cities

COURSE TITLE	**DESIGN PROJECT-I**			**CREDITS**	**1**
COURSE CODE	**EMD51800**	**COURSE CATEGORY**	**EEC**	**L-T-P-S**	**0-0-2-6**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

First Review	**Second Review**	**Third Review**	**Project Report & Viva Voce**
20%	**20%**	**10%**	**50%**

Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the basic real time problem statement. This course provides an exposure to teamwork to emulate a typical professional design environment. Simulations are to be used both in the execution of the design methodology and the management of the design project.
Course Objective	The course will enable the students to understand: 1. To develop literature survey and report preparation skills 2. To identify a project and execution of preliminary solution to address the problem statement 3. To enrich the communication and team management skills
Course Outcome	Upon completion of this course, the students will be able to 1. Identify a real time problem by intensive literature survey 2. Selection of appropriate methodology with the required modern tools 3. Design & Analyse the solution through appropriate Measurement and scientific calculations

Prerequisites: Basic knowledge in Measurements, Data Analysis, Interpretation.

CO, PO AND PSO MAPPING

	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	3	3	2	1	3	2	1	3	3	3	3	2		
CO-2	3	3	2	1	3	2	1	3	3	3	3	2		
CO-3	3	3	2	1	3	2	1	3	3	3	3	2		

COURSE TITLE	INTERNSHIP – 1 (To be carried out in summer after 2nd semester and evaluated in 3rd semester)			CREDITS	1
COURSE CODE	EMD51801	COURSE CATEGORY	EEC	L-T-P-S	0-0-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					

Weightage of Assessment:

Review / Examination Scheme	Weightage
First Review	20%
Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee will be constituted by the HoD for Review process

Assessment Rubrics

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

* - Attributes for individual contribution.

Visit Report, Feedback of the employer , Presentation & Viva Voce, MCQ Assessment	
100%	
Course Description	This course aims to inculcate the application of knowledge & skill learned through classroom practices. It demands the academic component consisting of research, reflection, written and oral skills of the learner.
Course Objective	The course will enable the students to 1. Explore career alternatives prior to graduation. 2. Integrate theory and practice. 3. Assess interests and abilities in their field of study. 4. Build a record of work experience.
Course Outcome	Upon completion of this course, the students will be able to 1. Choose appropriate modern tools used in the field of Electronics and Communication engineering to manage the resources effectively by applying innovative ideas 2. Demonstrate ethical conduct and professional accountability while working in a team for the benefit of society. 3. Communicate effectively and to write the scientific report of the learnings
Prerequisites: Basic knowledge in Measurements, Data Analysis, Interpretation.	

CO, PO AND PSO MAPPING

	PO -1	PO -2	PO - 3	PO -4	PO- 5	PO- 6	PO -7	PO- 8	PO -9	PO - 10	PO -11	PO -12	PSO -1	PSO-2
CO-1	3	3	-	-	3	2	-	-	-	-	2	-	-	3
CO-2	-	-	-	-	3	-	-	3	2	2	-	-	2	-
CO-3	-	-	-	-	-	-	-		3	3	3	2	--	-

Weightage of Assessment:

Assessment Scheme	Weightage
Presentation & Viva voce	50 %
Report	20 %
Feedback of the Employer	30%

A committee will be constituted by the HoD with Internship coordinator as head for learning assessment process

SEMESTER – IV

COURSE TITLE	STATISTICS AND DATA ANALYTICS			CREDITS	4
COURSE CODE	EMA51010	COURSE CATEGORY	BS	L-T-P-S	3-1-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance*	
15%	15%	10%	5%	5%	50%

Course Description	This course helps students develop the understanding that they will need to make informed decisions using data. The course is an introduction to the essential concepts, tools and methods of statistics for students. This course covers two main branches of statistics: descriptive statistics and inferential statistics. Descriptive statistics includes collecting data and summarizing and interpreting them through numerical and graphical techniques. Inferential statistics includes selecting and applying the correct statistical technique to make estimates or test claims about a population based on a sample.
Course Objective	**The course should enable the students to** 1. Develop the student's ability to deal with numerical and quantitative issues in Engineering applications. 2. Enable the use of statistical and graphical wherever relevant. 3. Have a proper understanding of Statistical applications and apply it in relevant disciplines. 4. Perform the techniques to analyze the data. 5. Deal with case studies.
Course Outcome	**Upon completion of this course, the students will be able to** 1. Find a meaningful pattern in data. 2. Graphically interpret data. 3. Implement the analytic algorithms. 4. Handle large scale analytics projects from various domains. 5. Develop intelligent decision support systems.

Prerequisites: Basics of Statistics.

CO, PO AND PSO MAPPING

CO	PO -1	PO -2	PO -3	PO -4	PO -5	PO-6	PO -7	PO -8	PO -9	PO - 10	PO - 11	PO -12	PSO -1	PSO-2
CO-1	3	3	1	3	1	-	-	-	-	-	-	2	3	2
CO-2	3	3	1	3	3	-	-	-	-	-	-	2	3	2
CO-3	3	3	1	3	3	-	-	-	-	-	-	2	3	2
CO-4	3	3	1	3	3	2	1	-	-	-	-	2	3	2
CO-5	3	3	1	3	3	2	1	-	-	-	-	2	3	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(12L)**
Definition – importance – scope – Population and sample - Elements, Variables, and Data categorization **Suggested Readings:** Statistics and Data Analytics – Why it matters? Challenges and opportunities in Data Science	**CO-1** **BTL-2**
MODULE 2: DESCRIPTIVE STATISTICS	**(12L)**
Levels of Measurement -Data management and indexing –Graphical approaches – Measures of central Tendency – Measures of dispersion – Skewness - Kurtosis. **Suggested Readings:** Descriptive statistics and its role in research	**CO-2** **BTL-3**
MODULE 3:INFERNTIAL STATISTICS	**(12L)**
Two Sample Tests - Type 1 and Type 2 Errors – Chi square tests – t Test - ANOVA and Test of Independence – Correlation analysis – Maximum likelihood test **Suggested Readings:** Significance of hypothesis testing in Inferential Statistics	**CO-3** **BTL-4**
MODULE 4: DATA ANALYSIS TECHNIQUES	**(12L)**
Regression analysis - Classification techniques: supervised – unsupervised - clustering **Suggested Readings:** Deep learning from statistical perspective	**CO-4** **BTL-4**
MODULE 5: CASE STUDIES	**(12L)**
Case studies in Sampling, Statistical measures, Design of experiments,	**CO-5**

ANOVA, Correlation, Regression and classification **Suggested Readings:** Why Data analytics is gaining hype today?	**BTL-4**

TEXT BOOKS	
1.	Roxy Peck, Chris Olsen and Jay L. Devore (2016), Introduction to statistics & Data Analysis, Cengage Learning , 5thEdition, US.
REFERENCE BOOKS	
1.	TotstenHothorn (2014), A Handbook of Statistical Analyses using R, CRC press, 3rd Edition.
2.	Clemens Reimann and Peter Filzmoser (2007), Statistical Data Analysis Explained, Wiley publications.
E BOOKS	
1.	https://advanceddataanalytics.net/ebooks/
2.	http://www.statsref.com/StatsRefSample.pdf
MOOC	
1.	https://www.coursera.org/browse/data-science/data-analysis?languages=en

COURSE TITLE	**PROFESSIONAL EDITING AND PROJECT WRITING**				**CREDITS**	**1**
COURSE CODE	**GLS51004**	**COURSE CATEGORY**	**HS**	**L - T – P - S**	**1 – 0 – 1 - 1**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL – 4**	

ASSESSMENT SCHEME					
CIA					**End Semester Examination (ESE) Theory**
First Periodical Assessment	**Second Periodical Assessment**	**Weekly assignment/ lab record and viva as approved by the Department Examination Committee "DEC"**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**	
15 %	**15 %**	**10 %**	**5 %**	**5 %**	**50%**

Course Description	Professional Editing and Project Writing is a course to help students develop their editing and writing skills for professional purposes. Topics include document structure, editing for clarity and accuracy, content types and project management. Students will edit documents, prepare presentations and develop writing projects. The course aims to help students understand the writing process and become more proficient in editing and writing for professional purposes.
Course Objectives	1. To Copyedit written texts professionally and appropriately 2. To understand and respect the role of the author in the editing process 3. To carry out a constructive and appropriate structural edit of written texts 4. To understand the editorial and production processes for producing books and other texts 5. To identify the market and readership of a text

Course Outcomes	Upon completion of this course, the students will be able to 1.Develop a comprehensive understanding of professional editing and project writing. 2.Effectively edit and revise documents for clarity, accuracy and consistency. 3.Demonstrate an understanding of the different types of content used in professional writing. 4. Construct coherent and well-structured documents for various audiences. 5.Gain experience in developing and delivering effective presentations.

Prerequisites: Intermediate Level

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	-	-	-	2	-	-	-	-	1	3	-	2	2	1
CO2	-	-	-	2	-	-	-	-	1	3	-	2	2	1
CO3	-	-	-	2	-	-	-	-	1	3	-	2	2	1
CO4	-	-	-	2	-	-	-	-	1	3	-	2	2	1
CO5	-	-	-	2	-	-	-	-	1	3	-	2	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1– INTRODUCTION TO PROFESSIONAL EDITING AND PROJECT WRITING (3Hrs.)	
Writing: Academic writing and kinds, Non-academic writing and kinds, Ways to an Effective Writing, Review/Research/Project Writing. Editing: Basics of Editing and Steps Involved in Editing. Traits of an Editor and Copy Editor. Basics of Proof-reading	**CO-1** **BTL-2**
MODULE 2 – MECHANICS OF WRITING- GRAMMAR, PUNCTUATION AND STYLE (3Hrs.)	
Reviewing the fundamentals of grammar, understanding common grammatical errors, Spelling, Punctuation, Capitalization, Italics, Names of Persons, Number, Vocabulary, Appropriate use of Abbreviations, Established Symbols. Dos & Don'ts of writing, Common Errors/Words often Confused. Exploring different writing styles, their appropriate usage and applying consistent style throughout a document	**CO-2** **BTL-3**
MODULE 3 – RESEARCH AND WRITING (3Hrs.)	
Elements of Writing: Selecting a Topic, Conducting Research, Using Sources, Evaluating and Incorporating Sources, Developing Ideas, Gather data, Incorporate it into a project, Writing Clear and Effective Sentences and Paragraphs, Developing Unity, Coherence, Revisions; Format of Manuscripts, Academic Honesty and Plagiarism.	**CO-3** **BTL-3**
MODULE 4 – DOCUMENTATION (3Hrs.)	
Documenting Sources, APA Style, Parenthetical documentation, List of works Cited, Figures, Charts and Tables, Endnotes, Footnotes, Citations components, Bibliography, and Appendices.	**CO-4** **BTL-3**
MODULE 5 – EDITING (3Hrs.)	
Types and Stages, Roles, Duty and Responsibility of an Editor, Principles and Components of Editing, Functions of Editing, Copy Editing, Editing and Review, Developing Editorial Skills and Editorial Functions	**CO-5** **BTL-4**

TEXT BOOKS

1	Dade, P. (2020). The Oxford Guide to Effective Writing and Speaking. Reference Reviews, OUP. London.
2.	Montagnes, I. (2018). Editing and publication: A training manual. Int. Rice Res. Inst..

REFERENCE BOOKS

1.	Strunk Jr, W., & White, E. B. (2007). The Elements of Style Illustrated. Penguin.
2.	Blumenstock, N. A. (1984). The Chicago Manual of Style. By the University of Chicago Press. Chicago: University of Chicago Press, 1982. ix, 740 pp.
3.	Lester, J. D., & Lester, J. D. (2005). Writing research papers: A complete guide. New York: Pearson/Longman.
4	Saller, C. F. (2016). The subversive copy editor. In The Subversive Copy Editor, Second Edition. University of Chicago Press.

E Books

1.	https://edisciplinas.usp.br/pluginfile.php/3928474/mod_resource/content/1/Introduction%20to%20Academic%20Writing.pdf
2.	https://www.routledge.com/rsc/downloads/A_Practical_Guide_to_Academic_Writing_for_International_Students-A_Routledge_FreeBook-_FINAL_VERSION_.pdf
MOOC Courses	
1	https://www.coursera.org/specializations/academic-english
2	https://www.coursera.org/learn/introduction-to-academic-writing

COURSE TITLE	**SOLID AND FLUID MECHANICS**			**CREDITS**	**4**
COURSE CODE	**EMD51005**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	The solid mechanics as a subject may be defined as a branch of applied mechanics that deals with behaviors of solid bodies subjected to various types of loadings. This is usually subdivided into further two streams i.e Mechanics of rigid bodies or simply Mechanics and Mechanics of deformable solids. The mechanics of deformable solids which is branch of applied mechanics is known by several names i.e. strength of materials, mechanics of materials etc. Also the course coverage is balanced with analytical treatments, physical concepts and practical applications in Solid and Fluid Mechanics.
Course Objective	**The course should enable the students to** 1. Understand the concepts of simple stresses and strains for loads in axial direction. 2. Classify the types of beams and solving problems while transverse loads acting on it 3. Derive the torsional equations and solve the numerical problems for torsional load on shafts 4. Understand the concept of fluid flow 5. Infer losses on fluid flow through pipe line.
Course Outcome	**Upon completion of this course, the students will be able to** 1. Relate the principles to solve solid bodies subjected to simple stresses 2. Comprehend the procedure to solve solid bodies subjected to transverse loading 3. Calculate by solving solid bodies subjected to torsional loading 4. Explain the basic concepts of fluid flow 5. Estimate losses on flow through circular conduit.
Prerequisites: NIL	

CO, PO AND PSO MAPPING

CO	**PO -1**	**PO-2**	**PO -3**	**PO -4**	**PO-5**	**PO -6**	**PO -7**	**PO -8**	**PO-9**	**PO - 10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**

CO-1	3	3	2	-	1	-	-	2	2	1	-	3	2	-
CO-2	3	3	3	-	1	-	-	2	2	1	-	3	2	-
CO-3	3	3	3	-	1	-	-	2	2	1	-	3	2	-
CO-4	3	3	-	-	-	-	-	2	2	-	-	3	2	-
CO-5	3	3	-	-	-	-	-	2	2	-	-	3	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: STRESS, STRAIN AND DEFORMATION OF SOLIDS	**(9L+ 6P)**
Concept of stress-strain, Hooke's law, Tension, Compression and Shear, stress-strain diagram, Poisson's relation, volumetric strain, Elastic constants and their relation. Stress in simple and composite bars subjected to axial loading and temperature. **Suggested Readings:** Laws of mechanics, System of forces – parallelogram, triangle and polygon law of forces – resultant of a force system and Mechanical properties of Materials **List of Experiments:** a. Tension Test on Mild Steel Rod b. Compression Test on Wood **Software / Equipment Required:** • Universal Testing Machine (UTM) Set-up	**CO - 1** **BTL - 3**
MODULE 2: TRANSVERSE LOADING ON BEAMS SHEAR FORCE AND BENDING MOMENT	**(9L+ 6P)**
Types of Beams, Transverse loading on beams shear force and bending moment in beams – cantilever, simply supported, overhanging beam subjected to concentrated load and UDL – maximum bending moment and point of contra flexure. **Suggested Readings:** Theory of simple bending and its assumptions **List of Experiments:** a) Verification of Maxwell's Reciprocal Theorem for deflection of beam. b) Bending Test on Mild Steel Rod **Software / Equipment Required:** • Deflection Test Equipment	**CO - 2** **BTL - 3**
MODULE 3: TORSION, SPRINGS AND COLUMNS	**(9L+ 6P)**
Theory of torsion and assumption – Torsion of circular shafts, solid & hollow – strain energy in torsion. Power transmission, strength and stiffness of shafts. Types of springs, stiffness stresses and deflection in helical spring and leaf spring. **Suggested Readings:** Applications of Torsional loads on shafts and suspension systems in vehicles **List of Experiments:** a. Torsion test on Mild Steel Rod b. Compression Test on open coil Helical spring **Software / Equipment Required:** • Open coiled Helical spring & Test set-up	**CO - 3** **BTL - 3**
MODULE 4: FLUID FLOW CONCEPTS AND BASIC EQUATIONS	**(9L+ 6P)**
Flow characteristics, concepts of system and control volume – continuity equation – Application of control volume to continuity – Energy Equation – Bernoulli equation and Momentum Equation –simple problems. **Suggested Readings:** Properties of fluids, Units and dimensions. **List of Experiments:** **a)** Calibration of Venturi Meter. **b)** Calibration of Orifice Meter. **c)** Calibration of Rotometer **Software / Equipment Required:**	**CO - 4** **BTL - 4**

• Venturi meter Test set-up, Orifice meter Test set-up & Rotometer Test set-up	
MODULE 5: FLOW THROUGH CIRCULAR CONDUITS	**(9L+ 6P)**
Fluid flow – Laminar and Turbulent flow through circular tubes. Darcy Equation on pipe roughness – Friction factor –Moody diagram, Minor loss. **Suggested Readings:** Flow characteristics and its applications **List of Experiments:** • Determination of Friction coefficients in pipe. **Software / Equipment Required:** • Friction Co-efficient Test set-up	**CO - 5** **BTL - 4**
TEXT BOOKS	
1 Ramamrutham S and Narayanan R., "Strength of material", Dhanpat Rai Pvt. Ltd., New Delhi, 2020.	
3 Bansal R.K., "Fluid Mechanics and Hydraulic Machines", Laxmi publications (P) Ltd., New Delhi, 2019.	
REFERENCE BOOKS	
1 Bansal R.K., "Strength of Material", Lakshmi publications Pvt. Ltd., New Delhi, 2016	
2 Ramamrutham S., "Fluid Mechanics and Hydraulics", Dhanpat Rai and Sons, Delhi, 2014.	
E RESOURCES FOR REFERENCE	
1. https://www.kobo.com/us/en/ebook/fluid-and-solid-mechanics.	
2. https://vipulzblog.files.wordpress.com/2018/08/strength-of-material-by-r-k-bansal-31.pdf	
MOOC	
1 https://nptel.ac.in/courses/112/107/112107146/	
2 https://nptel.ac.in/courses/112/105/112105171/	

COURSE TITLE	**ELECTRICAL MACHINES AND DRIVES**			**CREDITS**	**3**	
COURSE CODE	**EMD51006**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-0-2-2**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance ***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	Electrical machines drive the actuators that are applied in the field of movable translational or rotary systems. AC and DC machines rule the day to day commercial and domestic devices as the prime mover components. There exists a wide varied of machines based on the principle of operation and construction of the functional components. The basic understanding of the machines is possible with knowledge on the voltage and current laws. The analysis of the circuits for the basic understanding of the flow of voltage or current in a loop and the sources of power delivery is of significance. There are several strategies to start and control the speed of motors for satisfactory performance and to achieve greater					

	efficiency. The drive mechanism features, and their selection has many measures of significance such as heating and cooling, loading conditions, classes of duty and power rating. The solid-state drive mechanisms for the machines have gained a lot of importance, viz. various methods using power electronic devices and recovery schemes.
Course Objective	**The course should enable the students to** 1. Know the basics of electrical circuits and characteristics of transformers 2. Learn the construction, working principle and characteristics of dc, ac and special machines 3. Comprehend the types of starting and speed control methods of dc and ac machines 4. Realize various electrical drives and selection criteria's 5. Learn about the application of electrical drives in mechatronic applications.
Course Outcome	**Upon completion of this course, the students will be able to** 1. Recall the basics of circuit theory and functionality of transformers 2. Comprehend the construction and principle of operation of DC motors and AC motors 3. Perform the speed control of DC and AC motors. 4. Design circuits and select drives for applications based on various criteria's 5. Appraise the performance characteristics of drives in mechatronics applications.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	1	-	-	-	1	2	1	-	2	2	1
CO-2	3	3	1	1	-	-	-	1	2	1	-	2	2	1
CO-3	3	3	1	1	-	-	-	1	2	1	-	2	2	1
CO-4	3	3	2	2	-	-	-	1	2	1	-	2	2	1
CO-5	3	3	2	2	-	-	-	1	2	1		2	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: CIRCUITS AND TRANSFORMERS	**(6L+ 6P)**
D.C. Voltage, current, power-Ohms law-series, parallel circuits – Kirchhoff's laws – mesh analysis – A.C. voltage – sinusoidal waves, Phasor representation – power factor – complex power - basic idea of transformers – simple problems. **Suggested Readings**: Three phase system, basic safety measures at home and industry **Lab Experiments** • To Verify ohm's law in a circuit- Simulation • To Verify Kirchhoff's Current and Kirchhoff's voltage laws - Simulation • Performance characteristics of single-phase transformer **Software/Equipment Required** Electric circuit simulation software, Transformer characteristics kit.	**CO - 1** **BTL - 2**
MODULE 2: DC & AC MACHINES	**(6L+ 6P)**
Constructional details, principle of operation and performance characteristics of D.C. motors, AC motors-- single phase induction motor, three phase induction motor, universal motors, stepper motors and servo motors. **Suggested Readings:** DC and AC machines applications, special machines **Lab Experiments** 1. To perform test on mechanical and electrical characteristics of D.C. shunt motor	**CO - 2** **BTL - 3**

2. To perform test on mechanical and electrical characteristics of D.C. series motor 3. To perform test on mechanical and electrical characteristics of single phase induction motor 4. To perform test on mechanical and electrical characteristics of three phase induction motor **Software/Equipment Required** DC shunt, DC series, AC induction (single, Three phase) test setup.	
MODULE 3: SPEED CONTROL AND STARTERS	**(6L+ 6P)**
Speed control of D.C. motors – three phase induction motors – starting methods of D.C. motor and three phase induction motor – electrical braking – simple problems. **Suggested Readings:** Industrial application of speed control of motors and starters, Applications of various types of braking methods **Lab Experiments** 1. To perform speed control of D.C. shunt motor 2. To perform speed control of servo motor 3. To perform speed control of induction motor **Software/Equipment Required** DC shunt motor speed control setup, Servo motor setup, Induction motor speed setup.	**CO - 3** **BTL - 3**
MODULE 4: ELECTRICAL DRIVES	**(6L+ 6P)**
Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters – simple problems. **Suggested Readings:** Application of various types of machines, Industrial electrical drive controllers. **Lab Experiments** **1.** To perform control of stepper motors **Software/Equipment Required** Stepper motor speed control setup.	**CO - 4** **BTL - 3**
MODULE 5: CASE STUDY	**(2L+ 10P)**
Advantages of solid state drives – Case study of Kinova robot, Yaskawa robot, Gantry robot, Sew drives, CNC machine drives, Electric vehicle motors. **Suggested Readings:** Study of variable frequency drives, Study of solid state devices for efficient control in robots **Lab Experiments** 1. To perform control of servo drives with solid state devices 2. Selection and evaluation of motor and drive selection for Mechatronics applications **Software/Equipment Required** Servo motor with solid state control setup.	**CO - 5** **BTL - 3**

TEXT BOOKS	
1.	I.J. Nagrath, T.P. Kothari. “Basic Electrical Engineering”, McGraw-Hill Publishing company Ltd., Second edition, 2020
2.	N.K.De., P.K.Sen. “Electric Drives”, Prentice Hall, Eastern Economy Edition, 2019
REFEREREFERENCE BOOKS	
1.	S.K. Bhattacharya. “Electrical Machines”, Tata McGraw-Hill Pvt. Company Ltd. fourth edition, 2017
2.	G.K. Dubey. “Fundamental Electrical Drives”, Narosa Publications, Second edition, second edition, 2020
E RESOURCES FOR REFERENCE	
1.	https://www.kinovarobotics.com/sector/professional-robotics
2.	https://www.motoman.com/en-us/products/robots/industrial

3.	https://www.sew-eurodrive.de/industries/references/emag-handling-gantry/emag-handling-gantry.html
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc17_ec10/preview
2.	https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-685-electric-machines-fall-2013/
3.	http://em-coep.vlabs.ac.in/

COURSE TITLE	**FLUID POWER AUTOMATION (Industry Collaborated Course)**			**CREDITS**	**3**	
COURSE CODE	**EMD51007**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-0-2-2**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	Fluid Power is the technology that deals with the generation, control, and transmission of power, using pressurized fluids. Both liquids and gases are considered fluids. Fluid power is the muscle of the industry used to push, pull, regulate, or drive virtually all the machines of modern industry. This course is essential in engineering and technology to cope in modern industry to tackle a variety of problems and search for better solutions in power transmission and control.					
Course Objective	The course should enable the students to 1. Explain the working principles of fluid power and pumps. 2. Illustrate the working principles of fluid power accessories like Actuator and valves. 3. Perform the Hydraulic circuit for Simple Applications 4. Perform the Pneumatic circuit for simple Applications. 5. Apply the concept of hydraulic and pneumatic in different Applications					
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basic working principles of fluid power systems. 2. Comprehend the various types of valves used in fluid power systems. 3. Determine the appropriate Hydraulic circuit configuration for various applications. 4. Design pneumatic circuits for simple applications. 5. Identify the suitable hydraulic and pneumatic systems in specific applications.					
Prerequisites: Nil						

CO, PO AND PSO MAPPING

CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**1**

CO-2	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**1**
CO-3	**3**	**3**	**1**	**-**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**1**
CO-4	**3**	**3**	**1**	**-**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**1**
CO-5	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**1**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: FLUID POWER PRINICIPLES AND HYDRAULIC PUMPS	**(6L+ 6P)**
Introduction to Fluid power — Advantages and Applications — Fluid power systems — Types of fluids — Properties of fluids and selection — Basics of Hydraulics — Pascal's Law — Principles of flow — Friction loss — Work, Power and Torque Problems, Sources of Hydraulic power: Pumping Theory — Pump Classification — Construction, Working, Design, Advantages, Disadvantages, Performance, Selection criteria of Linear and Rotary — Fixed and Variable displacement pumps — Problems. **Suggested Readings**: Hydraulic systems, components, circuits, and control mechanisms. **Lab Experiments** 1. Study of Hydraulic Pumps. 2. Study of solenoid valves, limit switches. Pressure, flow control valve. **Equipments and Softwares** Pneumatics and Hydraulics Trainer Kit components	**CO - 1** **BTL - 3**
MODULE 2: HYDRAULIC ACTUATORS AND CONTROL COMPONENTS	**(6L+ 6P)**
Hydraulic Actuators: Cylinders — Types and construction, Application, Hydraulic cushioning — Hydraulic motors — Control Components: Direction Control, Flow control and pressure control valves — Types, Construction and Operation — Servo and Proportional valves — Applications — Accessories: Reservoirs, Pressure Switches — Applications — Fluid Power ANSI Symbols — Problems. **Suggested Readings:** Cylinders, Motors, Valves, Pumps, and Control systems **Lab Experiments** 1. Basic hydraulic circuit for the working of Single acting cylinder 2. Basic hydraulic circuit for the working of double acting cylinder **Equipments and Softwares** Hydraulics Trainer Kit	**CO - 2** **BTL - 3**
MODULE 3: HYDRAULIC CIRCUITS AND SYSTEMS	**(6L+ 6P)**
Accumulators, Intensifiers, Industrial hydraulic circuits — Regenerative, Pump Unloading, Double- Pump, Pressure Intensifier, Air-over oil, Sequence, Reciprocation, Synchronization, Fail-Safe, Speed Control, Hydrostatic transmission, Electro hydraulic circuits, Mechanical hydraulic servo systems. **Suggested Readings:** System modeling, component selection, and system performance optimization **Lab Experiments** 1. Speed control circuits. Different Metering methods Inlet & outlet flow control (meter-in & meter-out circuit). 2. Hydraulic Counter-balancing circuit **Equipments and Softwares** Hydraulics Trainer Kit	**CO - 3** **BTL - 3**
MODULE 4: PNEUMATIC AND ELECTRO PNEUMATIC SYSTEMS	**(6L+ 6P)**

Properties of air — Perfect Gas Laws — Compressor — Filters, Regulator, Lubricator, Muffler, Air control Valves, Quick Exhaust Valves, Pneumatic actuators, Design of Pneumatic circuit — Cascade method — Electro Pneumatic System — Elements — Ladder diagram — Problems, Introduction to fluidics and pneumatic logic circuits. **Suggested Readings:** Air compressors, actuators, valves, control methods, and system design considerations. **Lab Experiments** 1. Basic pneumatic circuit for the working of single and double acting cylinder 2. Pneumatic Sequencing circuit **Equipments and Softwares** Pneumatic Trainer Kit	**CO - 4** **BTL - 3**
MODULE 5: TROUBLE SHOOTING AND APPLICATIONS	**(6L+ 6P)**
Installation, Selection, Maintenance, Trouble Shooting and Remedies in Hydraulic and Pneumatic systems, Design of hydraulic circuits for Drilling, Planning, Shaping, Surface grinding, Press and Forklift applications. Design of Pneumatic circuits for Pick and Place applications and tool handling in CNC Machine tools — Low cost Automation — Hydraulic and Pneumatic power packs. **Suggested Readings:** Maintenance and troubleshooting of fluid power systems **Lab Experiments** 1. Circuit with cam operated pilot valves operating a pilot operated 4way direction Control 2. Study of hydraulics and Pneumatics circuit, based on the industrial application **Equipments and Softwares** Pneumatics and Hydraulics Trainer Kits	**CO - 5** **BTL - 3**

TEXT BOOKS	
1.	Klette PJ, "Fluid Power Systems", ATP (American Technical Publishers), 2016.
2.	Anthony Esposito, " Fluid Power with applications", Pearson Publications, 7th Edition, 2018.
REFEREFERENCE BOOKS	
1.	Ilango S, Soundararajan V, "Introduction to hydraulics and pneumatics", PHI Learning Pvt. Ltd., 2016.
2.	El-Din MG, Rabi M, "Fluid power engineering", McGraw-Hill Education, 2018.
E RESOURCES FOR REFERENCE	
1.	https://people.utm.my/shamsul/wp-content/blogs.dir/949/files/2015/12/Fluid-Power.pdf
2.	https://books.google.co.in/books?id=3REuDwAAQBAJ&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false
MOOC	
1.	https://nptel.ac.in/courses/112105046
2.	https://www.coursera.org/learn/fluid-power

COURSE TITLE	**DESIGN PROJECT-2**			**CREDITS**	1
COURSE CODE	**EMD51802**	**COURSE CATEGORY**	EEC	**L-T-P-S**	0-0-2-6
Version	1.0	**Approval Details**	37 th ACM	**LEARNING LEVEL**	BTL-4
ASSESSMENT SCHEME					
First Review	**Second Review**	**Third Review**	**Project Report & Viva Voce**		
20%	20%	10%	50%		

Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the real time problem statement. This course provides an exposure to emulate a typical professional development of solution as a team. Appropriate Simulation tools to be used in the execution of the design methodology. The resources and team management skills are utilised to develop an innovative, economic solution to the selected problem
Course Objective	The course will enable the students to: 1. Explore the literature study and report preparation skills 2. Demonstrate project identification and execution of feasible solution to address the problem statement 3. Elucidate the communication and team management skills
Course Outcome	Upon completion of this course, the students will be able to 1. Identify a real-time problem by intensive literature survey 2. Selection of appropriate methodology by using modern tools 3. Design & analyse the solution through appropriate Measurements and calculations
Prerequisites: Design Project-1	

CO, PO AND PSO MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	3	2	2	3	3	3	3	1		
CO-2	3	3	3	2	3	2	2	3	3	3	3	1		
CO-3	3	3	3	2	3	2	2	3	3	3	3	1		

Weightage of Assessment:

Review / Examination Scheme	Weightage
First Review	20%
Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee shall be constituted by the HoD for the Review.

Assessment Rubrics

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0

Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

*** - Attributes for individual contribution.**

EVALUATION PARAMETERS FOR ASSESSMENT

To be followed same as approved for Design project 1

SEMESTER – V

COURSE TITLE		PUBLIC SPEAKING			CREDITS	1
COURSE CODE		GLS51005	COURSE CATEGORY	HS	L - T – P – S	1 – 0 – 1 – 1
Version	1.0	Approval Details	37th ACM		LEARNING LEVEL	BTL – 4
ASSESSMENT SCHEME						
CIA						ESE

First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	Theory	Practicals
15 %	15 %	10 %	5 %	5 %	25%	25%

Course Description	This course is an introduction to speech communication that emphasises the practical skill of public speaking, including techniques to lessen speaker anxiety and the use of visual aids to enhance speaker presentations. Civility and ethical speech-making are the foundations of this course. Its goal is to prepare students for success in typical public speaking situations and to provide them with the basic principles of organisation and research needed for effective speeches.
Course Objective	By the end of this course, students will be able to: 1. Develop the ability to critically evaluate speeches by assessing both verbal and non-verbal elements to effectively analyse their overall effectiveness. 2. Enhance audience analysis skills to understand the preferences, needs, and characteristics of the target audience and design speeches that align with their expectations and interests. 3. Acquire the capability to organise speeches in a manner that achieves specific objectives, such as providing informative content, persuasive arguments, or fulfilling the unique requirements of special occasions. 4. Master the application of presentation aids to complement and amplify the impact of speeches, utilising visual, auditory, or other supportive tools to enhance engagement and comprehension. 5. Develop proficient research skills by critically analysing and interpreting diverse and relevant sources of information on a wide range of topics to bolster the credibility and depth of the speeches.
Course Outcome	Upon completion of this course, the students will be able to 1. Evaluate speeches based on a variety of verbal and non-verbal criteria. 2. Analyse the audience and design speeches to reflect the analysis. 3. Organise the speech that informs, persuades, or fulfils the needs of a special occasion. 4. Apply the presentation aids to enhance the speech. 5. Analyse meaningful research on a variety of topics.
Prerequisites: Plus Two English-Intermediate Level	

CO, PO AND PSO MAPPING

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	-	2	-	3	3	-	-	2	3	2	3	3	2
CO 2	2	-	2	-	3	3	-	-	2	3	2	3	3	2
CO 3	2	-	2	-	3	3	-	-	2	3	2	3	3	2
CO 4	2	-	2	-	3	3	-	-	2	3	2	3	3	2
CO 5	2	-	2	-	3	3	-	-	2	3	2	3	3	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 : Introduction to Public Speaking and Speech Evaluation (6 Hours)

Introduction – What is public speaking? – Different kinds of speeches – Mastery of language – Criteria for Evaluating Speeches-Awareness to strategies – Evaluating Verbal Criteria– Adapting Speech to Audience and Context **Speaking Skills (Activities):** Self-Introduction- Speak for 60 seconds	**CO-1 BTL-2**
MODULE 2 : Analyzing the Audience and Designing Speeches (6 Hours)	
Public Speaking and Audience Analysis- Acquire knowledge – Skill in real life presentation – Techniques for Conducting Audience Analysis– Adapting Speech Content- Visual aids – Ethical Considerations in Audience Analysis and Speech Design **Speaking Skills (Activities):** Group Discussions and Team Presentation-Role Plays - Monologues- Recitations	**CO-2 BTL-3**
MODULE 3 : Art Of Speaking (6 Hours)	
Organizing Speeches for Information, Persuasion, and Special Occasions- Art of speech – Organizational Structures for Informative Speeches– Adapting Speech Organization to Special Occasions - Visual and Verbal Techniques for Speech Organization- To have self-confidence – Humour – Anecdotes – Personal experiences – knowledge on current events **Speaking Skills (Activities)**: Group Debates - Impromptu Speaking	**CO-3 BTL-3**
MODULE 4 : Applying Presentation Aids to Enhance Speeches (6 Hours)	
Public Speaking and Presentation Aids- Types of Presentation Aids- Designing and Creating Effective Visual Aids- Incorporating Audio and Physical Aids-Delivering method – Involvement – Organization – Planning and designing meticulously- Presenting with Presentation Aids **Speaking Skills (Activities)**: Master of Ceremony-Group Activities and Open Discussion	**CO-4 BTL-3**
MODULE 5 : Delivery And Execution (6 Hours)	
Preparation – Purpose of the Speech - Selecting the subject – Making an outline – Research Analysis Methods for Informative Speeches -Gathering materials – Critical Thinking and Research Ethics– Time Management – Rehearsing **Speaking Skills (Activities)**: On the spot topic speech for 5 minutes-Mock Interviews – Panel sessions	**CO-5 BTL-4**
TEXT BOOKS	
1	Carnegie, Dale and Esenwein, J. Berg. The Art Of Public Speaking. Rupa Publications India, 2018
RENCE BOOKS	
1.	Peale, Norman Vincent. The Power of Positive Thinking, Fingerprint Publishing, 2017
2.	Carnegie, Dale. The Art of Public Speaking, Mittal Books Publishing House, 2015
E Books	
1	https://www.managementhelp.org/public-speaking
2	https://gtu.ge/Agro-Lib/successful-public-speaking.pdf
MOOC Courses	
1	https://www.coursera.org/learn/public-speaking
2	https://onlinecourses.nptel.ac.in/noc22_hs134/preview

COURSE TITLE	**CONTROL SYSTEMS**			**CREDITS**	**4**
COURSE CODE	**EMD51008**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					

CIA					ESE	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance ***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	Control system is designed to provide a clear concept of system analysis based on various aspects. This course gives theoretical and practical exposure for the students to understand open loop and closed loop, modelling, controller design, stability analysis and design of compensators suitable for system. This course is very essential as it works towards controller and the automation. Finds its role in academic, industry and research.
Course Objective	The course should enable the students to 1. Model the systems to derive its transfer function 2. Demonstrate time and frequency domain analysis using mathematical equations and response. 3. Build adequate knowledge on the concept of stability of control system and methods of stability analysis 4. Implement various methods of designing compensators for the control system. 5. Interpret the state models and state variables
Course Outcome	Upon completion of this course, the students will be able to 1. Simulate various input/output models of dynamic system 2. Solve the frequency domain descriptions for dynamic analysis 3. Apply the concept of stability and effect of feedback control on sensitivity 4. Construct classical control system design such as root locus and phase lead-lag compensation based on Bode plots 5. Apply the principles of control theory using state variable analysis

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO-2	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO-3	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO-4	3	3	3	2	-	-	-	-	-	-	-	2	2	2
CO-5	3	3	2	1	-	-	-	-	-	-	-	2	1	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: SYSTEMS AND THEIR REPRESENTATION **(9L+ 6P)**

Basic elements in control systems – open and closed loop systems. Examples – Mathematical model, Translational & Rotational systems, transfer function, block diagram reduction techniques, signal flow graph. **Suggested Readings**: Differential Equations, Laplace Transforms **Lab Experiments** 1. Simulation of basic open and closed loop systems	**CO - 1** **BTL - 3**

2. Response of first order and second order systems 3. Mathematical modelling of Spring mass damper system **Software/Equipment Required** MATLAB ,Simulink & Simscape	
MODULE 2: TIME RESPONSE (9L+ 6P)	
Time response, time domain specifications, types of test inputs – I and II order system response, error coefficients, generalized error series, steady state error, ON-OFF, P, PI, PD, PID controller characteristics. **Suggested Readings:** Error analysis, Controller Design and analysis. **Lab Experiments** 1. Generation of waveforms 2. Generation of unit step, ramp, impulse and convolution sequences 3. Analysis of Time Domain specifications 4. Design of Proportional Integral Derivative (PID) Controller **Software/Equipment Required** MATLAB & Simulink	**CO - 2 BTL - 3**
MODULE 3: FREQUENCY RESPONSE ANALYSIS AND DESIGN (9L+ 6P)	
Introduction to Performance specifications, correlation to time domain specifications, Bode plots and polar plots, gain and phase margin **Suggested Readings** Frequency Domain characteristics and Analysis. **Lab Experiments** 1. Frequency Domain (Stability) analysis 2. Design of Bode Plot 3. Design of Polar plot **Software/Equipment Required** MATLAB & Simulink	**CO - 3 BTL - 3**
MODULE 4: STABILITY OF CONTROL SYSTEMS AND COMPENSATOR DESIGN (9L+ 6P)	
Characteristic equation, location of roots in s-plane for stability, Routh Hurwitz criterion, root locus techniques, Concepts of Nyquist stability criterion , Lag compensator, Lead Compensator. **Suggested Readings:** Cascade System, Stability analysis of systems. **Lab Experiments** 1. Design of Lag compensator 2. Design of Lead compensator **Software/Equipment Required** MATLAB & Simulink	**CO - 4 BTL - 3**
MODULE 5: STATE VARIABLE ANALYSIS (9L+ 6P)	
Concept of state variables, State models for linear and time invariant systems, Solution of state and output equation in controllable canonical form, Controllability and Observability **Suggested Readings:** State transition matrix. **Lab Experiments** 1. Verification of system controllability 2. Verification of system observability **Software/Equipment Required** MATLAB & Simulink	**CO - 5 BTL - 3**
TEXT BOOKS	
1.	Katsuhiko Ogata, "Modern Control Engineering", Pearson Education, 5th Edition, 2021

2.	Golnaraghi, Farid and Benjamin C. Kuo, "Automatic Control Systems", New York: McGraw-Hill Education, 10th Edition, 2017
REFERENCE BOOKS	
1.	Leonard N.E. and William Levine, "Using MATLAB to Analyze and Design Control Systems", Addison Wesley, 2nd Edition, 1995.
2.	M. Gopal, "Digital Control and State Variable Methods", McGraw Hill Education, 4th Edition, 2017
E RESOURCES FOR REFERENCE	
1.	https://www.google.co.in/books/edition/Design_and_Analysis_of_Control_Systems/VSlHxALK6OoC?q= cont+rol+systems&gbpv=1#f=false
2.	https://www.pdfdrive.com/the-control-handbook-second-edition-control-system-fundamentals-second-edition-electrical-engineering-handbook-e162460502.html
MOOC	
1.	https://www.udemy.com/course/control-systems-engineering-from-scratc/
2.	https://onlinecourses.nptel.ac.in/noc19_de04/preview

COURSE TITLE	**INDUSTRIAL AUTOMATION**			**CREDITS**	**3**
COURSE CODE	**EMD51009**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-1-0-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	Industrial Instrumentation delivers the automation tools required for the Real time application. The knowledge of programmable logic controller basics, design for software and hardware requirements for a successful deployment. The different methods of programming the PLC and instructions used to program PLC are dealt with. The exposure to SCADA tools gives a cutting-edge deployment of effective management of resources available in plant or networked zones. The Distributed control system plays a vital role in industry scenario to monitor and control the day to day operations of the plant.
Course Objective	The course should enable the students to 1. The course should enable the students to classify Industrial automation systems 2. Understand the fundamental operation of Programmable logic controller 3. Distinguish Functioning of SCADA and HMI/MMI in automation systems 4. Gain an insight of the architecture and functioning of Distributed control system 5. Interface sensor and actuators for plant control in various applications

Course Outcome	Upon completion of this course, the students will be able to 1. Comprehend and gain knowledge about industrial automation systems. 2. Provide solutions with PLC ladder programming 3. Apprehend the various components of automation systems. 4. Develop plant control applications with DCS system programming 5. Design DCS based solution for industrial applications.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	2	2	-	-	-	-	-	1	1	2	2
CO-2	3	3	3	2	2	-	-	-	-	-	1	1	2	2
CO-3	3	3	3	2	2	-	-	-	-	-	1	1	2	2
CO-4	3	3	3	2	2	-	-	-	-	-	1	1	2	2
CO-5	3	3	3	2	2	-	-	-	-	-	1	1	2	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: AUTOMATION COMPONENTS (6L+3T)	
Introduction – Automation- Automation components- sensors and actuators for measurement- Industrial bus systems: Profibus- Modbus-Field bus-ethernet. PLC Hardware / Architecture- Relay / Digital Logics- Ladder Logics Programming- Functional Block Programming- PLC Scan Cycle- Introduction to Programmable Automation Controllers. **Suggested Readings:** Industrial Process Control Systems – Applications and Examples	**CO - 1 BTL - 2**
MODULE 2: PROGRAMMABLE LOGIC CONTROLLERS (6L+3T)	
Hardware, selection, I/O devices and programming- Bit, Byte & Word Instructions- Compare/Logical / Arithmetic- Program Control Instructions- Timer, Counter Configuration, Instruction Set, SFR- PID Mode Programming- Upload / Download / Monitoring of Program, Forcing Inputs & Outputs- Analog Input/Output Addressing- Digital Input/Output Addressing. PLC Troubleshooting:- I/O Modules Configuration Panel Wiring Designing Communication Drivers- Networking Configuration MMI/SCADA Interface. **Suggested Readings:** Study of Digital data systems, Study of data acquisition devices.	**CO - 2 BTL - 3**
MODULE 3: AUTOMATION SYSTEMS (6L+3T)	
SUPERVISORY CONTROL AND DATA ACQUISTION SYSTEMS:-- Introduction SCADA, Creating Database- Images, Objects Configuration- Dynamic Properties (Blinking Visibility, Movement, Filling)- Tag Creation & Addressing- Alarm / Events Configuration- Trends - Realtime & Historical- Database & DDE Connectivity- Interfacing with PLC- OPC/ODBC MAN/HUMAN MACHINE INTERFACE:- Introduction To MMI/HMI- Different Types of Operator Interfaces- Textual & Graphical- Properties for the Design- I/O Configuration- Data Handling with HMI- Configuration and Interfacing to PLC & PC **Suggested Readings:** Study of key components of automation systems, Study of various types of automation systems	**CO - 3 BTL - 3**
MODULE 4: DISTRIBUTED CONTROL SYSTEM (6L+3T)	

DISTRIBUTED CONTROL SYSTEM(DCS):- Architecture of DCS- Comparison of PLC and DCS- Hardware Configuration- I/O Modules- Communication Modules- Troubleshooting- I/O Wiring- Programming, CPU IP Setting, CPU Addressing, Node Addressing- Operator Interface Designing- Controller Interface- Communication Protocols for DCS. **Suggested Readings / Activities:** Study of key components of distributed control systems Study of data interfacing and communication from field devices	**CO - 4 BTL - 3**
MODULE 5: APPLICATIONS (6L+3T)	
Introduction to numbers systems, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates. **Suggested Readings:** Study of redundant systems and history servers, Study of DCS implementation for industries	**CO - 5 BTL - 3**

TEXT BOOKS	
1.	William C Dunn, "Fundamentals of Industrial Instrumentation and Process Control", McGraw Hill Education, Second Edition, 2018.
2.	Chanchal Dey, Sunit Kumar Sen ,"Industrial Automation Technologies", CRC Press, Third Edition, 2022
REFEREREFERENCE BOOKS	
1.	Stamatios Manesis, George Nikolakopoulos , "Introduction to Industrial Automation", CRC Press, Taylor & Francis Group, Third Edition, 2020.
2.	Frank Lamb, "Industrial Automation: Hands On", McGraw Hill LLC, Second Edition, 2017
E RESOURCES FOR REFERENCE	
1.	https://app.plcsimulator.online/
2.	https://www.plcfiddle.com/
3.	https://instrumentationtools.com/concept-of-dcs-in-industrial-automation/
MOOC	
1.	https://nptel.ac.in/courses/108105062
2.	http://www.eit.edu.au/cms/courses/industrial-automation-instrumentation-processcontrol/professional-certificate/in-instrumentation-automation-and-process-control
3.	https://www.udemy.com/share/108Sd8/

COURSE TITLE	**DESIGN OF MECHANICAL ELEMENTS**			**CREDITS**	**3**
COURSE CODE	**EMD51010**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-1-0-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 4**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	The course focuses on the fundamentals and principles of basic mechanical elements, failure theories and design criteria, and structures of basic mechanical systems. The goal of the course is to learn how to design simple mechanical elements and systems.
Course Objective	The course should enable the students to 1. Explain the concepts of different theories of failure and develop an ability to apply its knowledge for design of mechanical components and determine the resisting areas against failure. 2. Determine forces on transmission shaft and design of transmission shaft. 3. Explain the concepts to determine forces in welds and riveted joints and formulate design solution for size of weld and size of rivet. 4. Determine forces on springs and formulate design solution of various springs. 5. Select appropriate flywheel and bearings using standard procedure
Course Outcome	Upon completion of this course, the students will be able to 1. Analyse and design power screws with respect to different external loads 2. Design of shafts with respect to static and dynamic axial loads. 3. Analyse and design bolted, riveted, welded joints with respect to static and dynamic shear and bending loads. 4. Analyse and design various springs with respect to different external loads. 5. Select appropriate bearing and flywheels for different applications.

Prerequisites: NIL

CO, PO AND PSO MAPPING

	PO -1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO -8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	-	1	-	-	1	0	-	-	1	2	-
CO-2	3	3	3	-	1	-	-	1	0	-	-	1	2	-
CO-3	3	3	3	-	1	-	-	1	0	-	-	1	2	-
CO-4	3	3	3	-	1	-	-	1	0	-	-	1	2	-
CO-5	3	3	3	-	1	-	-	1	0	-		1	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO DESIGN PROCESS (6L+ 3T)

Factors influencing machine design, selection of materials based on mechanical properties – Direct, Bending and torsional stress equations – impact and shock loading-calculation of principle stresses for various load combinations, eccentric loading – Design of curved beams – crane hook and 'C' frame – Theories of failure – stress concentration – fatigue strength and the S-N diagram- Soderberg, Goodman and Gerber relations. **Suggested Readings:** • International standards for fits and tolerances • Case studies on sketching of fits and tolerances for machine drawing	**CO - 1** **BTL - 3**

MODULE 2: DESIGN OF SHAFTS AND COUPLINGS (6L+ 3T)

Design of solid and hollow shafts based on strength, rigidity and critical speed – Design of keys and key ways – Design of rigid and flexible couplings. **Suggested Readings:** • Study of Cotter joints • Case studies of modelling and analysis of cotter joints	**CO - 2** **BTL - 5**

MODULE 3: DESIGN OF FATERNERS AND WELDED JOINTS (6L+ 3T)	
Threaded fasteners – Design of bolted joints including eccentric loading - Design of welded joints for pressure vessels and structures – Theory of bonded joints. **Suggested Readings:** • Study of welding on dissimilar materials • A Case Study for the Welding of Dissimilar Aluminum Alloys by Friction Stir Welding	**CO - 3** **BTL - 3**
MODULE 4: DESIGN OF SPRINGS AND LEVERS (6L+ 3T)	
Design of helical, leaf, disc and torsion springs under constant loads and varying loads – concentric torsion springs – Belleville springs – Design of Levers. **Suggested Readings:** • Study of composite leaf spring • Case study on Design and Analysis of Leaf Spring by using Composite Material	**CO - 4** **BTL - 3**
MODULE 5: DESIGN OF BEARINGS AND FLYWHEELS (6L+ 3T)	
Design of bearings – sliding contact and rolling contact types – cubic mean load- Design of Journal bearings – Mckee's equation – Lubrication in Journal bearings – Calculation of bearing dimensions. Design of flywheels involving stresses in rim and arm. **Suggested Readings:** • Study on hydrodynamic gas bearing and its applications • Rolling element bearing failure analysis: A case study	**CO - 5** **BTL - 3**

TEXT BOOKS	
1.	Juvinall R. C., Marshek K.M., "Fundamentals of Machine component Design ", John Wiley & Sons, Fifth Edition, 2019.
2.	Bhandari, V.B., "Design of Machine Elements", Tata McGraw-Hill Publishing Company Ltd, 2017.
REFERENCE BOOKS	
1.	Norton R.L, "Design of Machinery", McGraw-Hill, 2004.
2.	Jack A. Collins, Henry R. Busby & George H. Staab, "Mechanical Design of Machine Elements and Machines", John Wiley & Sons, The Ohio State University., 2nd Edition, 2009.
E RESOURCES FOR REFERENCE	
1.	https://books.google.co.in/books?isbn=1118987683
2.	https://www.google.co.in/search?tbo=p&tbm=bks&q=isbn:1259083519
MOOC	
1.	http://nptel.ac.in/courses/112106137/
2.	http://www.nptelvideos.in/2012/12/design-of-machine-elements.html

COURSE TITLE	**DESIGN PROJECT-3**			**CREDITS**	**1**
COURSE CODE	EMD51804	**COURSE CATEGORY**	EEC	**L-T-P-S**	0-0-2-6
Version	1.0	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	BTL-4
ASSESSMENT SCHEME					
First Review	**Second Review**	**Third Review**	**Project Report & Viva Voce**		
20%	**20%**	**10%**	**50%**		

Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the real time problem statement and gives a strong Engineering and Practical foundation for understanding the different types of social problems and its solution based on engineering knowledge. This course is suitable for general engineering students to understand the importance of engineering concepts and its relevant applications. Different Simulation tools to be used in the execution of the design methodology. The resources and team management skills are utilized to develop an innovative, economic solution to the selected problem.
Course Objective	The course will enable the students to: 1. Explore the literature study and report preparation skills 2. Demonstrate project identification and execution of feasible solution to address the problem statement 3. Elucidate the communication and team management skills
Course Outcome	Upon completion of this course, the students will be able to 1. Identify a real-time problem by intensive literature survey 2. Selection of appropriate methodology by using modern tools 3. Design & analyse the solution through appropriate Measurements and calculations
Prerequisites: Design Project -2	

CO, PO AND PSO MAPPING

	PO - 1	**PO - 2**	**PO - 3**	**PO-4**	**PO - 5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO - 10**	**PO-11**	**PO-12**	**PSO -1**	**PSO-2**
CO -1	3	3	2	2	3	2	2	3	3	3	3	1		
CO -2	3	3	3	2	3	2	2	3	3	3	3	1		
CO -3	3	3	3	2	3	2	2	3	3	3	3	1		

Weightage of Assessment:

Review / Examination Scheme	**Weightage**
First Review	20%
Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee shall be constituted by the HoD for the Review.

Assessment Rubrics

Parameter	**Weightage (%)**
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0

Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

*** - Attributes for individual contribution.**

EVALUATION PARAMETERS FOR ASSESSMENT

To be followed same as approved for Design project 1

COURSE TITLE	**ENTREPRENEURSHIP**			**CREDITS**	**2**
COURSE CODE	**EGE51004**	**COURSE CATEGORY**	**ES**	**L-T-P-S**	**2-0-0-6**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance ***	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	The students shall develop a detailed insight about various aspects of Entrepreneurship. Knowledge and Skill levels of Entrepreneur will be discussed in the Module I , whereas stakeholders policies were briefed in the Module II. Detailed procedure of preparing a business plan will be taught in the Module III, mobilization of various resources will be discussed in the Module IV . Finally, Module V will provide insights about monitoring and evaluation of business.				
Course Objective	1. The course aims to utilize the basic concepts of Entrepreneurship 2. The course also equips the students to Identify the internal and external environments of new businessventure 3. The course aims to prepare organizational goals of new business 4. The course also trains the students to build strategic approaches to succeed in the start-up				

Course Outcome	Upon completion of this course, the students will be able to 1. Utilize the basic concepts of Entrepreneurship 2. Identify the internal and external environments of new business venture 3. Prepare organizational goals of new business 4. Build strategic approaches to succeed in the start-up 5. Assess the progress of a new business venture and promote sustainability

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	3	2	3	2	2	3	2	2	3	2	3
CO-2	3	2	1	2	3	3	2	1	3	3	2	3	3	3
CO-3	2	3	2	3	2	3	2	1	2	2	2	3	2	1
CO-4	3	3	2	2	2	2	1	2	3	3	2	3	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: ENTREPRENEURAL COMPETENCE (6L)	
Entrepreneurship concept – Entrepreneurship as a Career – Entrepreneurial Personality - Characteristics of Successful, Entrepreneur – Knowledge and Skills of Entrepreneur. **Suggested Readings:** 1. Knowledge and Skills of Entrepreneur	**CO-1** **BTL-3**
MODULE 2: ENTREPRENEURAL ENVIRONMENT (6L)	
Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organizational Services - Central and State Government Industrial Policies and Regulations - International Business. **Suggested Readings:** 1. Central and State Government Industrial Policies	**CO-2** **BTL-3**
MODULE 3: BUSINESS PLAN PREPARATION (6L)	
Sources of Product for Business - Prefeasibility Study - Criteria for Selection of Product - Ownership - Capital - Budgeting Project Profile Preparation - Matching Entrepreneur with the Project - Feasibility Report Preparation and Evaluation Criteria. **Suggested Readings:** 1. Criteria for Selection of Product	**CO-3** **BTL-3**
MODULE 4: LAUNCHING OF NEWVENTURE (6L)	
Finance and Human Resource Mobilization Operations Planning - Market and Channel Selection - Growth Strategies - Product Launching – Incubation, Venture capital, IT startups. **Suggested Readings:** 1.	**CO-4** **BTL-3**
MODULE 5: MANAGEMENT OF NEW VENTURE (6L)	
Monitoring and Evaluation ofBusiness - Preventing Sickness and Rehabilitation of Business Units- Effective Management of small Business. **Suggested Readings:** 1. Monitoring and Evaluation ofBusiness	**CO-5** **BTL-3**
T BOOKS	

COURSE TITLE	INTERNSHIP – 2 ((to be evaluated in 5th semester. To be carried out in summer after 4th semester)			CREDITS	1
COURSE CODE	EMD51803	COURSE CATEGORY	EEC	L-T-P-S	0-0-0-0
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-4
ASSESSMENT SCHEME					

1.	Hisrich, Entrepreneurship, Tata McGraw Hill, New Delhi, 2001.
2.	S.S.Khanka, Entrepreneurial Development, S.Chand and Company Limited, New Delhi, 2001
EREFERENCE BOOKS	
1	Mathew Manimala, Entrepreneurship Theory at the Crossroads, Paradigms & Praxis, Biztrantra ,2nd Edition ,2005
2	Prasanna Chandra, Projects – Planning, Analysis, Selection, Implementation and Reviews, Tata McGraw-Hill, 1996.
3	P.Saravanavel, Entrepreneurial Development, Ess Pee kay Publishing House, Chennai -1997.
4	Donald F Kuratko, T.V Rao. Entrepreneurship: A South Asian perspective. Cengage Learning. 2012
E Resources for Reference	
1.	https://epgp.inflibnet.ac.in/ahl.php?csrno=23 (Management P-01, M-02)
2.	https://epgp.inflibnet.ac.in/ahl.php?csrno=23 (Management P-01, M-13)
3.	https://epgp.inflibnet.ac.in/ahl.php?csrno=23 (Management P-01, M-14)
4	https://epgp.inflibnet.ac.in/ahl.php?csrno=23 (Management P-01, M-21)
5	https://epgp.inflibnet.ac.in/ahl.php?csrno=23 (Management P-01, M-30)
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc21_mg70/preview
2.	https://onlinecourses.nptel.ac.in/noc22_ge03/preview

Visit Report, Feedback of the employer , Presentation & Viva Voce, MCQ Assessment	
100%	
Course Description	This course aims to inculcate the application of knowledge & skill learned through classroom practices. It demands the academic component consisting of research, reflection, written and oral skills of the learner.
Course Objective	The course will enable the students to 1. Explore career alternatives prior to graduation. 2. Integrate theory and practice. 3. Assess interests and abilities in their field of study. 4. Build a record of work experience.
Course Outcome	Upon completion of this course, the students will be able to 1. Choose appropriate modern tools used in the field of Electronics and Communication engineering to manage the resources effectively by applying innovative ideas 2. Demonstrate ethical conduct and professional accountability while working in a team for the benefit of society. 3. Communicate effectively and to write the scientific report of the learnings
Prerequisites: Basic knowledge in Measurements, Data Analysis, Interpretation.	

CO, PO AND PSO MAPPING

	PO-1	PO-2	PO -3	PO-4	PO-5	PO-6	PO-7	PO-8	PO -9	PO -10	PO -11	PO -12	PS O-1	PSO-2
CO-1	3	3	-	-	3	2	-	-	-	-	2	-	-	3
CO-2	-	-	-	-	3	-	-	3	2	2	-	-	2	-
CO-3	-	-	-	-	-	-	-		3	3	3	2	--	-

Weightage of Assessment:

Assessment Scheme	Weightage
Presentation & Viva voce	50 %
Report	20 %
Feedback of the Employer	30%

A committee will be constituted by the HoD with Internship coordinator as head for learning assessment process

SEMESTER – VI

COURSETITLE	ENGLISH FOR COMPETITIVE EXAMINATIONS			CREDITS	1
COURSECODE	GLS51006	COURSE CATEGORY	HS	L-T-P-S	1-0-1-1
Version	1.0	ApprovalDetails	37th ACM	LEARNING LEVEL	BTL-4
ASSESSMENTSCHEME					

CIA					ESE	
First Periodical Assessment	**Second Periodical Assessment**	**Practical**	**Surprise Test / Quiz., as approved by the Department Examination Committee "DEC"**	**Attendance**	**Practical**	**Theory**
15 %	**15 %**	**10 %**	**5 %**	**5 %**	**25 %**	**25 %**
Course Description	This course provides students with the skills and strategies needed to succeed in competitive exams, such as English grammar, vocabulary, reading and writing skills, listening comprehension, and critical thinking. It also helps them to understand the English language and exam structure better.					
Course Objective	1. To provide an environment where people may compete on both a formal and casual level and employ those abilities in regular conversation, presentations, group discussions, and debates. 2. To prepare the students to read literary materials, comprehend them, and respond to questions based on them. 3. Assisting students in developing social awareness and positive responses to societal demands. 4. To give students a setting in which to take competitive exams.					
Course Outcome	Uponcompletionofthis course,thestudentswill beable to; 1. Acquire knowledge of the structure and format of competitive examinations. 2. Improve vocabulary and grammar to increase success in competitive examinations. 3. Develop critical thinking and problem-solving skills to answer complex questions. 4. Analyse their vocabulary and communication ability to build the knowledge of idioms, phrasal verbs and commonly used expressions.for better productivity, job performance and to develop self-confidence. 5. Learn how to approach and solve comprehension and essay questions with confidence.					

Prerequisites: PlusTwoEnglish-IntermediateLevel

CO, PO AND PSO MAPPING

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	-	2	-	3	3	-	-	2	3	2	3	3	1
CO2	2	-	2	-	3	3	-	-	2	3	2	3	3	1
CO3	2	-	2	-	3	3	-	-	2	3	2	3	3	1
CO4	2	-	2	-	3	3	-	-	2	3	2	3	3	1
CO5	2	-	2	-	3	3	-	-	2	3	2	3	3	1

1:Weaklyrelated,2:Moderatelyrelatedand3:Stronglyrelated

MODULE1 **(6 Hours)**

Introduction to Competitive Exams - IELTS, TOEFL etc., Precis writing – Types of Letter writing – Business Letters – Letters for employability	**CO-1 BTL-2**
MODULE2 (6 Hours)	
Reading Comprehension- Cloze Test- Passage Completion-Practice Test – Listening Comprehension Exercise (Lab)	**CO-2 BTL-3**
MODULE3 (6 Hours)	
Spotting Errors- Sentence Improvement-Practice Test	**CO-3BTL-3**
MODULE4 (6 Hours)	
Para Jumbles- Tracing Odd Sentences- Synonyms and Antonyms-Practice Test	**CO-4 BTL-3**
MODULE5 (6 Hours)	
Idioms and Phrases, One Word Substitution, Active and Passive Voice, Direct-Indirect Speech-Practice Tests	**CO-5 BTL-3**

TEXT-BOOK

1. General English for Competitive Exams, by Dr. Rashmi Singh, 2nd Edition

REFERENCEBOOKS

1. TOEFL

E-REFERENCES

1 https://www.careers360.com/all-ebooks

2 https://www.dishapublication.com/ebooks

3 https://www.visionias.net/p/free-e-books-for-all-competitive.html

4 https://www.fdaytalk.com/ebooks/

MOOC

1 https://www.mooc-list.com/tags/english

COURSE TITLE	**MOTION CONTROL**			**CREDITS**	**4**
COURSE CODE	**EMD51011**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**3-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**
ASSESSMENT SCHEME					
CIA				**ESE**	

First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	Motion control is a sub-field of automation, encompassing the systems or sub-systems involved in moving parts of machines in a controlled manner. A motion control system is extensively used in a variety of fields for automation purposes, including precision engineering, micro-manufacturing, and production lines, where power, efficiency, and accuracy of movement are of vital importance. Not only does a motion control system enable movement, but, more importantly, it ensures that a machine can stop. Therefore, the goal of this course is to introduce motion control concepts and components for the design of industrial systems. This course provides the basic concepts of sensors, drives, actuators, and control structures required for motion control system design. The main emphasis is on the fundamentals of sensing physical quantities, actuators, drives, control structures, and motion modes.
Course Objective	The course should enable the students to 1. Term Motion Control and appreciate its use in Industries. 2. Working principle of various sensors, associate signal processing, and its applications 3. The underlying principle of Drives, actuators, and transmission mechanisms 4. Various motion profiles and control strategies applied in motion control 5. Design a simple single and multi-axis motion control system
Course Outcome	Upon completion of this course, the students will be able to 1. Appreciate the fundamental concepts and the role and the common elements of the motion control systems. 2. Identify and select the necessary feedback and control devices used in the design of industrial motion control systems. 3. Comprehend various drives, controls, and transmission mechanisms and choose a suitable one for the system design. 4. Realize various Motion profiles and control structures in the design of a single and multi-axis system. 5. Discuss various networking standards and techniques used in the Industrial system design

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO -1	PO - 2	PO-3	PO-4	PO-5	PO-6	PO - 7	PO-8	PO- 9	PO -10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	1	-	1	1	1	-	1	2	2

CO-2	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**2**	**3**
CO-3	**3**	**3**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**2**	**3**
CO-4	**3**	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**1**	**1**	**-**	**1**	**2**	**3**
CO-5	**3**	**3**	**1**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**2**	**3**

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: INTRODUCTION TO MOTION CONTROL (6L+ 4P)	
Introduction – components of a motion control system – Open Loop Systems – Closed Loop Systems – Motion Control Parameters – Terminologies – Sensor, Actuator, and Controller blocks – Transmission Mechanisms **Suggested Readings:** Industrial Motion Control Systems – Applications and Examples **Lab Experiments:** 1. Study of Motion Control Systems – MOVITRAC, MOVIDRIVE, and MOVIFIT 2. Study of Uniaxial and Multiaxial System **Software / Equipment Required** MOVITRAC, MOVIDRIVE, MOVIFIT, MOVITools.	**CO - 1** **BTL - 2**
MODULE 2: FEEDBACK AND CONTROL DEVICES (12L+6P)	
Introduction to Feedback devices – Classification – Characteristics – Sensors for measurement of Position – Potentiometer, Capacitive sensors, Inductive Sensors; Force – Strain Gauge, Force Sensitive Resistor – Design of SG load cells; Angular velocity – Encoders, Optical Encoders, Sin Cos Encoders and temperature – Bimorph – Thermocouple – Thermistors – RTD. Detection sensors – Limit Switches – Proximity sensors – Photoelectric Sensors – Ultrasonic Sensors – Three-wire sensors. Evaluation of Sensors. Sensor Interfacing. Control Devices – Pilot Control Devices – Push buttons – Selector Switches – Indicator Lights. **Suggested Readings:** Signal Conditioning design for sensors measuring Position, Velocity, Temperature, etc. Design of Strain Gauge Load Cell. **Lab Experiments:** 1. Performance characteristics of a AC servo motor using MOVIDRIVE 2. Performance characteristics of AC Induction Motor using MOVITRAC **Software / Equipment Required** MOVITRAC, MOVIDRIVE, MOVIFIT, MOVITools.	**CO-2** **BTL - 3**
MODULE 3: DRIVES AND ACTUATORS FOR MOTION CONTROL (12L+12P)	
Introduction to drives/actuators for motion control - Types of Actuators – Electric Actuators – DC Motor, AC Motor, Servo Motors; Transmission mechanisms – drive trains – Gears, Pulley and Belt – Lead and Ball Screw – Rack and Pinion – Conveyor – drive train selection - Drives – Types of Drives – DC Drives – DC Drive Fundamentals – Variable Voltage DC Drive – PWM; AC Drives – Drive Electronics – Converters – Inverters – Flux Vector Controls – PWM Controls – Volts/ Hz control. Drive Selection – Braking – Braking Methods. **Suggested Readings:** Study of Basic control structures and loops of a motion control system; study of AC	**CO - 3** **BTL - 3**

servo and Induction motor Model **Lab Experiments:** 1. Speed Control of Servo Motor using Terminals – MoviDrive 2. Speed Control of AC Induction Motor and study its performance characteristics using Terminals – MoviTrac 3. Uni Axial System – Simple Positioning Control of AC Induction Motor using MOVITRAC Variable Frequency Drive (VFD) through MOVITools 4. Modulo Position Control of AC servo Motor using MOVIDRIVE® through Terminals and MOVITools **Software / Equipment Required** MOVITRAC, MOVIDRIVE, MOVIFIT, MOVITools.	
MODULE 4: MOTION PROFILE, CONTROL STRUCTURES, AND APPLICATIONS (9L+8P)	
Motion profiles – position and velocity controls – Inner and Cascaded loops – Pulse Width Modulation for DC motors, Servo Systems – Motion modes – linear, circular, and contour moves – motion programming – single axis motion – multi-axis motion – master-slave motion – industrial applications – case studies. **Suggested Readings:** Simulation model for vector control of an AC Induction motor and AC Servo Motor **Lab Experiments:** 1. Linear Operation: Multi Axle position control for pick and place operation using GANTRY Robot 2. Rotary Indexing: Modulo Position Control of Rotary Indexing Table using MOVITRAC® **Software / Equipment Required** MOVIAXIS® , GANTRY ROBOT, MOVITRAC – ROTARY INDEXER.	**CO - 4** **BTL - 3**
MODULE 5: INDUSTRIAL INTERFACING AND NETWORKING CONCEPTS (6 L)	
Introduction – Hierarchy of Industrial Networks: Sensor – Device and Control Bus Networks Enterprise Networks – Network Topologies: Bus – Ring - Star and Combination topologies – Data Flow Management: Token Passing - CSMA – Transmission Hardware: Twisted Pair, Co-axial, Quick Connect, and Fiber optic – Network Backbones – Switches, Hubs, Bridges and Gateway - Network Communication Standards - Field Bus Networks – Modbus, CAN bus, AS-Interface – HART, Fieldbus, Profibus, ProfiNet, CAN bus – Netlinx – Device Net – Control Net and EtherCAT. **Suggested Readings:** Study of various communication networks and protocols used in the industries. **Lab Experiment: N/A**	**CO - 5** **BTL - 2**

TEXTBOOKS	
1.	Hakan Gurocak, “Industrial Motion Control – Motor selection, Drives, Controller tuning, Applications” John Wiley and Sons Ltd., pp. 1 to 314, 2016.
2.	Terry L.M. Bartlet, “Industrial Automated Systems Instrumentation and Motion Control”, Delmar Cengage Learning, 2011.
REFERENCE BOOKS	
1.	Nathan Ida, “Sensors, Actuators and their Interfaces, A multidisciplinary introduction”, SCI TECH Publications, pp. 1 to 119, 281-324, 2014.
2.	Clarence W. de Silva, “Sensors and Actuators Engineering System Instrumentation”, CRC press, 2016.
E RESOURCES FOR REFERENCE	

1.	https://link.springer.com/book/10.1007/978-1-4302-6014-1
MOOC	
1.	https://ocw.tudelft.nl/course-lectures/5-motion-control/
2.	https://nptel.ac.in/courses/108/108/108108147/

COURSE TITLE	**INDUSTRIAL ELECTRONICS**			**CREDITS**	**3**	
COURSE CODE	**EMD51012**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-0-2-2**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	The field of industrial electronics covers a plethora of problems that must be solved in industrial practice and deals not only with the traditional electronics but also specialized electronics for high-power applications. This course gives an insight into the core areas of Industrial Electronics segmented into Power Electronics, Factory Automation, Mechatronics, Intelligent Systems and emerging technologies.					
Course Objective	The course should enable the students to 1. basic understanding of semiconductor devices and its specific types of applications. 2. understand basics power electronic devices. 3. overview of measurement and data acquisition systems 4. knowledge on application of semiconductor and power electronic devices in industrial automation					
Course Outcome	Upon completion of this course, the students will be able to 1. identify the type of semiconductor device for suitable applications 2. design switching circuits using power semiconductor devices 3. interface and acquire the signals from measurement systems 4. explain the concept of industrial automation and its applications					
Prerequisites: NIL						

CO, PO AND PSO MAPPING														
CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**

CO-1	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO-2	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**-**
CO-3	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**
CO-4	**3**	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**1**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: SEMICONDUCTOR DEVICES AND APPLICATIONS (6L+ 6P)	
Semiconductor materials- intrinsic and extrinsic types, Ideal Diode, PN junction diode, Zener diode and applications, Rectifier Circuits, Clipping and Clamping circuits, Bipolar Junction Transistors (BJTs)- Transistor as an amplifier, Transistor as a switch, Basic information on Op-Amps- Characteristics-open and closed loop configurations, Practical op amp circuits. **Suggested Readings**: • Distributed Control System **Lab Experiments** • Design of Practical op amp circuits – Clipper, clampers, amplifier, filters **Software/Equipment Required** LM741 IC, Passive and active electronic components	**CO - 1** **BTL - 2**
MODULE 2: POWER SEMI-CONDUCTOR DEVICES (8L+ 6P)	
Study of switching devices, - Power Diodes, Power transistors, DIAC TRIAC, SCRs - characteristics. Single phase and three phase inverters, Choppers, Cycloconverters Single phase AC voltage controllers - Basic Principle **Suggested Readings**: • IGBT - static characteristics and principle of operation **Lab Experiments** Design of single phase rectifier, inverter, and chopper. **Software/Equipment Required** • DIAC, TRIAC, SCR	**CO - 2** **BTL - 2**
MODULE 3: DATA ACQUISITION (6L+6P)	
Introduction - Measurement Systems Characteristics -PLC, Introduction to Automatic Control-P-I-D Control, Data Acquisition Systems **Suggested Readings**: • Virtual Instrumentation **Lab Experiments** 5. Design DAQ system through LABVIEW **Software/Equipment Required** • LABVIEW	**CO - 3** **BTL - 4**
MODULE 4: INDUSTRIAL AUTOMATION (6L+4P)	
Automation overview, Requirement of automation systems, Architecture of Industrial Automation system, Automation components, Distributed Control System, Intelligent systems **Suggested Readings**: • Intelligent systems	**CO - 4** **BTL - 2**

Lab Experiments • Basic Ladder logic programs **Software/Equipment Required** • Delta PLC	
MODULE 5: CASE STUDY (4L+8P)	
Applications of electronic devices in: Sustainable Lighting Technology, Light-Emitting Diode Systems, Solar Power Conversion, Battery Management Systems for Hybrid Electric Vehicles and Electric Vehicles, Electrical Loads in Automotive Systems, Plug-In Hybrid Electric Vehicles, Internet of things for plant automation and overview of Industry 4.0 **Suggested Readings**: • NA **Lab Experiments** • NA **Software/Equipment Required** • NA	**CO - 4** **BTL - 3**

TEXTBOOKS	
1.	Philip T.Krein, "Elements of Power Electronics" Oxford University Press, second Edition, 2017
2.	Terry L.M. Bartlet. "Industrial Automated Systems Instrumentation and Motion Control", Delmar Cengage Learning.
REFERENCE BOOKS	
1.	Reshid, M.H., "Power Electronics – Circuits Devices and Application", Prentice Hall International, New Delhi, 3rd Edition, 2011.
2.	Anthony Peyton, Vincent Walsh, "Analog Electronics with Op-amps: A Source Book of Practical Circuits", (Electronics Texts for Engineers and Scientists) 1st Edition, 2016.
E RESOURCES FOR REFERENCE	
1.	https://bok.asia/book/812190/493ebf?regionChanged=&redirect=7855146
MOOC	
1.	http://nptel.ac.in/syllabus/112106179/
2.	http://www.nptel.ac.in/courses/Webcourse-contents/IIT%20Kharagpur/Power%20Electronics/New_index1.html

COURSE TITLE	**CNC ENGINEERING**			**CREDITS**	**3**
COURSE CODE	**EMD51013**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL - 4**

ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination**	**Attendance***	**THEORY**	**PRACTICAL**

			Committee "DEC"			
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	This course would introduce the idea of Computer Numerical Control (CNC) of machine tools and processes. It will cover classification of such machine tools, technology and devices employed in CNC machines, 2D programming and interpolation using G and M codes. With every part, there will be MCQ, tutorial, problem solving and discussions.
Course Objective	**The course should enable the students to** 1. Describe the fundamental theoretical concepts of Computer Numerical control Machines 2. Comprehend the technologies and devices employed in CNC machines 3. Demonstrate control systems, feedback devices used in CNC machines and CNC printer and plotter 4. Develop the 2D programming and interpolation. 5. Explain troubleshoot and maintenance
Course Outcome	**Upon completion of this course, the students will be able to** 1. Comprehend the fundamental theoretical concepts of Computer Numerical control Machines 2. Familiarize the technologies and devices employed in CNC machines 3. Illustrate control systems, feedback devices used in CNC machines 4. Develop the 2D CNC programming and interpolation. 5. Expertise in troubleshoot and maintenance

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO-PO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	1	-	-	-	-	-	-	2	2	-
CO-2	3	3	-	-	1	-	-	-	-	-	-	2	2	-
CO-3	3	3	-	-	1	-	-	-	-	-	-	2	2	-
CO-4	3	3	-	-	2	-	-	-	-	-	-	2	2	-
CO-5	3	3	-	-	2	-	-	-	-	-	-	2	2	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: FUNDAMENTALS OF MECHANICAL MEASUREMENTS AND CNC MACHINES (6L+6P)

Introduction to Computer Numerical Control: CNC Systems – An Overview of Fundamental aspects of machine control, Different types of CNC machines – Advantages and disadvantages of CNC machines. **Suggested Readings:** • Difference between conventional machine and cnc machines **Lab Experiments:** • Demonstration on mechanical measurements, measurement of cutting tool parameters, gear measurement. **Software / Equipment Required:** • Machine vision system, Profile projector	**CO - 1** **BTL - 2**
MODULE 2: CONSTRUCTIONAL FEATURES OF CNC MACHINES & RETROFITTING (6L+6P)	
Features of CNC Machines: Structure, Drive Mechanism, gearbox, Main drive, feed drive, Spindle Motors, Axes motors. Timing belts and pulleys, Spindle bearing – Arrangement and installation, Slide ways, Re-circulating ball screws – Backlash measurement and compensation, linear motion guide ways. Tool magazines, ATC, APC, Chip conveyors. **Suggested Readings:** • Accessories of conventional machine and CNC machine **Lab Experiments:** • Work setting and tool setting using tool holders, Setting the CNC machine and setting work reference **Software / Equipment Required:** • Torque wrench and Bench vice	**CO - 2** **BTL - 2**
MODULE 3: CONTROL SYSTEMS, FEEDBACK DEVICES AND TOOLING (6L+6P)	
Description of a simple CNC control system, Interpolation systems, Features available in a CNC system – introduction to widely used CNC control systems. Types of measuring systems in CNC machines – Incremental and absolute rotary encoders, linear scale – resolver – Linear inductosyn – Magnetic Sensors for Spindle Orientation, Qualified and pre-set tooling – Principles of location – Principles of clamping – Work holding devices –Microcontroller based Two axis CNC printer- X-Y Plotter. **Suggested Readings:** • Modern sensors for measuring systems in cnc machine **Lab Experiments:** • CNC coordinate systems **Software / Equipment Required:** • CNC Simulator Pro	**CO - 3** **BTL - 3**
MODULE 4: CNC PART PROGRAMMING (6L+6P)	
Part Program Terminology - G and M Codes – Types of interpolation Methods of CNC part programming – Manual part programming – Computer Assisted part programming – APT language – CNC part programming using CAD/CAM-Introduction to Computer Automated Part Programming. **Suggested Readings:** • Specifications of machines and control system. **Lab Experiments:** • Manual and computer assisted part programming for linear interpolation and circular interpolation for milling machine operations and turning machine operations.	**CO - 4** **BTL - 4**

Software / Equipment Required: • CNC Simulator Pro	
MODULE 5: ECONOMICS AND MAINTENANCE (6L+6P)	
Factors influencing selection of CNC Machines – Cost of operation of CNC Machines – Practical aspects of introducing CNC machines in industries – Maintenance features of CNC Machines – Preventive Maintenance, Other maintenance requirements. **Suggested Readings:** • Troubleshooting and Maintenance features of CNC machines. Retro-fitting of Conventional Machine Tools: Modification to be carried out on conventional machines for retrofitting. **Lab Experiments:** • Programming for turning cycles and milling cycles. **Software / Equipment Required:** • CNC Simulator Pro	**CO - 5** **BTL - 4**

TEXT BOOKS	
1.	Mike Mattson, "CNC Programming", Thomson Learning, 2018.
2.	Radhakrishnan P, "Computer Numerical Control Machines", New Central Book Agency, 2017.
REFERENCE BOOKS	
1.	YoreurKoren, "Computer Control of Manufacturing Systems", Pitman, London, 2017.
2.	Groover, M.P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall, 2016.
E RESOURCES FOR REFERENCE	
1.	https://books.google.co.in/books?id=5BDPlAEACAAJ&dq=cnc+technology&hl=en&sa=X&ved=0ahUKEwiDkdHNzvDZAhVLqI8KHSv0B1QQ6AEIJjAA
MOOC	
1.	https://nptel.ac.in/courses/112/105/112105211/
2.	https://www.classcentral.com/course/swayam-computer-numerical-control-cnc-of-machine-tools-and-processes-13953

COURSE TITLE	**INDUSTRY 4.0**			**CREDITS**	**3**
COURSE CODE	**EMD51014**	**COURSE CATEGORY**	**PC**	**L-T-P-S**	**2-0-2-6**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	Industry 4.0, also known as the fourth industrial revolution, represents a significant advancement in digital technology compared to previous decades. It elevates the role of connectivity through the Internet of Things (IoT), real-time data accessibility and the integration of cyber-physical systems. Industry 4.0 introduces a more comprehensive and interconnected approach to manufacturing, bridging the physical and digital realms. This facilitates improved collaboration and accessibility across various aspects such as departments, partners, vendors, products and individuals. Business owners are empowered by Industry 4.0 to exercise better control and understanding of every aspect of their operations. They can leverage instantaneous data to enhance productivity, streamline processes and drive growth. The course provides an overview of the major trends and fundamental concepts of Industry 4.0, highlighting its relevance for development. It also offers a detailed explanation of emerging technologies and their impact.
Course Objective	The course should enable the students to 1. Explore the fundamental concept in Industry 4.0 for various applications. 2. Gain knowledge on the concept of sensors, communication and networking protocol applied in industries. 3. Outline the use of analytics and data management in industrial IoT 4. Enumerate the application of computing in IoT security 5. Develop solution for Real time problems and analyze case studies related to industrial IoT
Course Outcome	Upon completion of this course, the students will be able to 1. Comprehend the basic concepts involved in industry 4.0 2. Infer knowledge in the basics of sensors, communication and networks commercialized in industries. 3. Paraphrase the importance of Big Data analytics and data management in industrial IoT 4. Summarize the application of computing in IoT security 5. Illustrate the applications of Industrial IoT with real-time case studies.

Prerequisites: Basic knowledge of computer network and internet

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	3	3	3	3	2	-	1	-	2	3	3	-	2	2	
CO-2	3	3	3	3	2	-	1	-	2	3	3	2	2	2	
CO-3	3	3	3	3	2	-	1	-	2	3	3	-	2	2	
CO-4	3	3	3	3	2	-	1	-	2	3	3	-	2	2	
CO-5	3	3	3	3	2	-	1	-	2	3	3	2	2	2	

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO INDUSTRY 4.0
(9L+ 3P)

The Fourth Revolution, Globalization and Emerging Issues, LEAN Production Systems, Introduction : Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence **Suggested Readings**: Comparison of Industry 4.0 Factory and Today's Factory **Lab Experiments** 1. Introduction to Arduino 2. Introduction to raspberry Pi **Software/Equipment Required** duino, Raspberry Pi	**CO-1** **BTL-3**
MODULE 2: INDUSTRIAL IoT **(9L+ 3P)**	
IIoT-Introduction, Industrial IoT: Business Model and Reference Architecture, Topology, Industrial IoT- Layers: IIoT Sensing, IIoT Processing, IIoT Communication, IIoT Networking, **Suggested Readings:** Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0 **Lab Experiments** 1. Interfacing Arduino to Zigbee module 2. Interfacing Arduino to Bluetooth module **Software/Equipment Required** Arduino, Zigbee, Bluetooth	**CO-2** **BTL-3**
MODULE 3: BIG DATA AND IIoT ANALYTICS **(9L+ 3P)**	
Big Data, Characteristics and types of Big Data, Analysing of Data, Applications, Big Data tools, Introduction to Machine Learning and Data Science ,R and Julia Programming, IIOT Analytics, Role of Analytics in IIOT, Data visualization Techniques. **Suggested Readings** Software Defined Networking **Lab Experiments** 1. Measurement of temperature values of the process 2. Measurement of pressure values of the process **Software/Equipment Required** Arduino/Raspberry pi/Node mcu	**CO-3** **BTL-3**
MODULE 4: IIoT SECURITY **(9L+ 3P)**	
Industrial IoT: Security, Cloud Computing in IIoT, Fog Computing in IIoT **Suggested Readings:** Data Management using Hadoop **Lab Experiments** Modules and Sensors / Actuators Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor, Relay, Motor, Buzzer) **Software/Equipment Required** Raspberry pi/node mcu, Relay, Motor, Buzzer, Sensors	**CO-4** **BTL-3**
MODULE 5: APPLICATIONS AND CASE STUDIES **(9L+ 3P)**	
Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies : Smart Home, Smart Farm and Smart Car **Suggested Readings:** Food Industry, Manufacturing Industries **Lab Experiments** Smart home applications **Software/Equipment Required** Embedded PC based development boards	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Alasdair Gilchrist, ”Industry 4.0: The Industrial Internet of Things”, Apress, 2016.
2.	Ismail Butun, “Industrial IoT : Challenges, Design Principles, Applications, and Security”, first edition, Springer, 2020.
REFERENCE BOOKS	
1.	Christoph Jan Bartodziej, “The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics”, Springer, 2017.
2.	Rajkamal, “Embedded System: Architecture, Programming and Design”, 3rd edition, McGraw Hill Education, 2017.
E RESOURCES FOR REFERENCE	
1.	https://www.pdfdrive.com/industry-40-industrial-revolution-of-the-21st-century-e187573163.html
2.	https://download.e-bookshelf.de/download/0007/6832/86/L-G-0007683286-0014731014.pdf
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc20_cs24/preview
2.	https://www.coursera.org/learn/industrial-internet-of-things?

COURSE TITLE	**DESIGN PROJECT-4**			**CREDITS**	**1**
COURSE CODE	**EMD51805**	**COURSE CATEGORY**	**EEC**	**L-T-P-S**	**0-0-2-6**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-5**

ASSESSMENT SCHEME

First Review	Second Review	Third Review	Project Report & Viva Voce
20%	20%	10%	50%

Course Description	This course provides the student significant design experience with the knowledge and skills required to analyse the real time problem statement and gives a strong Engineering and Practical foundation for understanding the different types of social problems and its solution based on engineering knowledge. This course suitable for general engineering students to understand the importance of engineering concepts and its relevant applications. Different Simulation tools to be used in the execution of the design methodology. The resources and team management skills are utilised to develop an innovative, economic solution to the selected problem.
Course Objective	The course will enable the students to: 1. Demonstrate a wide range of the skills learned during their course of study by delivering a product that has passed through the design, analysis, testing and evaluation. 2. Encourage multidisciplinary research by integrating the concepts learned in a various courses. 3.Develop problem solving, analysis, synthesis and evaluation skills and communication skills by emphasizing them to prepare project report, poster and oral presentation.
Course Outcome	Upon completion of this course, the students will be able to 1. Identify and work for the real life needs of the society 2. Implement practical solutions to the societal problem 3. Demonstrate the importance of Engineering concepts and its relevant application

Prerequisites: Design Project-3

CO, PO AND PSO MAPPING

	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	2	3	2	2	3	3	3	3	1		
CO-2	3	3	3	2	3	2	2	3	3	3	3	1		
CO-3	3	3	3	2	3	2	2	3	3	3	3	1		

Weightage of Assessment:

Review / Examination Scheme	Weightage
First Review	20%
Second Review	20%
Third Review	10%
End Semester Viva Voce	50%

A committee shall be constituted by the HoD for the Review.

Assessment Rubrics

Parameter	Weightage (%)
Title & Objectives	5.0
Review of Literature (RL)	10.0
Design / Implementation	10.0
Methodology	5.0
Planning of Project Work	5.0
Testing Environment / Test Cases	5.0
Analytical thinking*	5.0
Technical Knowledge*	5.0
Presentation*	10.0
Demonstration*	5.0
Individual Roles Distribution* (Individual Objectives in the project work)	5.0
Individual Contributions* (Towards the individual objectives in the project work)	5.0
Deliverables	5.0
Team- work	10.0
Report / Thesis	5.0
Peer Assessment*	5.0

*** - Attributes for individual contribution.**

EVALUATION PARAMETERS FOR ASSESSMENT

To be followed same as approved for Design project 1

DEPARTMENTAL ELECTIVES

DEPARTMENTAL ELECTIVES - 1

COURSE TITLE	MOBILE ROBOTS			CREDITS	3	
COURSE CODE	EMD51500	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2	
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3	
ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	Mobile Robot is an autonomous navigating device that can maneuver and reach the target in an environment. The autonomous robots are applied in many fields viz healthcare, industry, and environmental monitoring. The application of mobile robot requires a basic skill like the robot mechanisms, electronic circuits and array of sensors. A basic knowledge on sensor characteristics and selection of sensor for variety of applications. Fundamental programming knowledge of robots with Python and C language and to design the sensors interface to the controllers. Autonomous navigation of mobile robots with the help of Image based sensors, mapping and localization of robots by various algorithms to avoid obstacles and find the optimal path for reaching the target location. Design and developing mobile robots for various applications by selecting sensors, navigation techniques and suitable controllers for the effective implementation is focused here.
Course Objective	The course will enable the students to understand the: 1. Term of mobile robots and appreciate its use in industries 2. Working principle of the knowledge on sensors and actuators for robot applications 3. Apply vision based navigation in mobile robots 4. Various system integration for mobile robots 5. Learn the applications of mobile robots
Course Outcome	Upon completion of this course, the students will be able to 1. Recall the fundamentals of mobile robots 2. Apply knowledge on sensors and actuators for robot applications 3. Apply vision-based navigation in mobile robots 4. Perform system integration for mobile robots 5. Build Mobile Robots for specific applications
Prerequisites: Nil	
CO, PO AND PSO MAPPING	

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	2	2	-	-	-	-	-	1	1	2	3
CO-2	3	3	3	3	2	2	-	-	-	1	1	2	2	3
CO-3	3	3	3	3	2	2	-	-	-	1	1	2	2	3
CO-4	3	3	3	3	2	2	-	-	-	1	1	2	2	3
CO-5	3	3	3	3	2	2	-	-	-	1	1	2	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 – INTRODUCTION (6L+6P)	
Introduction to mobile Robots – Laws of Robots, Types of locomotion, legged robots, wheeled robots. UAV, Unmanned Aerial Vehicle (UAV), Remotely Operated Vehicle(ROV) **Suggested reading:** Case study of mobile robots in various domains **Lab Experiments:** 1. Study of mobile robots and its anatomy 2. Study if Arduino ide and hardware **Software/Equipment Required:** Arduino IDE	**CO - 1** **BTL - 2**
MODULE 2 – SENSORS AND ACTUATORS (6L+6P)	
Sensors for mobile robots – Sensor Characteristics –Classification of Sensors- Odometric position estimation, Global Positioning System (GPS), Doppler effect-based sensors, vision-based sensors, Inertial Measurement Unit(IMU), uncertainty in sensing, filtering – Electric Actuators – DC Motors – Servo motor, stepper motor – Linear Actuators – Encoders – Motor Drives. Image Acquisition. **Suggested reading:** Study of calibration of sensors Study of electrical drives and controllers **Lab Experiments:** 1. Blink of LED 2. Study of Digital and Analog input in Arduino 3. Study of Potentiometer and analog input **Software/Equipment Required:** Arduino IDE	**CO - 2** **BTL - 2**
MODULE 3 – MOBILE ROBOT KINEMATICS AND DYNAMICS (6L+6P)	
Forward and inverse kinematics, holonomic and non-holonomic constraints, kinematic models of simple car and differentially driven robots, dynamics simulation of mobile robots; **Suggested reading:** Study of optimization algorithm for navigation Study of localization algorithm. **Lab Experiments:** 1. Study of motor driver and motor direction control. 2. Study of serial monitor and Bluetooth controls.	**CO - 3** **BTL - 3**

3. Control of DC motor using **Software/Equipment Required:** Arduino IDE	
MODULE 4 –LOCALIZATION, PATH PLANNING AND NAVIGATION (6L+6P)	
Dead reckoning, probabilistic mapping, Markov localization, Bayesian localization, Kalman localization, positioning beacon systems, path planning algorithms based on A-star, Dijkstra, Voronoi diagrams, probabilistic roadmaps (PRM), rapidly exploring random trees (RRT), Markov Decision Processes (MDP), stochastic dynamic programming (SDP); **Suggested reading:** Study of interfacing programming of sensors and actuators Study of python programming for interfacing **Lab Experiments:** 1. Study of Optical encoder 2. Study of ultrasonic sensor' 3. Study of Infrared sensor 4. The study of kinematics of differential robot **Software/Equipment Required:** Arduino IDE, Python 3/ Matlab	**CO - 4** **BTL - 3**
MODULE 5 – BUILDING OF MOBILE ROBOTS (6L+6P)	
Robot Programming – Basic Embedded Programming for Robots – Data Acquisition – Interfacing Sensors and Actuators with Robot Controller – Program for Interfacing. Navigation and Vision-Demonstration and Exercises **Suggested reading:** Study of sensing methods in mobile robots Study of mobile robots for variable applications **Lab Experiments:** 1. Building of basic Mobile robot 2. Making of obstacle avoidance robot **Software/Equipment Required:** Arduino IDE, Python 3/ Matlab	**CO - 5** **BTL - 3**
LAB / MINI PROJECT / FIELD WORK	
1. Design and develop a mobile robot for a specific application	
TEXT BOOKS	
1.	Ulrich Nehmzow, "Mobile Robots - A practical introduction", Springer, second edition, 2018.
2.	Fahimi, Farbod, "Autonomous robots", Springer, 2019.
REFERENCE BOOKS	
1.	Blum, Jeremy, "Exploring Arduino: tools and techniques for engineering", wizardry. John Wiley & Sons, 2019.
2.	Katsuhiko Ogata, "Modern Control Engineering", Pearson Education, 2011.
E RESOURCES FOR REFERENCE	
1	https://ftp.idu.ac.id/wp-content/uploads/ebook/tdg/DESIGN%20SISTEM%20DAYA%20GERAK/Designing%20Autonomous%20Mobile%20Robots%20Inside%20The%20Mind.pdf
MOOC	
1.	https://www.coursera.org/learn/mobile-robot
2.	https://nptel.ac.in/courses/112106298

COURSE TITLE	INDUSTRIAL MEASUREMENTS	CREDITS	3

COURSE CODE	EMD51501	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	Industrial measurements comprehend the utilization of measurement techniques within manufacturing processes. They offer a way to evaluate the appropriateness of measuring instruments, their calibration, and the quality assurance of manufactured components.
Course Objective	The course should enable the students to 1. Investigate the principles of measurements and the attributes of sensors. 2. Evaluate the methods used for linear and angular measurements. 3. Acquire understanding of the techniques employed for form measurements. 4. Assess the methodologies utilized for measuring physical quantities. 5. Explore the applications of cutting-edge metrology techniques.
Course Outcome	Upon completion of this course, the students will be able to 1. Utilize the precision measurement instruments typically available in a metrology workshop. 2. Analyze the design critically and comprehend the application of commonly used precision measuring instruments across various applications. 3. Choose the appropriate measuring tool with predetermined accuracy suitable for a specific application. 4. Explain the instruments employed in assessing the significance of accuracy, its impact on results and the associated uncertainty. 5. Make decisions on the selection of instruments for a specific application by considering their specifications.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	1	-	-	-	1	2	1	-	2	2	1
CO-2	3	3	1	1	-	-	-	1	2	1	-	2	2	1
CO-3	3	3	1	1	-	-	-	1	2	1	-	2	2	1
CO-4	3	3	2	2	-	-	-	1	2	1	-	2	2	1
CO-5	3	3	2	2	-	-	-	1	2	1	-	2	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: BASICS OF MEASUREMENTS AND INSTRUMENTS (6L+ 6P)	
Basics of Measurements: Accuracy, Precision, resolution, reliability, repeatability, validity, Errors and their analysis, Standards of measurement, Static and dynamic characteristics of instruments and measurement system. Introduction to sensors and transducers. **Suggested Readings**: AC and DC Bridges, voltmeter, multimeter **Lab Experiments:** 1. Study of static characteristics of sensors **2.** Study of dynamic characteristics of sensors **Software/Equipment Required :** NIL	**CO - 1** **BTL - 3**
MODULE 2: LINEAR AND ANGULAR MEASUREMENT (6L+ 6P)	
Measurement of Length, Angle and Area : Dimensional measurement, Dial gauges, Gauge blocks, Mechanical Comparator, Sine bar, Bevel Protractor. Vibration Measurement: Strain gauges, Differential transformer, tachometers, Accelerometers. **Suggested Readings:** Motion measurement, Optical measurement **Lab Experiments:** 1. Linear measurements 2. Angular measurements 3. Vibration measurement **Software/Equipment Required:** Vernier Caliper, Screw gauge, Micrometer, Slip gauge, Sine bar, Bevel Protractor, Mechanical comparator, Vibration trainer kit	**CO - 2** **BTL - 3**
MODULE 3: FORM MEASUREMENT (6L+ 6P)	
Measurement of screw threads-Thread gauges, floating carriage micro meter-measurement of gear-tooth thickness-constant chord and base tangent method-Gleason gear testing machine – radius measurements-surface finish, straightness, flatness and roundness measurements. **Suggested Readings:** Taylor Series **Lab Experiments:** 1. Screw thread measurement **2.** Gear profile measurement **Software/Equipment Required:** Floating carriage micro meter, Vision inspection system	**CO - 3** **BTL - 3**
MODULE 4: MEASUREMENT OF POWER, FLOW AND TEMPERATURE (6L+ 6P)	
Power measurement, Flow measurement:- Venturi, Orifice, Rotameter, Pitot tube. Temperature: Bimetallic strip, Thermometers, Thermocouples, Electrical resistance Thermistor. **Suggested Readings:** Torque measurement, Errors in temperature measurement **Lab Experiments:** 1. Torque measurement 2. Displacement measurement 3. Strain measurement **Software/Equipment Required:** Load cell, LVDT, Torque trainer kits	**CO - 4** **BTL - 3**
MODULE 5: CASE STUDY (6L+ 6P)	
Case Study:- 3d Printers, LCR meter, Vacuum cleaner. Measurements with Piezo electric sensor, Ultrasonics sensor, Gyroscopes, Compass, GPS **Suggested Readings:** Different types of sensors and 3d printers **Lab Experiments:** Fusion deposition modelling	**CO - 5** **BTL - 3**

Software/Equipment Required: 3D Printer	

TEXT BOOKS	
1.	Richard S Figliola, Donald E Beasley, "Theory and Design for Mechanical Measurements", Wiley India, 6th Edition, 2014.
2.	Doeblin, E.O, "Measurement systems, Applications and Design", McGraw-Hill., 6th Edition, 2017.

REFEREREFERENCE BOOKS	
1.	Graham T.Smith, "Machine Tool Metrology: An Industrial Handbook", 1st ed. Kindle Edition, 2016
2.	N V Raghavendra and Krishnamurthy, "Engineering Metrology and Measurement", Oxford University Press, 2013.

E RESOURCES FOR REFERENCE	
1.	https://www.bbau.ac.in/dept/UIET/Study%20MAterials%20for%20EME-403.pdf
2.	https://www.google.co.in/books/edition/Mechanical_Measurements/A5PCmGteqlsC?hl=en&gbpv=1

MOOC	
1.	https://onlinecourses.nptel.ac.in/noc19_me70/preview
2.	https://www.udemy.com/course/metrology/

COURSE TITLE	**MODERN MANUFACTURING SYSTEMS**			**CREDITS**	**3**	
COURSE CODE	**EMD51502**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	Modern manufacturing is at the core of industrial production from base materials to semi-finished goods and final products. Over the last decade, a variety of innovative methods have been developed that allow for manufacturing processes that are more versatile, less energy-consuming, and more environmentally friendly.					
Course Objective	The course should enable the students to 1. Describe the working principle of Ultrasonic machining process. 2. Explain the working principle of Abrasive Jet machining and Water Jet machining. 3. Demonstrate the working Electrochemical and Chemical Machining Process 4. Explain the working principle of Electrical Discharge Machining, 5. Explain the working principle of Plasma Arc, Laser Beam and Electron Beam Machining					

Course Outcome	Upon completion of this course, the students will be able to 1. Explain the ultrasonic machining process based on machining requirements for a product. 2. Choose the Abrasive jet machining and water jet machining process based on machining requirements for a product. 3. Select the Electrochemical and Chemical Machining Process based on machining requirements for a product. 4. Choose the Electrical Discharge Machining Process based on machining requirements for a product. 5. Compare the Plasma Arc, Laser Beam and Electron Beam Machining Process based on machining requirements for a product.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	-	-	-	-	2	2	-	-	1	2	1
CO-2	3	3	2	2	2	-	-	2	2	-	-	1	2	1
CO-3	3	3	1	-	-	-	-	2	2	-	-	1	2	1
CO-4	3	3	1	-	-	-	-	2	2	-	-	1	2	1
CO-5	3	3	3	2	2	-	-	2	2	-		1	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: ULTRASONIC MACHINING (6L+6P)	
Introduction, equipment, tool materials & tool size, abrasive slurry, cutting tool system design: - Effect of parameters on Material removal rate, tool wear, Accuracy, surface finish, applications, advantages & Disadvantages of USM. **Suggested Readings:** Study the construction and working principle of USM **Lab Experiments:** Case study of Ultrasonic Machining Process	**CO - 1** **BTL - 3**
MODULE 2- ABRASIVE JET AND WATER JET MACHINING (6L+6P)	
Introduction, Equipment, Variables in AJM: Carrier Gas, Type of abrasive work material, standoff distance (SOD), nozzle design, shape of cut. Process characteristics-Material removal rate, Nozzle wear, Accuracy & surface finish. Applications, advantages & Disadvantages of AJM. Water Jet Machining: Principle, Equipment, Operation, Application, Advantages and	**CO - 2** **BTL - 3**

limitations of Water Jet machining. **Suggested Readings:** Study the construction and working principle of AJM and WJM **Lab Experiments:** Case study of Abrasive Jet and Water Jet Machining.	
MODULE 3: ELECTROCHEMICAL AND CHEMICAL MACHINING (6L+6P)	
Introduction, study of ECM machine, elements of ECM process: ECM Process characteristics – Material removal rate, Accuracy, surface finish, Applications, Electrochemical turning, Grinding, Honing, deburring, Advantages, Limitations. CHEMICAL MACHINING (CHM): Introduction, elements of process, chemical blanking process, process characteristics of CHM: material removal rate, accuracy, surface finish, Hydrogen embrittlement, advantages & application of CHM. **Suggested Readings:** Study the Construction and Working Principle of Electrochemical Machining and Chemical Machining **Lab Experiments:** Case study of Electrochemical Machining and Chemical Machining.	**CO - 3** **BTL - 3**
MODULE 4: ELECTRICAL DISCHARGE MACHINING (6L+6P)	
Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tools (electrodes) Electrode feed control, EDM process characteristics: metal removal rate, accuracy, surface finish, Heat Affected Zone. Machine tool selection, Application, electrical discharge grinding, wire EDM. **Suggested Readings: S**tudy the Construction and working Principle of Electrical discharge Machining **Lab Experiments:** Case study of Electrical discharge Machining.	**CO-4** **BTL-3**
MODULE 5: PLASMA ARC, LASER BEAM AND ELECTRON BEAM MACHINING (6L+6P)	
Introduction, equipment, non-thermal generation of plasma, selection of gas, Mechanism of metal removal, PAM parameters, process characteristics. Applications, Advantages and limitations. LASER BEAM MACHINING (LBM): Introduction, equipment of LBM mechanism of metal removal, LBM parameters, Process characteristics, Applications, Advantages & limitations. ELECTRON BEAM MACHINING (EBM): Principles, equipment, operations, applications, advantages and limitation of EBM. **Suggested Readings:** Study the Construction and Working Principle of PLASMA ARC, LASER BEAM AND ELECTRON BEAM MACHINING **Lab Experiments:** Case study of Laser Beam Machining.	**CO - 5** **BTL - 3**

TEXT BOOKS	
1.	Pandey and Shan, “Modern machining process”, Tata McGraw Hill, 2017.
2.	Kalpakjian, “Manufacturing Engg. & Technology”, Pearson Education, 6th Edition, 2018.
REFEREFERENCE BOOKS	
1.	Joseph R. Davis, “Metals Handbook: Machining”, Volume 16, American Society of Metals, 2017.
2.	Aditya,” Modern Machining Process”, TMH Publisher, 2002.
E RESOURCES FOR REFERENCE	
1.	http://nguyen.hong.hai.free.fr/EBOOKS/SCIENCE%20AND%20ENGINEERING/ENGINNEERING-DESIGN/Engineering%20-%20Mechanical%20Engineering%20Handbook/Ch13.pdf
MOOC	
1.	https://www.udemy.com/course/modern-manufacturing/

COURSE TITLE	SENSOR SIGNAL PROCESSING AND SIGNAL CONDITIONING			CREDITS	3
COURSE CODE	EMD51503	COURSE CATEGORY	PC	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	This course provides the basic concepts of sensors and the signal acquisition in a system design. Signal conditioning is an electronic circuit that manipulates a signal in a way that prepares it for the next stage of processing. Many data acquisition applications involve environmental or mechanical measurement from sensors, such as temperature and vibration. These sensors require signal conditioning before a data acquisition device can effectively and accurately measure the signal. Signal conditioners take the analog signal from the sensor, manipulate it, and send it to the ADC (analog-to-digital converter) subsystem to be digitized for further processing (usually by computer software. Therefore, the goal of this course is to introduce signal processing and conditioning principles for the design of industrial systems.
Course Objective	The course should enable the students to 1. Appreciate the need of signal processing and conditioning in Industries. 2. Understand the working principle of various sensors, associate signal processing, and its applications. 3. Understand the underlying principle of sensor signal conditioning 4. Design a sensor signal processing and conditioning circuit
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the basic properties of signal and systems and the various methods of classification. 2. Select the sensors for suitable applications. 3. Design appropriate signal conditioning requirements 4. Analyze the concepts of signal processing through mathematical tools. 5. Appreciate the fundamental concepts and the role of machine learning in signal analysis

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO-2	3	3	3	2	2	-	-	-	-	-	-	2	3	1

CO-3	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**
CO-4	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**
CO-5	**3**	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: SIGNALS & SYSTEMS (6L+ 6P)	
Introduction – Signals & Systems- continuous, Discrete and Digital signals – Classification of continuous and Discrete Time signal - Elementary signals – UNIT step, Ramp, Impulse. Classification of systems **Suggested Readings:** • Time domain and frequency domain analysis of signal **Lab Experiments:** • Generation of signals in MATLB **Software/Equipment Required:** MATLAB	**CO - 1** **BTL - 2**
MODULE 2: SENSORS (6L + 6P)	
Introduction to sensors and transducers - definition - classification - Performance terminology - Sensors for measurement of Position, Force, Motion, velocity, temperature - Sensor Interfacing **Suggested Readings:** • Need of Signal Conditioning design for sensors measuring Position, Velocity, Temperature, etc. **Lab Experiments:** • Simulate the interfacing Sensors and Actuators with controller in Tinkercad **Software/Equipment Required:** TINKERCAD	**CO - 2** **BTL - 3**
MODULE 3: SIGNAL CONDITIONING (6L + 6P)	
Signal conditioning of sensor signals using analog circuits, understanding the need and design of filters and pre-amplifiers, level shifter, zero crossing detector and wave-shaping circuits. Signal conditioning of sensor signal using digital circuits **Suggested Readings:** • Case study of design of analog systems and digital systems for various sensors. **Lab Experiments:** • Design and demonstrate a signal conditioning circuit for temperature sensor **Software/Equipment Required:** TINKERCAD	**CO - 3** **BTL - 3**
MODULE 4: SIGNAL PROCESSING (6L + 6P)	
Transforming Data into Information, Signal processing in MATLAB. Data Acquisition and signal analysis in LabView **Suggested Readings:** • Industrial Applications – case studies. **Lab Experiments:** • Perform basic signal processing operations in MATLAB and LABVIEW **Software/Equipment Required** MATLAB and LABVIEW	**CO - 4** **BTL - 3**
MODULE 5: ROLE OF MACHINE LEARNING IN SIGNAL PROCESSING (6L+6P)	

Basics of Machine Learning-Case study. **Suggested Readings** • Study of ECG/EEG signal characteristics **Lab Experiments** • Perform machine learning based prediction and classification in MATLAB **Software/Equipment Required** MATLAB	**CO - 5** **BTL - 3**

TEXTBOOKS	
1.	B. W. G. Newby, "Electronic Signal Conditioning", Butterworth-Heinemann Publishers, The 1st Edition, 2014.
2.	Meerja Akhil Jabbar, Kantipudi MVV Prasad, Sheng-Lung Peng, Mamun Bin Ibne Reaz, "Machine Learning Methods for Signal, Image and Speech Processing", River Publishers; 1st edition, 2021.
REFERENCE BOOKS	
1.	Clarence W. de Silva, "Sensors and Actuators Engineering System Instrumentation", CRC press, 2016.
2.	Gökhan Gökmen, "Electrical Measurements for Data Acquisition: Sensing and Signal Conditioning", LAP LAMBERT Academic Publishing; 1st edition, 2017.
E RESOURCES FOR REFERENCE	
1.	B. W. G. Newby, "Electronic Signal Conditioning", Butterworth-Heinemann Publishers, The 1st Edition, 2014.
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc23_ee105/preview
2.	https://onlinecourses.nptel.ac.in/noc23_ee65/preview

DEPARTMENTAL ELECTIVE – 2

COURSE TITLE	**INDUSTRIAL ROBOTICS**			**CREDITS**	**3**
COURSE CODE	**EMD51504**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation/lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	The goal of this course is to familiarize the students with the basic concepts and techniques of robotics starting from elements, types, drive systems, sensors, and their applications in robot system design. In addition, this course also discusses the various programming methods, applications, justification, and implementation of robots.
Course Objective	The course should enable the students to 1. The different robotic configurations, classification of end effectors, sensing, and actuation. 2. The robotic drive systems and mechanical transmission methods. 3. Underlying principle and applications of various grippers and their design.

	4. The Kinematics and Dynamics of Robot. 5. Safety considerations of the robot and Applications of the robot for material transfer, welding, assembly, Spray painting, etc.
Course Outcome	Upon completion of this course, the students will be able to 1. Recall and identify the parts of robots, their configurations, DOF, and workspace. 2. Develop kinematic solutions for simple robots through a geometric and analytical approach. 3. Identify and discuss the various drives, transmission mechanisms, and end effectors used in the robot design. 4. Comprehend the use of programming languages in robotics and model and simulate robots using the software. 5. Discuss the various applications of robots

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO - 1	PO - 2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	1	1	-	-	-	-	-	-	-	2	-
CO-2	3	3	2	2	1	-	-	-	-	-	-	-	2	-
CO-3	3	3	2	2	1	-	-	-	-	-	-	-	2	-
CO-4	3	3	2	2	2	-	-	-	-	-	-	-	2	-
CO-5	3	3	2	2	2	-	-	-	-	-	-	-	2	1

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: INTRODUCTION TO ROBOTICS
(6L+ 6P)

Introduction - Automation and Robotics – An Overview of Robotics – present and future applications. Components of Industrial Robotics: common types of arms. Components, Architecture, number of degrees of freedom – Work Space – Work Volume - Precision of Movement: Resolution, Accuracy and Repeatability, Speed of Response, and Load Carrying Capacity. **Suggested Readings:** Various configurations of manipulators are used in Industrial applications. **Lab Experiments:** 1. Study of configurations of the robot 2. Study of workspace, work volume, and D.o.F of various robots **Software/Equipment Required:** Industrial Robot	**CO - 1** **BTL - 2**

MODULE 2: KINEMATICS
(6L + 6P)

Introduction – Positions, Orientations, and frames, Mappings: Changing descriptions from frame to frame, Operators: Translations, Rotations, and Transformations – Transformation Arithmetic – Forward and inverse Kinematics – 2 DoF and 3 DoF Geometrical and Analytical approach. **Suggested Readings:** Articulated and Parallel manipulators and their applications **Lab Experiments:**	**CO - 2** **BTL - 3**

1. Derive kinematic solutions of 2 DOF articulated robot and wrist configurations using a Geometrical approach. 2. Derive kinematic solutions of 2 DOF articulated robot and wrist configurations using an Analytical approach **Software/Equipment Required:** Industrial Robot, MATLAB, Robodk	
MODULE 3: DRIVES, ACTUATORS SENSORS, AND END EFFECTORS (6L + 6P)	
Robot drive mechanisms, hydraulic – electric – servomotor- stepper motor – pneumatic drives, Mechanical transmission method - Gear transmission, Belt drives, cables, Roller chains, Link – Rod systems – Rotary-to-Rotary motion conversion, Rotary-to-Linear motion conversion, Rack and Pinion drives, Lead screws, Ball Bearing screws. Sensors – Classification - Exteroceptive – Proprioceptive – Selection of sensors – End Effectors - Grippers - Mechanical, Vacuum, and Adhesive Grippers **Suggested Readings:** Various Actuators are used for the design of robotic configurations; the Study of Grasping Modes, Forces, and Stability; Smart Tactile Sensors for gripper design. **Lab Experiments:** 1. Identification of various transmission mechanisms those are present in the Industrial Manipulator in the Robotics laboratory. 2. Identification of various actuators and sensors that are present in the Industrial Manipulator in the Robotics laboratory. **Software/Equipment Required:** Industrial Robot, Robodk	**CO - 3** **BTL - 3**
MODULE 4: ROBOT LANGUAGES AND PROGRAMMING (6L + 6P)	
Robot Languages – Classification of Languages – VAL, RAIL, AML, Python, ROS, etc., - Robot Language Structure – Motion Commands – End Effector and Sensor Commands – Development of languages from WAVE to ROS. Robot Software - Motosim – Webots – Robodk. **Suggested Readings:** Selection of suitable programming languages for robotic applications **Lab Experiments:** 1. Simulate the motions of the industrial manipulator in Robot software Motosim / Robodk **Software/Equipment Required:** Motosim, Robodk	**CO - 4** **BTL - 3**
MODULE 5: APPLICATIONS OF ROBOTS (6L + 6P)	
Industrial Applications of Robots for material transfer, machine loading/unloading, welding, assembly, and spray-painting operation. RGV, AGV, Implementation of Robots in Industries – Various Steps; Robot Cell design- Interlocks - Safety for robot and standards - Safety Considerations for Robot Operations – Safety sensors and monitoring – Maintenance and Troubleshooting. **Suggested Readings:** The socio-Economic aspect of robotization and economic aspects of robot design; Need an application of AI, New trends & recent updates in robotics. **Lab Experiments:** 1. Case study on Robotic Pick and Place Systems and their applications in industries 2. Troubleshooting of robotic sensors and motions. **Software/Equipment Required:** Industrial Robot	**CO - 5** **BTL - 3**
TEXTBOOKS	

1.	Saeed B Nikku, “Introduction to Robotics: Analysis, Control, Applications”, Wiley, 3rd Edition, 2019.
2.	Mikell P. Groover, Mitchel Weiss, Roger N. Nagel, Nicholas G odrey and Ashish Dutta, “Industrial Robotics: Technology, Programming, and Applications”, McGraw-Hill. 3rd Edition, 2017.
REFERENCE BOOKS	
1.	Deb S. R. and Deb S., “Robotics Technology and Flexible Automation”, Tata McGraw Hill Education Pvt. Ltd, 2017.
2.	John Craig, “Introduction to Robotics – Mechanics and Control”, Pearson, 4th edition, 2022.
E-RESOURCES FOR REFERENCE	
1.	https://www.google.co.in/books/edition/Robotics/jPCAFmE-logC?hl=en&gbpv=1
MOOC	
1.	https://nptel.ac.in/courses/107/106/107106090/
2.	https://www.coursera.org/specializations/modernrobotics

COURSE TITLE	**PROCESS AUTOMATION**			**CREDITS**	**3**	
COURSE CODE	**EMD51505**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee “DEC”**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	Process Automation a specialized area focusing on essentials of automation. The course provides an exposure to sensors, controllers, end effectors and communication devices. The fundamentals of automation like modelling of systems, basics of controllers, algorithms, the various methods to tune the controllers and the variety of control valves are focused here. Process automation simplifies this with the help of sensors at thousands of spots around the plant that collect data on temperatures, pressures, flows and so on. The information is stored and analyzed on a computer and the entire plant and each piece of production equipment can be monitored on a large screen in a control room. Plant operating settings are then automatically adjusted to achieve the optimum production. In process automation, the computer program uses measurements to show not only how the plant is working but to simulate different operating modes and find the optimal strategy for the plant. A unique characteristic of this software is its ability to "learn" and predict trends, helping speed up the response time to changing conditions.					
Course Objective	The course should enable the students to 1. Asses the basics of mathematical modeling of processes and identify their characteristics. 2. Learn the different types of controllers and their evaluation criteria 3. Comprehend the types of control schemes used I process automation. 4. Summarize the actuators and converters used in process industries. 5. Associate the various operations in the industries.					

Course Outcome	**Upon completion of this course, the students will be able to** 1. comprehend the characteristics of different order processes 2. Interpret the characteristics of various controllers used in process industries and perform the different methods of tuning techniques for the controllers used and to analyze their performance. 3. Explain the various control schemes used in processes and their application. 4. Construct, classify and analyze the characteristics of final control element. 5. Distinguish the unit operations used and their corresponding control scheme.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	-	-	-	1	1	-	2	2	1
CO-2	3	3	1	1	-	-	-	-	1	1	-	2	2	1
CO-3	3	3	1	1	-	-	-	-	1	1	-	2	2	1
CO-4	3	3	1	1	-	-	-	-	1	1	-	2	2	1
CO-5	3	3	1	1	-	-	-	-	1	1		2	2	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: MATHEMATICAL MODELLING OF PROCESS (6L+ 6P)

Need for process control -Mathematical model of first order liquid level and thermal processes -Higher order process -Process with dead time, process with inverse response -Interacting and non-interacting systems -Continuous and batch process -Servo and regulator operation. **Suggested Readings**: MATLAB control system toolbox, Industrial process systems **Lab Experiments:** 1. To simulate standard testing signals in control system. 2. To simulate of first order system response to various inputs. 3. To simulate of second order system response to various inputs. **Software/Equipment Required:** MATLAB with Simulink, control system toolbox.	**CO - 1** **BTL - 2**

MODULE 2: CONTROLLER CHARACTERISTICS & TUNING (6L+ 6P)

Basic control action -Characteristics of ON-OFF, proportional, integral and derivative control modes-Composite control modes -P+I, P+D and P+I+D control modes -Electronic controllers to realize various control actions -Evaluation criteria -IAE, ISE, ITAE and ¼ decay ratio -Tuning of controllers -Ziegler-Nichol's method and Cohen coon method -Damped oscillation method. **Suggested Readings:** PID controller variations design and Implementation, Multiloop controllers **Lab Experiments:** 1. To perform simulation of Open/Closed loop control system—ON/OFF. 2. To perform simulation of Open/Closed loop control system—Composite controller modes. 3. Study of performance evaluation criteria for a typical first order system. 4. To perform tuning of controllers with Simulink tuning GUI. **Software/Equipment Required:**	**CO - 2** **BTL - 3**

MATLAB with Simulink, control system toolbox.	
MODULE 3: CONTROL SYSTEMS WITH MULTIPLE LOOPS (6L+ 6P)	
Cascade control -Feed forward control -Ratio control -Selective control systems -Split range control -Adaptive and inferential control. Sequence Control: Programmable Logic Controllers, Relay Ladder Logic, Programming. **Suggested Readings:** Industrial application of multi loop control schemes, Robotics application with ladder programming **Lab Experiments:** 1. To perform simulation of multi loop control for a typical system. 2. To perform Ladder logic programming simulation of basic functions 3. To control motor with ladder programming- forward, reverse and brake mode. **Software/Equipment Required:** MATLAB with Simulink, control system toolbox, plc toolbox, PLC simulation IDE, PLC device with Input and Output setup.	**CO - 3** **BTL - 3**
MODULE 4: FINAL CONTROL ELEMENT (6L+ 6P)	
I/P converter -Pneumatic and electric actuators -Valve positioner -Control valves characteristics -Classification of control valves -Control valve sizing - Cavitation's and flashing -Selection of control valves. Industrial Communication Systems: Characteristic features of industrial networks. Field bus architecture, CAN bus, Ethernet, IIoT protocols. **Suggested Readings:** Performance aspects of Industrial Automation Systems **Lab Experiments:** 1. To control hydraulic system with ladder programming. 2. To control pneumatic system with ladder programming. **Software/Equipment Required:** MATLAB with Simulink, control system toolbox, plc toolbox, PLC simulation IDE, PLC device with Input and Output setup, hydraulic system setup, pneumatic system setup.	**CO - 4** **BTL - 3**
MODULE 5: SELECTED UNIT OPERATIONS (6L+ 6P)	
Flexible automation system, PLC control system, Sew AC drive control, Sew VFD control scheme. Case study of control schemes of Gantry Robot, CNC machine, 3D printer, Laser cutting machine. **Suggested Readings:** Automation systems for manufacturing **Lab Experiments:** **1.** Ladder programming for unit operations. **Software/Equipment Required:** PLC simulation IDE, PLC device with Input and Output setup, hydraulic system setup, pneumatic system setup. Flexible manufacturing system.	**CO - 5** **BTL - 3**
TEXT BOOKS	
1.	Donald P. Eckman, "Automatic Process Control", Creative Media Partners, LLC, 2021.
2.	Dale E. Seborg, Thomas F. Edgar, Duncan A. Mellichamp, Francis J. Doyle, "Process Dynamics and Control" sixth edition, 2019.
REFEREFERENCE BOOKS	
1.	Curtis D. Johnson, "Process Control Instrumentation Technology", Pearson Education, New Delhi, 7th Edition, 2020.
2.	B.G.Liptak, "Process Control", Chilton Book Company, 2019.
E RESOURCES FOR REFERENCE	

1.	https://controlguru.com/table-of-contents/
2.	https://learncheme.com/screencasts/process-controls/
3.	https://library.iitd.ac.in/new-resources
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc20_me39/preview
2.	https://nptel.ac.in/courses/103105064
3.	https://nptel.ac.in/courses/103106148

COURSE TITLE	**INDUSTRIAL PRACTICES**			**CREDITS**	**3**
COURSE CODE	**EMD51506**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	Industrial Practices covers a broad spectrum including Quality management, production planning and control, manufacturing systems and processes, facilities design, quality control, systems reliability, and systems analysis with a strong emphasis on advanced computing.
Course Objective	The course should enable the students to 1. Know about Leadership qualities, human values and recognition of work 2. Use the different quality management principles 3. Various production planning activities carried out in industries. 4. Gain knowledge on current topics and advanced techniques In Operations Research for industrial solutions 5. Application of Statistical quality control tools.
Course Outcome	Upon completion of this course, the students will be able to 1. Develop their leadership qualities and improve the involvement of employee. 2. Implement the quality concepts in the required field. 3. Optimize the resources of an organization and improve productivity. 4. Apply L.P.P, scheduling and sequencing in industrial optimization problems. 5. Analyze the SQC tools and concepts of reliability

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	**3**	**3**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**

CO-2	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO-3	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO-4	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**
CO-5	**3**	**3**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION (6L+ 6P)	
Leadership - Quality Statements, Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating. **Suggested Readings**: Quality policies, brainstorming on preparation of quality policies **Lab Experiments:** 1. Study and apply 5S principles in your preferred place. 2. Prepare a rating scheme for a particular service activity. **Software/Equipment Required:** NIL	**CO - 1** **BTL - 2**
MODULE 2: QUALITY MANAGEMENT (6L+ 6P)	
The seven traditional tools of quality - Six sigma: Concepts - Bench marking Process-FMEA - Stages, Types - Quality Circles - Cost of Quality - Quality Function Deployment (QFD) - Taguchi quality loss function - TPM - Concepts, improvement needs - Performance measures. **Suggested Readings:** various Failure analysis methods **Lab Experiments:** 1. Prepare and analyse stages to solve the given problem in Institute/ Industry using FMEA concept. 2. Prepare and analyse steps to solve the given problem in Institute/ Industry using Quality circle concepts. **Software/Equipment Required:** NIL	**CO-2** **BTL-3**
MODULE 3: AGGREGATE PLANNING (6L+ 6P)	
Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rules, Master Production Schedule(MPS), Procedure for developing MPS, MRP, Lot sizing methods of MRP, MRP Implementation issues, MRP – II. **Suggested Readings:** Designing of planning charts for various industries **Lab Experiments** 1. Prepare detailed process plan for Hexagonal Nut/ Hexagonal Headed Bolt/ Plain Washer. 2. Prepare chart of sequence of operation for manufacturing of simple job like Hexagonal Nut/ Hexagonal Headed Bolt/ Plain Washer. **Software/Equipment Required:** NIL	**CO-3** **BTL-3**
MODULE 4: OPERATIONS RESEARCH (6L+ 6P)	

Introduction to Operations Research – assumptions of linear programming problems - Formulations of linear programming problem – Graphical method. Solutions to LPP using simplex algorithm – Two phase method – Big M method **Suggested Readings:** Real-time case studies for linear programming **Lab Experiments:** 1. Solve problems in Linear programming using MATLAB 2. Solve problems in Big M method using MATLAB **Software/Equipment Required:** MATLAB	**CO-4** **BTL-3**
MODULE 5: STATISTICAL QUALITY CONTROL (6L+ 6P)	
Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) , Tolerance limits - Acceptance sampling. **Suggested Readings:** Dimensional analysis **Lab Experiments:** 1. Prepare the control charts for the given process parameters 2. Calculate the tolerance limits for the given work samples. **Software/Equipment Required:** MATLAB	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Douglas. C. Montgomery, "Introduction to Statistical quality control", John Wiley, 13th edition, 2016.
2.	Buffa E.S., "Modern Production / Operational Management", John Wiley & Sons, 2009.
REFEREREFERENCE BOOKS	
1.	Grant, Eugene. I., "statistical quality control", McGraw-Hill, 7th Edition, 2017.
2.	R. Danreid & Sanders., "Operations Management", John Wiley & Sons, 7th Edition, 2020.
E RESOURCES FOR REFERENCE	
1.	http://psbm.org/Ebooks/Total%20Quality.pdf
MOOC	
1.	http://engineering.nyu.edu/academics/online/masters/industrial-engineering
2.	https://online.engineering.arizona.edu/online-programs/industrial-engineering/master-ofscience-in-industrial-engineering/

COURSE TITLE	**PROGRAMMING FOR MICROCONTROLLERS**			**CREDITS**	**3**
COURSE CODE	**EMD51507**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**5%**	**5%**	**5%**	**25%**	**25%**

Course Description	Learning to program a microcontroller is a crucial skill in the world of mechatronics. Microcontrollers allow you to make circuits that interact with the physical world around them via sensors (which gather data from the surrounding environment) and actuators like motors (which can affect the environment). In this course, you will learn the basic microcontroller functionality required to control inputs and outputs using simple hardware like buttons and LEDs, including an "under the hood" look at how the microcontroller works. The programming

	concepts you learn in this course will set the stage for controlling more advanced hardware like sensors and motors in future courses and projects.
Course Objective	The course should enable the students to 1. Term Programming and appreciate its use in system design. 2. Comprehend various sensors and actuators and interface with microcontroller 3. Develop algorithm and Implement in microcontroller 4. Design and develop a complete embedded system using microcontroller
Course Outcome	Upon completion of this course, the students will be able to 1. Appreciate the fundamental concepts of programming an embedded system 2. Identify and select the I/O devices used in the design of system 3. Develop algorithm in embedded C for system design. 4. Install Arduino IDE and demonstrate programs 5. Design and Develop a simple embedded system using microcontroller

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	-	-	-	-	-	-	-	3	-
CO-2	3	3	3	2	2	-	-	-	-	-	-	2	3	1
CO-3	3	3	3	2	2	-	-	-	-	-	-	2	3	1
CO-4	3	3	3	2	2	-	-	-	-	-	-	2	3	1
CO-5	3	3	3	3	2	-	-	-	-	-	-	2	3	1

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: EMBEDDED SYSTEM DESIGN: BASICS (6L+6P)	
Introduction to embedded systems, Components of embedded system, Advantages and applications of embedded systems, Different Microcontroller Architectures, Memory Architectures. **Suggested Readings:** • Embedded Systems – Applications and Examples **Lab Experiments:** • Digital Camera – Case Study **Software/Equipment Required:** N/A	**CO - 1** **BTL - 2**
MODULE 2: LEARNING ARDUINO PLATFORM (6L+6P)	
Introduction to ARDUINO, Programming in Embedded-C, Concepts of C language, General Hardware Interfacings: LED's, Switches, Seven Segment Display, Multi Segment Displays, Relays (AC Appliance Control), LCD, Buzzer, IR Sensors, Other Digital Sensors **Suggested Readings:** • Familiarization of open-source simulation platform **Lab Experiments:** • Illustration of various operators and functions using I/O devices and simulation **Software/Equipment Required:** TINKERCAD	**CO - 2** **BTL - 4**

MODULE 3: CONTROLLING EMBEDDED SYSTEM-BASED DEVICES USING ARDUINO (6L+6P)	
Introduction to sensors and actuators, sensors, such as Humidity, Proximity, IR Motion, Accelerometer, Sound, Light Distance, Pressure, Thermal etc to ARDUINO Board, Reading various sensor data on serial monitor and LCD Display; Reading data from analog and digital sensors on Serial Monitor/LCD Monitor, Work with LED Controlled by Switch/potentiometer, 7 segment displays, connect relays and servomotors to ARDUINO Board **Suggested Readings:** • Significance of programming aspect in system implementation **Lab Experiments:** • Install Arduino IDE and demonstrate simple programs **Software/Equipment Required:** Arduino development board, Sensors and Actuators	**CO - 3** **BTL - 4**
MODULE 4: RASPBERRY PI PLATFORM AND PYTHON PROGRAMMING (6L+6P)	
Raspberry Pi Processor, Raspberry Pi vs. Arduino, Raspberry Pi Setup and configuration, Python on Raspberry Pi **Suggested Readings:** • Using Python **Lab Experiments:** • Installation and basic demonstration **Software/Equipment Required:** Linux, Raspberry Pi development board	**CO - 3** **BTL - 4**
MODULE 5: PROJECT BASED ON EMBEDDED SYSTEM DESIGN USING ARDUINO BOARD (6L+6P)	
System Design - Case Studies, (Mini Project) - Interfacing Microcontroller, Sensors and Actuators (Peripherals). **Suggested Readings:** N/A **Lab Experiments:** Mini Project – System design interfacing Sensor, Actuator and Programming using a microcontroller. Students can make projects on Arduino/ Raspberry Pi Based Embedded systems. **Software/Equipment Required:** Arduino/ Raspberry Pi, Sensors and Actuators	**CO – 4** **BTL - 3**

TEXTBOOKS	
1.	Armstrong Subero, “Programming Microcontrollers with Python: Experience the Power of Embedded Python”, A-press, 1st Edition, 2021.
2.	Simon Monk, “Programming the Raspberry Pi, Second Edition: Getting Started with Python”, McGraw Hill, 2nd Edition, 2015.
REFERENCE BOOKS	
1.	Nathan Ida, “Sensors, Actuators and their Interfaces, A multidisciplinary introduction”, SCI TECH Publications, 2014.
2.	Clarence W. de Silva, “Sensors and Actuators Engineering System Instrumentation”, CRC press. 2016.
E RESOURCES FOR REFERENCE	
1.	https://link.springer.com/book/10.1007/978-1-4842-2659-9
MOOC	
1.	https://www.coursera.org/learn/python
2.	https://www.coursera.org/learn/raspberry-pi-platform#about

DEPARTMENTAL ELECTIVE – 3

COURSE	ROBOTIC OPERATING SYSTEM	CREDITS	3

TITLE					
COURSE CODE	EMD51508	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL- 3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	The Robot Operating System (ROS) provides a powerful platform for quickly building robotic applications by providing access to a vast set of open-source software and tools. ROS has become an essential tool for roboticists, with a large and active community that has contributed extensively to the development of these tools. In this course, students will learn how to use various ROS tools to create a complete robotic application. They will work with their own standalone Ubuntu-Linux installation and interact with industrial and mobile robots on the physics-based simulation engines, Gazebo and Webots. Students will learn to program and configure basic robotic tasks, such as pick-and-place objects and navigate through obstacles, using ROS.
Course Objective	The course should enable the students to 1. Use ROS communication tools such as topics, services, and actions to exchange information between functional modules. 2. Visualize and create a custom environment with a robot using tools such as RViz and Gazebo. 3. Map the robot's environment and enable navigation for a mobile robot using the ROS Navigation Stack. 4. Implement a pick-and-place function with industrial robot arms using the ROS MoveIt! package. 5. Design a complete robotic application using state machines and ROS components for communication, navigation, and manipulation.
Course Outcome	Upon completion of this course, the students will be able to 1. Analyze the core components of ROS, including topics, messages, services, and actions 2. Apply the core components of ROS to create simple robotic applications . 3. Predict and test robotic behavior using ROS simulation tools such as Gazebo 4. Modify and optimize robotic navigation and manipulation tasks using ROS libraries 5. Create solutions for simple robotic problems by integrating sensors and actuators with ROS

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	1	1	1	2	1	-	-	-	-	-	-	2	3
CO-2	3	3	3	1	3	1	-	-	2	1	-	1	2	3

CO-3	**3**	**3**	**3**	**1**	**3**	**1**	**-**	**-**	**2**	**1**	**-**	**1**	**2**	**3**
CO-4	**3**	**3**	**2**	**1**	**3**	**1**	**-**	**-**	**2**	**1**	**-**	**1**	**2**	**3**
CO-5	**3**	**2**	**2**	**1**	**3**	**1**	**-**	**-**	**2**	**1**	**1**	**1**	**2**	**3**
1: Weakly related, 2: Moderately related, and 3: Strongly related														

MODULE 1: INTRODUCTION (6L+6P)	
Introduction to ROS - ROS file system level - architecture - ROS computation graph level – ROS essentials - ROS community level **Suggested Readings:** ● Importance of ROS ● ROS ecosystem **Lab Experiments:** ● Design and build a simple robot with a microcontroller (e.g., Arduino) **Software Required:** ● Arduino IDE ● Design software tool	**CO-1** **BTL-2**
MODULE 2: ROS COMMUNICATION AND COMPONENTS (6L+6P)	
ROS topics, messages, and services- ROS publishers and subscribers - ROS client libraries and tools - ROS nodes and nodelets - ROS launch files - ROS parameters and configuration **Suggested Readings:** ● Understanding communication in ROS (Final system level and Graph level) **Lab Experiments:** ● Use ROS to establish communication between the robot and a computer ● Create ROS topics and messages to send and receive data between the robot and the computer ● Write ROS publisher and subscriber nodes in C++ or Python to control the robot's movement and receive sensor data **Software Required:** ● ROS Noetic Ninjemys/ROS2 ● OS- Linux Ubuntu 20.04 ● C++, Python , XML	**CO-2** **BTL-3**
MODULE 3: ROBOTICS SIMULATION WITH GAZEBO (6L+6P)	
Understanding Gazebo - Gazebo components and models - Simulating joints and mobile robot models - Interfacing with ROS controllers **Suggested Readings:** ● Build robot using URDF and Visualize in RViz ● Solidworks to URDF **Lab Experiments:** ● Use Gazebo to simulate a mobile robot with a 2D LIDAR sensor and a camera **Software/Components Required:** ● ROS Noetic Ninjemys/ROS2 - Gazebo simulator ● OS- Linux Ubuntu 20.04 ● C++, Python , XML	**CO-3** **BTL-3**
MODULE 4: ROBOT NAVIGATION & MANIPULATION WITH ROS (6L+6P)	
Introduction to robot navigation - ROS navigation components - Using ROS navigation libraries Introduction to robot manipulation - ROS manipulation components - Using ROS manipulation libraries **Suggested Readings:** ● Map creation with GMapping package **Lab Experiments:**	**CO-4** **BTL-3**

• Implement the ROS MoveIt! package to control the robotic arm's movement • Pick and place operation of a robotic manipulator in MoveIt • Implement the ROS Navigation Stack to navigate the robot through a known environment **Software Required:** • ROS Noetic Ninjemys/ROS2 - MoveIt tool and Gazebo Simulator • OS- Linux Ubuntu 20.04 • C++, Python , XML	
MODULE 5: ROS MASTER SLAVE SIMULATION (6L+6P)	
Creating and running simulations with Master-Slave nodes in ROS - Testing the simulation for Master-Slave communication - Developing a complete ROS project using Master-Slave communication **Suggested Readings:** • ROS/Slave_API **Lab Experiments:** • Developing a Complete ROS Project Using Master-Slave Communication **Software/Components Required:** • ROS Noetic Ninjemys/ROS2 - Gazebo simulator • OS- Linux Ubuntu 20.04 • C++, Python , XML	**CO-5** **BTL- 2**

TEXTBOOKS	
1.	Lentin Joseph, “Mastering ROS for Robotic Programming”, Packt Publishing, 2015.
2.	Morgan Quigley, Brian Gerkey, William D. Smart, “Programming Robots with ROS: A Practical Introduction to the Robot”, O'Reilly, 2015.
REFERENCE BOOKS	
1.	Anis Koubaa, “Robot Operating System (ROS): The Complete Reference – Volume 1”. Springer, 2016.
2.	R. Patrick Goebel. (2012). ROS by Example: A Do-It-Yourself Guide to the Robot Operating System. Lulu.
E RESOURCES FOR REFERENCE	
1.	https://www.ebooks.com/en-us/book/96305456/robot-operating-system-ros/anis-koubaa/
MOOC	
1.	https://www.udemy.com/course/ros-for-beginners/
2.	https://robocademy.com/2021/01/19/advanced-ros-programming-live-course-by-lentin-joseph/

COURSE TITLE	**FACTORY AUTOMATION**			**CREDITS**	**3**
COURSE CODE	**EMD51509**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee “DEC”**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	The students shall develop an intuitive understanding of the circuit analysis, basic concepts of electrical machines and basics of electronics and be able to apply them in practical situation.

Course Objective	The course should enable the students to 1. Understand the basic concepts in automation in Industries. 2. Analyse automation system modelling and identify their components 3. Infer the automation components and its tools 4. Interpret the Industrial networking protocols. 5. Review the components of Industrial control system.
Course Outcome	Upon completion of this course, the students will be able to 1. Identify potential areas for automation and justify need for automation. 2. Comprehend system modelling and identify inspection methods. 3. Apply automation tools and do quality control analysis with too 4. Examine the networking protocols for industry. 5. Apply cybersecurity and framework concepts Industrial control systems.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	-	-	-	1	-	1	1	1	-	1	2	2
CO-2	3	3	3	2	2	2	1	1	1	1	-	1	2	3
CO-3	3	3	3	3	2	2	1	1	1	1	-	1	2	3
CO-4	3	3	3	2	2	2	1	1	1	1	-	1	2	3
CO-5	3	3	1	1	1	1	-	-	-	-	-	1	2	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION
(6L+ 6P)

Introduction: Definition of automation, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automation. Automation in Production System- Types of production. Production Economics: Methods of Evaluating Investment Alternatives, Costs in Manufacturing, Break-Even Analysis, Unit cost of production, Cost of Manufacturing Lead time and Work-in-process. **Suggested Readings**: safety monitoring, maintenance and repair diagnostics, and error detection and recovery **Lab Experiments:** • To study the fundamentals of automation systems. • To study about costs in manufacturing, break-even analysis **Software/Equipment Required:** Automation systems, cost analysis software.	**CO - 1** **BTL - 2**

MODULE 2: DC & AC MACHINES
(6L+ 6P)

Modeling automated manufacturing systems: role of performance modeling, performance measures, The future automated factory: trends in manufacturing the social impact. **Material handling and Identification Technologies:** Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods. computerized line balancing methods, flexible manual assembly lines. **Automated inspection and testing**: Inspection and testing, statistical quality control, automated inspection principles and methods, sensor technologies for automated inspection, machine vision, other optical inspection methods. **Suggested Readings:** on-line/in-process inspection **Lab Experiments:** 1. To perform exercises on material handling and identification technologies. 2. To identify technologies practiced in automated manufacturing systems. 3. To study about control technologies in automation. 4. To perform exercises on material transport and storage systems. 5. To identify the sensors used in inspection and testing methods. **Software/Equipment Required:** Material handling setup, Automation systems for transport and storage, sensors for inspection and testing.	**CO - 2** **BTL - 3**
MODULE 3: AUTOMATION COMPONENTS **(6L+ 6P)**	
Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS Planning and Implementation. Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Inspection Principles and Practices, Inspection Technologies. **Suggested Readings:** Fixed, Programmable, Integrated Automation. **Lab Experiments:** 1. To perform exercises on machine vision based inspection system. 2. To perform exercises on optical inspection system. 3. To perform exercises on flexible manufacturing system. 4. Perform exercises with SPC tools. **5.** Evaluate the performance characteristics of Modern Quality Control Methods. **Software/Equipment Required:** Machine vision based inspection system setup, optical inspection system setup, flexible manufacturing system, SPC tool.	**CO - 3** **BTL - 3**
MODULE 4: INDUSTRIAL NETWORKING **(6L+ 6P)**	
UART, USB, PCIe, I2C, SPI, Profinet, Fieldbus, Ethernet, Ether CAT, Ethernet/IP --CC-Link IE -- Time sensitive networks-- Ethernet TSN -- OPC-UA based protocols, 3GPP LTE -5G- 802.11 –CRAN-- ISA/IEC 62443. **Suggested Readings:** Industry standard wired and wireless bus communication systems. **Lab Experiments:** 1. To perform case studies in a typical process industry and submit report of the automation tools and networking systems. **Software/Equipment Required:** Nil	**CO - 4** **BTL - 3**
MODULE 5: INDUSTRIAL CONTROL SYSTEM-CYBERSECURITY & FRAMEWORKS **(6L+ 6P)**	
ICS cybersecurity:- key terms and concepts, CIS control and categories IT/OT. ICS threat landscape:- ICS attacks, real-world attack run-through, defend against common types of cyber events. Industrial Frameworks:- MITRE, IEC 62443, CIS and NERC CIP -- OT security. Best practices & action plans:-step-by-step guidance on organizational buy-in --ICS cybersecurity program. **Suggested Readings:**	**CO - 5** **BTL - 3**

Cyber security systems, threats, attacks. **Lab Experiments:** 1. To submit a draft proposal for automating a typical work process incorporating cybersecurity and frameworks for an industry. **Software/Equipment Required:** Nil	

TEXT BOOKS	
1.	Mikell P. Grover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education Asia, fifth edition, 2019.
2.	By Dong Seong Kim, Hoa Tran-Dang, "Industrial Sensors and Controls in Communication Networks From Wired Technologies to Cloud Computing and the Internet of Things", Springer International Publishing, First edition, 2019
REFEREFERENCE BOOKS	
1.	Alexander Kott, Edward J. M. Colbert , "Cyber-security of SCADA and Other Industrial Control Systems", Springer International Publishing, First edition, 2018.
2.	N.Viswanadham and Y.Narahari, "Performance Modeling of Automated Manufacturing Systems", Prentice Hall India Pvt. Ltd, Eastern economy edition, 2015.
3.	Stephen J. Derby, Marcel Decker, "Design of Automatic Machinery, Special Indian Edition", Yesdee publishing Pvt. Ltd, 2019.
E RESOURCES FOR REFERENCE	
1.	https://webstore.iec.ch/preview/info_iec62443-4-1%7Bed1.0%7Den.pdf
2.	https://cybersecurity.umsl.edu/links/index.html
3.	https://www.sans.org/security-resources/
MOOC	
1.	https://www.classcentral.com/course/miriadax-networked-control-systems-with-arduino-an-introduction-to-technology-programming-and-robotics-10413
2.	https://onlinecourses.nptel.ac.in/noc20_me39/preview
3.	https://nptel.ac.in/courses/106106199

COURSE TITLE	**DESIGN FOR MANUFACTURE**			**CREDITS**	**3**	
COURSE CODE	**EMD51510**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**	
ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	Design for manufacturing covers the importance of design considerations and material selection for various manufacturing operations such as casting, welding, forging, machining and assembly. The environmental factors for design are also considered in details.					

Course Objective	**The course should enable the students to** 1. Select the design principle and suitable material for designing a product/component. 2. Select the appropriate material, proper working principle and a feasible design. 3. Design (optimum) a component which requires less material removal, easy to machine, assemble, access and cost effective. 4. Redesign the uneconomical casting design and know the applications of DFMA. 5. Incorporate the Environmental Objectives, issues and guidelines into the design
Course Outcome	**Upon completion of this course, the students will be able to** 1. Identify the appropriate design for economical production and select the materials. 2. Select the suitable design parameters for various machining and metal joining processes. 3. Apply a systematic understanding of knowledge in the field of metal casting and forging. 4. Fabricate the parts using various metal working processes 5. Fabricate basic parts and assemblies using powered and non –powered machine shop equipment in conjunction with mechanical documentation.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	2	-	-	-	-	3	3	2	3	2	2
CO-2	3	3	3	2	-	-	-	-	3	3	2	3	2	2
CO-3	3	3	3	2	-	-	-	-	3	3	2	3	2	2
CO-4	3	3	3	2	-	-	-	-	3	3	2	3	2	2
CO-5	3	3	3	2	-	-	-	-	3	3	2	3	2	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(6L+ 6P)**
Introduction: Design philosophy – steps in design process – general design rules for manufacturability – basic principles of designing for economical production – creativity in design, application of linear & non-linear optimization techniques. **Materials:** Selection of materials for design – developments in material technology – criteria for material selection – material selection interrelationship with process selection – process selection charts. **Suggested Readings**: Material selection interrelationship with process selection – process selection charts. **Lab Experiments:** 1. Read and interpret mechanical drawings of systems with moderate complexity. **Software/Equipment Required:** Solidworks/AutoCAD	**CO-1** **BTL-3**
MODULE 2: DESIGN FOR MACHINING AND METAL JOINING	**(6L+ 6P)**
Machining process: Overview of various machining processes – general design rules for machining - dimensional tolerance and surface roughness – design for machining – ease – redesigning of components for machining ease with suitable examples, general design recommendations for machined parts. **Metal joining:** Appraisal of various welding processes, factors in design of weldments – general design guidelines – pre and post treatment of welds – effects of thermal stresses in weld joints – design of brazed joints.	**CO-2** **BTL-3**

Suggested Readings: **E**ffects of thermal stresses in weld joints – design of brazed joints **Lab Experiments:** 1. Create correct mechanical drawings of simple elements and systems 2. Design and model a component with min 5 design considerations stated for machining and metal joining **Software/Equipment Required:** Solidworks/AutoCAD	
MODULE 3: DESIGN FOR CASTING AND FORGING	**(6L+ 6P)**
Metal casting: Appraisal of various casting processes, selection of casting process, - general design considerations for casting – casting tolerances – use of solidification simulation in casting design. **Forging:** Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations. **Suggested Readings:** Product design rules for sand casting **Lab Experiments:** 1. Design and model a component with min 5 design considerations stated for casting and forging process. **Software/Equipment Required:** Solidworks/AutoCAD	**CO-3** **BTL-3**
MODULE 4: DESIGN FOR METAL WORK	**(6L+6P)**
Extrusion and sheet metal work: Design guidelines for extruded sections - design principles for punching, blanking, bending, and deep drawing – Keeler Goodman forming line diagram **Suggested Readings:** component design for blanking **Lab Experiments:** 1. Design and model a component with min 5 design considerations stated for extrusion and sheet metal work **Software/Equipment Required:** Solidworks/AutoCAD.	**CO-4** **BTL-3**
MODULE 5: DESIGN FOR ASSEMBLY AND ENVIRONMENT	**(6L+ 6P)**
Assembly: Compliance analysis and interference analysis for the design of assembly – design and development of features for automatic assembly. **Environment:** Introduction to environment; motivations for environment principles of environment, product life cycle perspective, environment tools and processes, environment design guidelines **Suggested Readings:** liaison diagrams, eco-efficiency **Lab Experiments** **1.** Design and model an assembly with min 5 design considerations stated for assembly and environment **2.** Make effective presentations in a design review format. **Software/Equipment Required:** Solidworks/AutoCAD.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Bralla, Design for Manufacture handbook, McGraw hill, 2014.
2.	Boothroyd, G, Heartz and Nike, Product Design for Manufacture, Marcel Dekker, 2016.
3.	A K Chitale and R C Gupta, “Product Design and Manufacturing”, PHI, New Delhi, 2018.
REFERENCE BOOKS	
1.	Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff, Prentice Hall. Reason Pub., 2011.
2.	George E Deiter, “Engineering Design”, Mc-Graw Hill International, 2020
3.	Kevien Otto and Kristin Wood, Product Design, Pearson Publication, 2019.
E RESOURCES FOR REFERENCE	
1.	https://link.springer.com/book/10.1007/978-1-4615-5785-2
2.	https://www.sciencedirect.com/book/9780750673419/design-for-manufacturing
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc21_me66/preview

2.	https://onlinecourses.nptel.ac.in/noc19_me48/preview

COURSE TITLE	MACHINE VISION			CREDITS	3
COURSE CODE	EMD51511	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL- 4

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	Theory	Practical
15%	15%	10%	5%	5%	25%	25%

Course Description	The purpose of this course is to provide a basic understanding of computer vision and image analysis for 2D computer vision. The course will focus on solving industrial problem using machine vision. This course also introduces the student to fundamental digital imaging processing concepts and their application to the fields of robotics, automation, and signal processing.
Course Objective	The course should enable the students to 1. To familiarize students, the essentials of image processing 2. To learn contemporary, approaches, and techniques of computer vision and pattern recognition 3. To identify various issues in machine vision and object recognition systems 4. To get acquainted with programming experience, executing computer vision and object recognition applications.
Course Outcome	Upon completion of this course, the students will be able to 1. Processing and analysis of gray level images to understand the scene. 2. Image processing for simple problem solving. 3. Getting to know color and color images and using them to solve visual problems 4. Solving 2D industrial problems using Machine vision 5. Scene analysis for robot vision

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO - 1	PO - 2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO -2
CO-1	3	3	-	-	-	1	-	1	1	1	-	1	2	2
CO-2	3	3	3	2	2	2	1	1	1	1	-	1	2	3
CO-3	3	3	3	3	2	2	1	1	1	1	-	1	2	3
CO-4	3	3	3	2	2	2	1	1	1	1	-	1	2	3
CO-5	3	3	1	1	1	1	-	-	-	-	-	1	2	3

1: Weakly related, 2: Moderately related, and 3: Strongly related	
MODULE 1: INTRODUCTION	**(6L+6P)**
Computer Vision Definition and Image Processing and Their Differences - History and Applications of Computer Vision **Lab Experiments:** 1. Acquiring images using MATLAB. **Software/Equipment Required:** MATLAB	**CO-1** **BTL-2**
MODULE 2: IMAGE PROCESSING AND SEGMENTATION	**(6L+6P)**
Thresholding, Geometric Properties, Projections, Binary Algorithm – Size filter, Region boundary, Optical Character Recognition, Region Segmentation, Region Representation – Array, Hierarchical, Symbolic, Split and Merge, Region Growing. **Lab Experiments:** Basic Operations on Images using MATLAB 1. Basic Image Processing Operations 2. Segmentation and Feature extraction **Software/Equipment Required:** MATLAB	**CO-2** **BTL-4**
MODULE 3: IMAGE FILTERING **(6L+6P)**	
Image filtering, Histogram, Median Filter, Gaussian Smoothing – Rotational Symmetry, Fourier Transform Property, Gaussian Filters, Cascading Gaussian **Lab Experiments:** Basic Operations on Images using MATLAB 1. Object detection and Counting **Software/Equipment Required:** MATLAB	**CO-3** **BTL-4**
MODULE 4: IMAGE PRE-PROCESSING **(6L+6P)**	
Pixel brightness transformation, Geometric transformation, Local pre-processing – Image Smoothing, Edge Detection, Image restoration – Inverse filtering, Wiener filtering, Image Enhancement Technique. **Lab Experiments:** Basic Operations on Images using MATLAB 1. Monocular Visual Odometry 2. Scene Change Detection **Software/Equipment Required:** MATLAB	**CO-4** **BTL-4**
MODULE 5: OBJECT RECOGNITION **(6L+6P)**	
Statistical pattern recognition – Support Vector machines, Cluster analysis, Neural Networks – Feed-forward, Hopfield Neural networks, Fuzzy System, Random forests **Lab Experiments:** Basic Operations on Images using MATLAB 1. Color-based object detection **Software/Equipment Required:** MATLAB	**CO-5** **BTL- 2**
TEXTBOOKS	
1.	Sonka, Milan, Vaclav Hlavac, and Roger Boyle. “Image processing, analysis, and machine vision”, 4th Edition. Cengage Learning, 2014.
2.	Muthukumaran Malarvel, Soumya Ranjan Nayak, Surya Narayan “Machine Vision Inspection Systems, Image Processing, Concepts, Methodologies, and Applications”. United States: Wiley, 2020.
REFERENCE BOOKS	
1.	Parker, J. R. “Algorithms for Image Processing and Computer Vision”, Germany: Wiley, 2010.
2.	Nixon, M., Aguado, A. “Feature Extraction and Image Processing for Computer Vision. United Kingdom” Elsevier Science, 2019.
E RESOURCES FOR REFERENCE	
1.	https://link.springer.com/book/10.1007/978-3-030-38148-6
MOOC	

1.	https://nptel.ac.in/courses/108103174

DEPARTMENTAL ELECTIVE – 4

COURSE TITLE	AI AND ROBOTICS			CREDITS	3
COURSE CODE	EMD51512	COURSE CATEGORY	DE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL- 3

ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation/lab records as approved by the Department Examination Committee "DEC"	Attendance	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	This course offers a solid conceptual grounding in intelligent systems alongside the chance to apply your knowledge in a practical setting, designing, building and testing robots. Areas of study may include robot principles and design; software engineering; robot intelligence control; AI and mobile robots; and operational information security management. This course is designed as a project-based learning course, where the outcome is to develop controllers incorporating the AI for mobile robot applications in Webots simulation environment. The assessment is based on evaluation of the outcomes of the exercises that are planned to be carried out at the end of each unit.
Course Objective	The course should enable the students to 1. Physical structure, sensing/actuation and programming are required to develop an intelligent robot. 2. Comprehend the sensory techniques that are used to produce intelligent behaviors in robot systems. 3. Capability of Identifying and Applying suitable robot navigation and control techniques appropriate for a range of different robotic applications 4. By considering case studies they will be able to critically appraise robot systems developed by others.
Course Outcome	Upon completion of this course, the students will be able to 1. Acquire the fundamental concepts behind Intelligent Robotic systems and differentiate various intelligent control techniques. 2. Identify and Apply Intelligent algorithms, navigation and control techniques appropriate for a range of different robotic applications. 3. Comprehend the sensory techniques that are used to produce intelligent behaviours in robot systems. 4. Design, Develop and Program an artificially intelligent robot for applications involving the basic modalities of sensing, path planning and navigation.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO - 1	PO - 2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	1	1	-	-	-	-	-	-	2	2	1

CO-2	**3**	**3**	**2**	**2**	**2**	**1**	**1**	**2**	**2**	**2**	**-**	**2**	**2**	**1**
CO-3	**3**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**2**	**2**
CO-4	**3**	**3**	**3**	**3**	**3**	**1**	**1**	**2**	**2**	**2**	**-**	**2**	**2**	**2**

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: INTRODUCTION (6L+6P)	
Artificial Intelligence – Introduction – History – State of the Art – Agents and Environments – Role and Applications in Robotics, Automation and Manufacturing. Robot Paradigms – History – Need of Intelligence – Social Implications – Telepresence and Semi-Autonomous control – Seven Areas of AI – classifications. **Suggested Readings:** Robot Paradigms and its applications **Lab Experiment:** 1. Study of Webots – Environment, Physical Model, Nodes and Controllers **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 1** **BTL - 3**
MODULE 2: CONTROL METHODS (6L+6P)	
Hierarchical, Deliberative and Reactive Paradigms – Attributes - Closed world assumptions – advantages & disadvantages – Reactive Paradigms – Biological Foundations – Behaviours – reflexive, coordination and perception in behaviours- Schema Theory – Transferring Insights to robots. Attributes of Reactive Paradigm - Subsumption Architecture – Potential Field Methodologies - Implementation of reactive systems - Designing a Reactive Implementation – Case studies **Suggested Readings:** Study of kinematic model for Differential drive mobile robots **Lab Experiment:** 1. Build simple tele-operative differential drive mobile robots in "Webots" environment. Tele-operation can be performed using Keyboard control. **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 2** **BTL - 4**
MODULE 3: SENSORS AND SENSING TECHNIQUES FOR ROBOTS (6L+6P)	
Overview- Sensors – Transducers – Attributes - Sensors for Motion, Force, Position, Light, Vision - Tactile sensing – Advanced Sensors – Applications; Hybrid Control Paradigms and its architectural attributes **Suggested Readings:** Construction and Working principle of sensors used for perception of motion, position, force and distance. **Lab Experiment:** 1. Integrate sensors in the previously build model for navigating the environment **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 3** **BTL - 3**
MODULE 4: PATH PLANNING AND NAVIGATION (6L+6P)	
Introduction to Path planning and Navigation – Landmarks – Relational and associative methods; Metric Path planning – Configuration Space – Graph based path planners. Localization – continuous localization – feature based localization – exploration. **Suggested Readings:** Study of different path planning and localization techniques used in mobile robots. **Lab Experiment:** 1. Develop a braitenberg controller for the robot to navigate in the environment.	**CO - 4** **BTL - 3**

Software/Equipment Required: Webots – Virtual Robotics Simulation Software.	
MODULE 5: DESIGN OF ROBOTICS APPLICATIONS USING AI IN WEBOTS (6L+6P)	
Webots – Introduction – design of differential drive mobile robot – Teleoperation – Braitenberg control - Path Planning and Navigation **Suggested Readings:** Study of kinematic model for Skid Steer mobile robot **Lab Experiment:** 1. Modify the controller designed by implementing behaviours for a robot to navigate the environment by avoiding obstacles 2. Modify the controller designed by making the robot to plan its path using any navigational methods to reach the goal by avoiding the obstacle. **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 4** **BTL - 3**

TEXTBOOKS	
1.	Govers, F. X, "Artificial intelligence for robotics: Build intelligent robots that perform human tasks using AI techniques". Packt Publishing Ltd, 2018.
2.	Igor Skrjanc, Andrej Zdesar, SasoBlazic and Gregor Klancar, "Wheeled Mobile Robotics From Fundamentals Towards Autonomous Systems", ELSEVIER, 2017.
REFERENCE BOOKS	
1.	Robin R Murphy. "Introduction to AI Robotics", MIT Press, 2nd edition, 2019.
2.	Roland Siegwart and I. Nourbaksh. "Introduction to Mobile Robots", MIT Press, 2nd edition, 2011.
MOOC	
1.	https://nptel.ac.in/courses/106102220

COURSE TITLE	**NDT AND CONDITION MONITORING**			**CREDITS**	**3**
COURSE CODE	**EMD51513**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 4**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation/lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	NDT (Non-Destructive Testing) and Condition Monitoring is an interdisciplinary subject that encompass several areas of knowledge including materials science, engineering, physics, and mathematics. They are concerned with the evaluation and monitoring of the properties and conditions of materials, components, and systems without causing damage. Both NDT and Condition Monitoring play an important role in ensuring the safety, reliability, and efficiency of

	critical systems and components in a wide range of industries including aerospace, defense, energy, transportation, and manufacturing.
Course Objective	The course should enable the student to, 1. Impart knowledge in various methods of NDT 2. Compare various techniques and select the method for various defects flaws 3. Arrange and calibrate the instrumentation for NDT and Condition Monitoring 4. Appraise the condition monitoring techniques and their applications in industries.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the nature and techniques of NDT 2. Explain the fundamentals of various NDT techniques 3. Differentiate various defect types and select the appropriate NDT methods for the specimen 4. Discuss the condition monitoring methodology 5. Demonstrate thorough understanding of condition monitoring principles and their applications in industries.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	1	-	2	-	-	-	1	-	-	1	2
CO-2	3	3	2	1	-	2	1	-	-	1	-	2	1	2
CO-3	3	3	2	2	3	2	-	-	-	1	-	2	1	2
CO-4	3	3	3	3	3	2	1	-	-	1	-	2	1	2
CO-5	3	3	3	3	1	2	0	2	2	1	2	2	1	2

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: VISUAL INSPECTION & LIQUID PENETRANT TESTING (6L+6P)

Introduction to NDT, Scope and Advantage of NDT, Comparison of NDT with DT, Classifications of NDT, Visual Optical methods, Dye penetrant testing, Basic principle, Types of dye and methods of application, Developer application and Inspection. **Suggested Readings:** Various evaluation techniques **Lab Experiment:** • Study of various NDT techniques for the detection of defects in various applications like welding, casting etc.	**CO-1** **BTL-2**

MODULE 2: MAGNETIC PARTICLE TESTING & EDDY CURRENT TESTING (6L+6P)

Magnetic particle testing, Magnetization methods, Field indicators, Particle application, Inspection. Eddy current testing, Basic principle, Inspection system and probes, Applications . **Suggested Readings:** Eddy current testing for railways **Lab Experiment:** • Practice in MPT & Eddy Current for the detection of defects in various applications like welding, casting etc.	**CO-2** **BTL- 3**
MODULE 3: ULTRASONIC TESTING & RADIOGRAPHY (6L+6P)	
Ultrasonic testing: Basics of ultrasonic waves, Pulse and beam shapes,Ultrasonic transducers, Acoustic emission testing, Radiography- Basic Principle **Suggested Readings:** Different UT applications **Lab Experiment:** • Practice in Ultrasonic Testing for the detection of defects in various applications like welding, casting etc.	**CO-3** **BTL-3**
MODULE 4: CONDITION MONITORING (6L+6P)	
Introduction to condition monitoring, Basic concept, techniques -visual monitoring, temperature monitoring, vibration monitoring, lubricant monitoring, crack monitoring, thickness monitoring, noise and sound monitoring. **Suggested Readings:** Fault Diagnosis and Prognosis **Lab Experiment:** Experiments in condition monitoring applications like shaft misalignment, bearing failure, looseness etc. • Condition Monitoring and Prognostics Using Vibration Signals • Tune PID Controller in Real Time Using Open-Loop PID Auto tuner Block • Fault Diagnosis of Centrifugal Pumps using Residual Analysis	**CO-4** **BTL-4**
MODULE 5: CASE STUDY (6L+6P)	
Application and case studies of condition monitoring: Bearings, gear boxes, engines, structural health monitoring, machine tool condition monitoring etc. **Suggested Readings:** Instrumentation and Signal Processing	**CO-5** **BTL-3**

TEXTBOOKS	
1.	Baldev raj, T Jeyakumar, M. Thavasimuthu, “Practical Non Destructive Testing”, Narosa publishing house, New Delhi, 2012
REFERENCE BOOKS	
1.	Amiya R Mohanty, “Condition Monitoring Principles and Practices”, CRC Press, USA, 2015
2.	Krautkramer. J., “Ultra Sonic Testing of Materials”, 1st Edition, Springer Verlag Publication, New York, 1996.
3.	Peter J. Shull, “Non Destructive Evaluation: Theory, Techniques and Application”, Marcel Dekker, Inc., New York, 2002.
4.	Chen CH. “Ultrasonic and advanced methods for nondestructive testing and material characterization”, World Scientific; 2007.
5.	Omar M, “Nondestructive Testing Methods and New Applications”, BoD–Books on Demand; 2012.
E RESOURCES FOR REFERENCE	
1.	https://www.asnt.org/Store/ProductDetail?productKey=f8daff8d-5c00-493a-b2d7-1bf5b3198b05
2.	http://www.issp.ac.ru/ebooks/books/open/Nondestructive_Testing_Methods_and_New_Applications.pdf
MOOC	
1.	https://nptel.ac.in/courses/112105232

COURSE TITLE	**COMPUTER INTEGRATED MANUFACTURING**			**CREDITS**	**3**
COURSE	**EMD51514**	**COURSE**	**DE**	**L-T-P-S**	**2-0-2-2**

CODE		CATEGORY			
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	Computer Integrated Manufacturing, known as CIM, is the phrase used to describe the complete automation of a manufacturing plant, with all processes functioning under computer control with digital information tying them together.
Course Objective	The course should enable the students to 1. Write NC, DNC and CNC program in CIM. 2. Design manufacturing solution based on CAD System in CIM. 3. Select Materials handling and Storage in CIM. 4. Write coding for Group Technology in CIM 5. Design automated manufacturing based on Artificial Intelligent system, Expert system and FMS in CIM.
Course Outcome	Upon completion of this course, the students will be able to 1. Write program for NC, DNC and CNC in Automated Manufacturing systems such as CIM. 2. Design manufacturing solution with the features of CAD System such as Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate in design and modeling for CIM 3. Select appropriate Materials handling and storage systems such as AGVs, AS/RS and Robots for material handling and Storage System in CIM 4. Write codes using DCLASS, MICLASS and OPITZ for Group Technology in CIM 5. Design Automated Manufacturing based on Artificial Intelligent system, Expert system and FMS to gradually convert Traditional Manufacturing environment in CIM.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	-	-	-	-	2	2	-	-	1	2	-
CO-2	3	3	2	2	2	-	-	2	2	-	-	1	2	-

CO-3	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**-**
CO-4	**3**	**3**	**1**	**-**	**-**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**-**
CO-5	**3**	**3**	**3**	**2**	**2**	**-**	**-**	**2**	**2**	**-**	**-**	**1**	**2**	**-**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO CIM (6L+6P)	
Automated Manufacturing system – Needs, Types. CIM - CIM wheel - Components, Evolution, needs, Benefits. NC system - Components, NC motion control system, application, advantages and disadvantages. Computer Numerical control System – Components, functions, advantages. Direct Numerical Control System – Components, functions, advantages. **Suggested Readings**: Computer Numerical Control and Numerical Control **Lab Experiments:** 1. Study of Various G Codes and M Codes in Computer Numerical Control 2. Turning and Facing Cycle 3. Write and simulate CNC Part program for three axes Milling machine **Software/Equipment Required:** CNC Simulator	**CO - 1** **BTL - 3**
MODULE 2- COMPUTER AIDED DESIGN (6L+6P)	
Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate. - typical CAD command structure - Types CAD modeling - wire frame modeling, surface modeling and solid modeling. **Suggested Readings:** Constructive Solid Geometry and B-Rep **Lab Experiments:** 1. Isometric and Orthographic projections. **Software/Equipment Required:** PROE/CATIA	**CO - 2** **BTL - 3**
MODULE 3: MATERIAL HANDLING AND STORAGE SYSTEMS (6L+6P)	
Materials handling and Storage Systems - Automated storage and retrieval systems, carousel storage systems - Interfacing of Handling and Storage with Manufacturing system. AGVs - types, advantages and application. Robot – Basic concepts, applications. **Suggested Readings:** Unmanned Aerial Vehicle and Unmanned Ground Vehicle **Lab Experiments:** 1. Pick and Place robot. **Software/Equipment Required:** Yaskawa 6 DOF and Kinova Robot	**CO - 3** **BTL - 3**
MODULE 4: GROUP TECHNOLOGY (6L+6P)	

Group Technology – Role of GT in CAD/CAM Integration, part families, part Classification and coding–DCLASS and MICLASS and OPITZ coding systems - facility design using GT, benefits of GT -Cellular Manufacturing. **Suggested Readings:** Part Classification and Coding **Lab Experiments:** 1. Write the Optiz Classification System for a given Component. 2. Write the MICLASS System for a given component **Software/Equipment Required:** Not required	**CO - 4** **BTL - 3**
MODULE 5: ARTIFICIAL INTELLIGENT SYSTEM, EXPERT SYSTEM AND FMS (6L+6P)	
Artificial Intelligence System, Basic concepts of Artificial intelligence, Intelligent systems and expert systems. Flexible manufacturing systems – Configurations, workstations, planning, applications and benefits – Automated inspection and testing - Machine vision. **Suggested Readings:** Image Processing Techniques. **Lab Experiments:** 1. Flexible Manufacturing System **Software/Equipment Required:** Flexible Manufacturing System Trainer KIT.	**CO - 5** **BTL - 3**

TEXT BOOKS	
1.	Mikell. P. Groover, "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education, 2015.
2.	Mikell. P. Groover and Emory ZimmersJr, "CAD/CAM", Prentice hall of India Pvt. Ltd, 2018.
REFEREREFERENCE BOOKS	
1.	James A. Regh and Henry W. Kreabber, "Computer Integrated Manufacturing", Pearson Education second edition, 2005.
2.	Chris McMahon and Jimmie Browne, "CAD CAM Principles", Practice and Manufacturing Management, Pearson Education second edition, 2005.
E RESOURCES FOR REFERENCE	
1.	https://www.google.co.in/books/edition/COMPUTER_INTEGRATED_MANUFACTURING/GlL0TO6n320C? hl=en&gbpv=1&dq=inauthor:%22A.+ALAVUDEEN%22&printsec=frontcover
MOOC	
1.	https://nptel.ac.in/courses/112104289

COURSE TITLE	**ROBOTIC PROCESS AUTOMATION**			**CREDITS**	**3**
COURSE CODE	**EMD51515**	**COURSE CATEGORY**	**DE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**

15%	15%	10%	5%	5%	25%	25%

Course Description	Robotic Process Automation (RPA) is a technology that allows businesses to automate repetitive, time-consuming tasks by using software robots. RPA is a powerful tool that can help businesses streamline their operations, reduce costs, and improve efficiency. This comprehensive course is designed to equip students with a deep understanding of the key characteristics, benefits, risks, and challenges of Robotic Process Automation (RPA). Through practical training and hands-on exercises, students will learn to design, develop, and implement RPA solutions for simple applications. By the end of the course, students will have gained the skills and knowledge necessary to leverage RPA as a powerful tool for optimizing business processes, reducing costs, and improving operational efficiency.
Course Objective	The course should enable the students to 1. Comprehend understanding of the principles, benefits, risks, and challenges of RPA 2. Design and develop their own RPA solutions for simple applications 3. Create bots that can automate common work processes using various automation techniques, including those that utilize tools such as Excel, Email, and Workbook. 4. Apply their knowledge and skills to real-world scenarios, such as identifying and evaluating potential use cases for RPA 5. Promote collaboration and teamwork through hands-on exercises, case studies, and group projects
Course Outcome	Upon completion of this course, the students will be able to 1. Evaluate the potential benefits of Robotic Process Automation (RPA) for businesses and assess its significance in streamlining business processes. 2. Develop different types of workflows using RPA tools and techniques. 3. Create control flows and record events to improve the efficiency of business processes. 4. Apply screen and website scraping techniques to extract relevant data from different sources. 5. Perform automation of both image and text-based tasks to enhance the effectiveness of RPA solutions.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO -1	PO - 2	PO - 3	PO-4	PO-5	PO-6	PO-7	PO - 8	PO-9	PO -10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	2	-	-	-	-	-	-	-	-	2	1	-	-
CO-2	3	3	3	-	3	-	-	-	3	3	-	-	-	-
CO-3	3	3	3	-	3	-	-	-	3	3	-	-	-	-
CO-4	3	3	3	2	3	-	-	2	2	3	2	3	1	2
CO-5	3	3	3	3	3	-	-	2	2	3	2	3	1	2

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: INTRODUCTION TO ROBOTIC PROCESS AUTOMATION (6L+6P)

Introduction to Business process automation – Robotic process automation – RPA Tools and Technology **Suggested Readings:** UiPath Robotic Process Automation **Lab Experiments:** • Working with UIPath Studio and StudioX • Data Entry Automation: Create an automation that enters data from an Excel	**CO-1** **BTL-2**

spreadsheet into an online form **Software Required:** • UiPath Studio	
MODULE 2: ROBOTIC PROCESS AUTOMATION WORKFLOW (6L+6P)	
Types of Workflow – Sequences – Flowcharts – State Machines – Variables – Arguments - Namespaces **Suggested Readings:** • Data Manipulation, Managing arguments **Practical:** • Create RPA workflow using UIPath • Invoice Processing Automation: Create an automation that extracts data from invoices and enters it into an accounting system. **Software Required:** • UiPath Studio	**CO-2** **BTL-3**
MODULE 3: CONTROL FLOW & RECORDING (6L+6P)	
Control flow – Control flow activities. Recording: Types – Automatic Recording - Interface **Suggested Readings:** • Example of Automatic Recording with Basic Desktop and Web **Lab Experiments:** • Develop RPA solution for a given problem using appropriate control flows Myths in RPA recorder Sales Order Processing Automation: Develop an RPA solution to automate the process of processing sales orders. Identify the inputs and outputs, analyze the process to identify any decision points, loops, or conditional statements, and design the workflow using appropriate control flows. **Software Required:** • UiPath Studio	**CO-3** **BTL-3**
MODULE 4: UI ELEMENTS & SCRAPING (6L+6P)	
UI elements – UI activities properties – Input Methods. Scraping: Data Scraping – Screen Scraping – Relative Scraping **Suggested Readings:** • PDF Automation, Image and text automation **Lab Experiments:** • Scrap data from various UI elements- Perform screen scraping Product Catalog Scraping: Create an automation that scrapes data from an e-commerce website's product catalog. Use the "Data Scraping" activity to select the relevant UI elements on the web page, such as the product name, price, and description. Save the scraped data to a file or database for further analysis or use in other automation processes. **Software Required:** • UiPath Studio	**CO-4** **BTL-3**
MODULE 5: INDUSTRIAL INTERFACING AND NETWORKING CONCEPTS (6L+6P)	
Introduction – Mouse and keyboard activities – Text activities – OCR activities – Image activities **Suggested Readings:** • Orchestrator UI Interface **Lab Experiments:** • Perform image and text automation Image Recognition Automation: Create an automation that uses image recognition to	**CO-5** **BTL- 2**

	identify and click on a specific UI element on a website or application. Use the "Click Image" activity to select the relevant image on the screen and perform the desired action, such as clicking a button or link. **Software Required:** • UiPath Studio	
TEXTBOOKS		
1.	Tom Taulli. "The Robotic Process Automation Handbook: A Guide to Implementing RPA Systems", Apress, 2020.	
REFERENCE BOOKS		
1.	Nandan Mullakara, Arun Kumar Asokan. "Robotic Process Automation Projects: Build real-world RPA solutions using UiPath and Automation Anywhere", Packt Publishing Ltd, 2020.	
E RESOURCES FOR REFERENCE		
1.	https://cdn2.hubspot.net/hubfs/2854653/Digital%20Files/digital-knowledge-center/ebook/RPA_eBook.pdf	
MOOC		
1.	https://www.udemy.com/robotic-process-automation/	
2.	https://academy.uipath.com/landing	

NON DEPARTMENTAL ELECTIVES

NON DEPARTMENTAL ELECTIVE -1

COURSE TITLE	**APPLICATIONS OF AI IN ROBOTICS**			**CREDITS**	**3**
COURSE CODE	**EMD51700**	**COURSE CATEGORY**	**NE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation/lab records as approved by the Department Examination Committee "DEC"**	**Attendance**	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	Robotics is a programmable system that can execute multiple tasks and has applications in industry, surveillance, disaster management, and defence. Robots with close coupling between perception and action in the target environment are known as mobile robots. They are created on hardware systems with the appropriate software tools. The use of mobile robotics technology is growing across a number of industries, including agriculture, medicine, and defence. This course's main objective is to teach students how to apply AI principles to robots used in a variety of applications..

Course Objective	The course should enable the students to 1. Recognize the representation of agents and agent environments. 2. Comprehend the searching techniques. 3. Distinguish the knowledge representation and learning. 4. Apply AI techniques in applications involving tight coupling between perceptions, reasoning and learning.
Course Outcome	Upon completion of this course, the students will be able to 1. Acquire a basic understanding of the building blocks of AI and distinguish various paradigms. 2. Identify and Apply Intelligent algorithms, navigation and control techniques appropriate for a range of different robotic applications. 3. Comprehend the sensory techniques that are used to produce intelligent behaviors in robot system. 4. Recognize the role of AI in UAV's and its planning and control. 5. Design, Develop and Program an artificially intelligent robot for applications involving the basic modalities of sensing, path planning and navigation.

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO - 1	PO - 2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	2	1	2	-	1	1	-	-	-	2	-	-
CO-2	2	2	3	3	2	-	2	2	-	-	-	2	-	-
CO-3	2	2	2	2	2	-	1	2	-	-	-	2	-	-
CO-4	3	3	2	2	2	-	2	2	-	-	-	2	-	-
CO-5	3	3	3	3	3	-	2	2	-	-	-	2	-	-

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: INTRODUCTION (6 L+6P)	
Artificial Intelligence – Introduction – History – State of the Art – Agents and Environments – Role and Applications in Robotics, Automation and Manufacturing. Robot Paradigms – History – Need of Intelligence – Social Implications – Telepresence and Semi-Autonomous control – Seven Areas of AI – classifications. **Suggested Readings:** Various control strategies of Intelligent Robotic Applications. **Lab Experiments:** 1. Study of Webots – Environment, Physical Model, Nodes and Controllers **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 1** **BTL - 2**
MODULE 2: CONTROL METHODS (6L+6P)	
Hierarchical, Deliberative and Reactive Paradigms – Attributes - Closed world assumptions – advantages & disadvantages – Reactive Paradigms – Biological Foundations – Behaviours – reflexive, coordination and perception in behaviours- Schema Theory – Transferring Insights to robots. Attributes of Reactive Paradigm - Subsumption Architecture – Potential Field Methodologies - Implementation of reactive systems - Designing a Reactive Implementation – Case studies **Suggested Readings:** Study of kinematic model for Differential drive mobile robots and Subsumption Architecture. **Lab Experiment:**	**CO - 2** **BTL - 3**

1. Build simple tele-operative differential drive mobile robots in "Webots" environment. Tele-operation can be performed using Keyboard control. **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	
MODULE 3: SENSORS AND SENSING TECHNIQUES (6L+6P)	
Overview- Sensors – Transducers – Attributes - Sensors for Motion, Force, Position, Light, Vision - Tactile sensing – Advanced Sensors – Applications; Hybrid Control Paradigms and its architectural attributes **Suggested Readings:** Study of various sensors that are used in a typical mobile robot and comprehend with the sensors found in Aerial robots. **Lab Experiments:** 1. Integrate sensors in the previously build model for navigating the environment. **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 3** **BTL - 3**
MODULE 4: AI IN UAVS (6L+6P)	
History of unmanned air vehicle (UAV) development. Unmanned aircraft systems: coordinate frames, kinematics and dynamics, forces and moments, lateral and longitudinal autopilots. UAV navigation: accelerometers, gyros, GPS, IMU, Light Detection and Ranging (LiDAR), Imaging cameras, Hyper-spectral sensors, Laser Detection and Range (LADAR). Introduction to navigation systems and types of guidance; Mission Planning and control. **Suggested Reading:** Construction and Working principle of LIDAR and LADAR. **Lab Experiment:** 1. Using WEBOTS, design a virtual environment for a drone and integrate sensors and navigate in the designed environment. **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 4** **BTL - 3**
MODULE 5: AI IN INDUSTRIAL ROBOTS (6L+6P)	
AI in Industrial Robot Applications – Welding, Palletizing, Deburring, Assembly, Material handling and Processing applications, recent trends in industrial collaborative robots. **Suggested Reading:** Cobots – Collaborative Robots and it's applications. **Lab Experiment:** 1. Using WEBOTS, simulate a pick and place operation using Industrial Robot (IRB) **Software/Equipment Required:** Webots – Virtual Robotics Simulation Software.	**CO - 5** **BTL - 3**

TEXTBOOKS	
1.	Liu, Albert Chun-Chen, Oscar Ming Kin Law, and Iain Law, "Understanding Artificial Intelligence: Fundamentals and Applications", John Wiley & Sons, 2022.
2.	Kaliraj, P., and T. Devi, eds., "Artificial Intelligence Theory, Models, and Applications", CRC Press, 2021.
REFERENCE BOOKS	
1.	Aggarwal, C. C., "Artificial Intelligence: A Textbook", Springer Nature, 2021.
2.	Murphy, Robin R, "Introduction to AI robotics", MIT press, 2019.
MOOC	
1.	https://nptel.ac.in/courses/106102220

COURSE TITLE	**NEW PRODUCT DEVELOPMENT**			**CREDITS**	**3**
COURSE CODE	**EMD51701**	**COURSE CATEGORY**	**NE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME						
CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	This course immerses students in the new product development process with the objective of learning modern key tools, techniques and methods. This course will help them to gain thorough understanding in the entire new product development process from consumer need identification, product ideation, concept development, concept evaluation, product design to marketing of any product. Since every industry develop new products in order to be successful in the business market this course is important for the students to be familiar and use latest technology tools for designing any product and efficiently handle whole project management cycle.
Course Objective	The course should enable the student to, 2. Understand the new product development process. 3. Learn how to integrate the customer and end-consumer into this process. 4. Learn and apply the concepts and tools necessary through case examples and assignments. 5. Use the new product development process by conceiving your own new product or service and an introductory launch plan. 6. Participate in group work sessions and teams to become acquainted with the importance of teamwork and collaboration that is critical to new product success.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the nature and techniques of new product development process 2. Discuss the market opportunities, develop an understanding of customer and user needs, and assess the competitive landscape 3. Competent with a set of tools and methods for product design and development. 4. Demonstrate the best level of practice in each problem situation within the context of innovation and new product development 5. Work collaboratively on a team to successfully complete a design project and to effectively communicate the results of projects and other assignments in a written and oral format

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	1	1	-	2	-	-	-	1	-	-	-	-
CO-2	3	3	2	1	-	2	1	-	-	1	-	2	-	-
CO-3	3	3	2	2	3	2	-	-	-	1	-	2	-	-

CO-4	3	3	3	3	3	2	1	-	-	1	-	2	-	-
CO-5	3	3	3	3	1	2	0	2	2	1	2	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION (6L+ 6P)	
Research and new product development –Need for developing new products - relevance of product lifecycle issues in design-Generic New Product Development Process- Intellectual property rights (IPR)-Patents - Patent search - Patent laws - International code for patents. **Suggested Readings:** Product design analysis, Intellectual property rights(IPR), patent laws **Lab Experiments:** 1. Design of a new novel design of a soft gripper for pick and place application 2. Study on procedure for Intellectual Property Rights **Software/Equipment Required:** Solidworks/Proteus	**CO - 1** **BTL - 2**
MODULE 2: CONSUMERS AND OPPORTUNITIES (6L+ 6P)	
Identifying customer needs –voice of customer –customer populations- hierarchy of human needs-need gathering methods – affinity diagrams – needs importance-establishing engineering characteristics-competitive benchmarking- quality function deployment- house of quality- product design specification-case studies **Suggested Readings:** Customer need gathering methods **Lab Experiments:** 1. Root cause analysis of customer feedback through affinity diagrams 2. Study on procedure for product design specification with GD&T concepts **Software/Equipment Required:** Infographic	**CO - 2** **BTL- 3**
MODULE 3: NEW PRODUCT DEVELOPMENT PROCESS – I (6L+ 6P)	
Idea generation- Collection of ideas and purpose of project - Selection criteria - screening ideas for new products - Principal, Point Forward Developing and Selecting Product Concepts- concept development- Concept evaluation techniques. **Suggested Readings:** Concept development and evaluation techniques **Lab Experiments:** 1. Translate from Idea to Orthographic views 2. Design of gear for 3D printing **Software/Equipment Required:** Solidworks/Proteus	**CO - 3** **BTL - 3**
MODULE 4: NEW PRODUCT DEVELOPMENT PROCESS – II (6L+ 6P)	
Design process- Different stages in design and their significance - Design detailing- Material selection, Design visualization- Solid modeling; Detailed 2D drawings; Tolerance; Use of standard items in design; Research needs in design- Designing and branding a product. Selecting a brand name, packaging **Suggested Readings:** Designing and branding a product **Lab Experiments:** 1. Orthographic view of a product logo in CAD models 2. Design of internal component of a IC engine as per standards **Software/Equipment Required:** Solidworks	**CO - 4** **BTL - 4**
MODULE 5: STRATEGIC MARKETING (6L+ 6P)	
Sales Forecasting and Financial Analysis- Marketing Plan-Secrets of New Product Success- Strategic Launch Planning -Implementation of the Strategic Plan-Cases	**CO - 5** **BTL - 3**

Examples of New Innovative Product Forecasting Before Launching- Open innovation; User innovation; Crowd sourcing; Free innovation-Continuous innovation and creating a culture of innovation **Suggested Readings:** Sales forecasting and financial analysis **Lab Experiments:** 1. Cost analysis of Yamaha R1 2. Design of a novel innovative patients assistive robot and analyses its bill of materials **Software/Equipment Required:** Solidworks	

TEXT BOOKS	
1.	Bhise Vivek D, "Designing complex products with systems engineering processes and techniques", CRC Press, 2023.
2.	Chitale, A K., and R. C. Gupta. "Product design and manufacturing", PHI Learning Pvt. Ltd., 2021.
REFEREREFERENCE BOOKS	
1.	Cross Nigel, "Design thinking: Understanding how designers think and work", Bloomsbury Publishing, 2018.
2.	Chang, K. H., "Motion Simulation and Mechanism Design with SOLIDWORKS Motion 2023", SDC publications, 2023.
E RESOURCES FOR REFERENCE	
1.	http://libgen.rs/book/index.php?md5=9349D1CE7855CB0F749788A46D5942A5
2.	http://libgen.rs/book/index.php?md5=303981DFCFBD29C22819AF008DFC0092
MOOC	
1.	https://nptel.ac.in/courses/107103082
2.	https://nptel.ac.in/courses/112107217

COURSE TITLE	**BUILDING OF MOBILE ROBOTS**			**CREDITS**	**3**
COURSE CODE	**EMD51702**	**COURSE CATEGORY**	**NE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee "DEC"**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	Mobile Robot is an autonomous navigating device that can maneuver and reach the target in an environment. The autonomous robots are applied in many fields viz healthcare, industry, and environmental monitoring. Having a fundamental understanding of robot mechanisms, electronic circuits, and a range of sensors is essential for deploying mobile robots. It is also important to possess basic knowledge regarding sensor characteristics and how to select the appropriate sensor for various applications. This course helps in autonomous navigation of mobile robots with the help of various sensors to avoid obstacles and find the right path for reaching the target location. Design and developing mobile robots for various applications by selecting sensors, navigation techniques and suitable controllers for the effective implementation is focused here.

Course Objective	The course will enable the students to understand the: 1. Term of mobile robots and appreciate its use in industries 2. Working principle of the knowledge on sensors and actuators for robot applications 3. Apply vision based navigation in mobile robots 4. Various system integration for mobile robots 5. Learn the applications of mobile robots
Course Outcome	Upon completion of this course, the students will be able to 1. Recall the fundamentals of mobile robots 2. Apply knowledge on sensors and actuators for robot applications 3. Apply vision-based navigation in mobile robots 4. Perform system integration for mobile robots 5. Build Mobile Robots for specific applications

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	3	3	2	2	-	-	-	-	-	1	1	-	-
CO-2	3	3	3	3	2	2	2	1	1	1	1	2	-	-
CO-3	3	3	3	3	2	2	2	1	1	1	1	2	-	-
CO-4	3	3	3	3	2	2	2	1	1	1	1	2	-	-
CO-5	3	3	3	3	2	2	2	1	1	1	1	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1 – INTRODUCTION (6L+6P)

Introduction to mobile Robots – Laws of Robots – Robot Anatomy – Basic Mechanics of Robots– Basic Electronics for Robots, Robot Applications - Companion Robots – Robots for Agriculture Applications – Space Robots – Defense Robots. **Suggested Readings:** Mobile robots applications **Lab Experiments:** 1. Study of mobile robots and its anatomy 2. Study if Arduino ide and hardware **Software/Equipment Required:** Arduino IDE Arduino Uno R3 or combatable board with appropriate Cable	**CO - 1** **BTL - 2**

MODULE 2 – SENSORS (6L+6P)

Sensors for mobile robots – Need – Types & Classification of Sensors- Sensor Characteristics – Sensors for Odometric position estimation, Doppler effect-based sensors, Position, Force, Range, Tactile and Vision – Selection of Sensors. **Suggested Readings:** Sensors interfacing with mobile robot controllers Study of calibration of sensors Study of electrical drives and controllers **Lab Experiments:** 1. Blink of LED 2. Study of Digital and Analog input in Arduino	**CO - 2** **BTL - 2**

3. Study of Potentiometer and analog input **Software/Equipment Required:** Arduino IDE Arduino Uno R3 or combatable board with appropriate Cable	
MODULE 3 – ACTUATORS (6L+6P)	
Introduction to Controllers –design of simple controller by basic electronic devices – Digital controller – design of simple controller using logic gates – Introduction to Microcontroller – simple program for Obstacle Detection and Avoidance – Localization **Suggested reading:** Study of optimization algorithm for navigation Study of localization algorithm. Actuators interfacing with mobile robot controllers **Lab Experiments:** 1. Study of motor driver and motor direction control. 2. Study of serial monitor and Bluetooth controls. 3. Control of DC motor **Software/Equipment Required:** Arduino IDE Arduino Uno R3 or combatable board with appropriate Cable	**CO - 3 BTL - 3**
MODULE 4 – CONTROLLERS (6L+6P)	
Introduction to Controllers –design of simple controller by basic electronic devices – Digital controller – design of simple controller using logic gates – Introduction to Microcontroller – simple program for Obstacle Detection and Avoidance – Localization **Suggested reading:** Arduino interfacing with motor drive Study of python programming for interfacing **Lab Experiments:** 1. Study of Optical encoder 2. Study of ultrasonic sensor' 3. Study of Infrared sensor 4. The study of kinematics of differential robot **Software/Equipment Required:** Arduino IDE Arduino Uno R3 or combatable board with appropriate Cable, Sensors: Optical encoder, Ultrasonic sensor Infrared sensor	**CO - 4 BTL - 4**
MODULE 5 – BUILDING OF MOBILE ROBOTS (6L+6P)	
Building of simple mobile robot – Use of various Sensing methods - Interfacing Sensors and Actuators with Robot Controller – Design of simple Mobile robot **Suggested reading:** Study of sensing methods in mobile robots Study of mobile robots for variable applications **Lab Experiments:** 1. Building of basic Mobile robot 2. Making of obstacle avoidance robot **Software/Equipment Required:** Arduino IDE Arduino Uno R3 or combatable board with appropriate Cable	**CO-5 BTL-4**
LAB / MINI PROJECT / FIELD WORK	

1. Design and develop a mobile robot for a specific application	
TEXT BOOKS	
1.	Ulrich Nehmzow, “Mobile Robots - A practical introduction”, Springer, second edition, 2003.
2.	Fahimi, Farbod, “Autonomous robots”, Boston, MA, USA:: Springer, 2009.
3.	S. M. LaValle, “Planning Algorithms”, Cambridge University Press, 2006.
4.	H. Choset, K. M. Lynch, S. Hutchinson, G. Kantor, W. Burgard, L. E. Kavraki, and S. Thrun, “Principles of Robot Motion: Theory, Algorithms and Implementations”, PHI Ltd., 2005.
REFERENCE BOOKS	
1.	Woo-Kyung Choi, Hong-Tae Jeon, Seong-Joo Kim, “Multiple Sensor Fusion and Motion Control of Snake Robot Based on Soft-Computing”, INTECH Open Access Publisher, 2007.
2.	Blum, Jeremy. “Exploring Arduino: tools and techniques for engineering wizardry”, John Wiley & Sons, 2019.
3.	Katsuhiko Ogata. “Modern Control Engineering”, Pearson Education, 2011.
MOOC	
1.	https://www.coursera.org/learn/mobile-robot
2.	https://nptel.ac.in/courses/112106298

COURSE TITLE	**MOTION CONTROL FOR AUTOMATION INDUSTRY (For MECH, AUTO, EEE, ECE, AERO, AEROSPACE)**			**CREDITS**	**3**
COURSE CODE	**EMD51703**	**COURSE CATEGORY**	**NE**	**L-T-P-S**	**2-0-2-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL- 3**

ASSESSMENT SCHEME						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee “DEC”**	**Attendance***	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**

Course Description	Motion control is a sub-field of automation, encompassing the systems or sub-systems involved in moving parts of machines in a controlled manner. A motion control system is extensively used in a variety of fields for automation purposes, including precision engineering, micro-manufacturing, and production lines, where power, efficiency, and accuracy of movement are of vital importance. Not only does a motion control system enable movement, but, more importantly, it ensures that a machine can stop. Therefore, the goal of this course is to introduce motion control concepts and components for the design of industrial systems. This course provides the basic concepts of sensors, drives, actuators, and control structures required for motion control system design. The main emphasis is on the fundamentals of sensing physical quantities, actuators, drives, control structures, and motion modes.

Course Objective	The course should enable the students to 1. Term Motion Control and appreciate its use in Industries. 2. Working principle of various sensors, associate signal processing, and its applications 3. The underlying principle of Drives, actuators, and transmission mechanisms 4. Various motion profiles and control strategies applied in motion control. 5. Design a simple single and multi-axis motion control system
Course Outcome	Upon completion of this course, the students will be able to 1. Appreciate the fundamental concepts and the role and the common elements of the motion control systems. 2. Identify and select the necessary feedback and control devices used in the design of industrial motion control systems. 3. Comprehend various drives, controls, and transmission mechanisms and select a suitable one for the system design. 4. Write a ladder logic program for simple applications 5. Appreciate the role of PLC as a motion controller in industrial automation systems

Prerequisites: NIL

CO, PO AND PSO MAPPING

CO	PO - 1	PO - 2	PO-3	PO-4	PO - 5	PO-6	PO-7	PO-8	PO- 9	PO -10	PO-11	PO - 12	PSO-1	PSO-2
CO-1	3	3	-	-	-	1	-	1	1	1	-	1	-	-
CO-2	3	3	3	2	2	2	1	1	1	1	-	1	-	-
CO-3	3	3	3	3	2	2	1	1	1	1	-	1	-	-
CO-4	3	3	3	2	2	2	1	1	1	1	-	1	-	-
CO-5	3	3	1	1	1	1	-	-	-	-	-	1	-	-

1: Weakly related, 2: Moderately related, and 3: Strongly related

MODULE 1: INTRODUCTION TO MOTION CONTROL (6L+ 6P)

Introduction – Industrial automation – automation hierarchy – Basic Components of Industrial Automation – Types of Automation – Fixed – programmable – flexible. Need of motion Control in automation - components of a motion control system – Open Loop Systems – Closed Loop Systems – Motion Control Parameters – Terminologies – Sensor, Actuator, and Controller blocks – Transmission Mechanisms

Suggested Readings: Industrial Motion Control Systems – Applications and Examples

Lab Experiment:

1. Study of Motion Control Systems – Uniaxial and Multiaxial System

Software / Equipment Required: MOVITRAC, MOVIDRIVE, MOVIFIT, MOVITools

CO - 1
BTL - 2

MODULE 2: FEEDBACK AND CONTROL DEVICES (6L+ 6P)

Introduction to Feedback devices – Classification – Characteristics – Sensors for motion control - Detection sensors – Limit Switches – Proximity sensors – Photoelectric Sensors – Ultrasonic Sensors – Three-wire sensors. Evaluation of Sensors. Sensor Interfacing. Control Devices – Pilot Control Devices – Push buttons – Selector Switches – Indicator Lights.

Suggested Readings: Various sensors measuring Position, Velocity, Temperature, etc. Design of Strain Gauge Load Cell.

Lab Experiments:

- Study of Various sensors used in the Single and Multi-Axis System

CO - 2
BTL - 3

Software / Equipment Required: MOVITRAC, MOVIDRIVE, MOVIFIT, MOVITools	
MODULE 3: DRIVES AND ACTUATORS FOR MOTION CONTROL (6L+ 6P)	
Introduction to drives/actuators for motion control - Types of Actuators – Electric Actuators – DC Motor, AC Motor, Servo Motors; Transmission mechanisms – drive trains – drive train selection - Drives – Types of Drives – Converters – Inverters – Flux Vector Controls – PWM Controls – Volts/ Hz control. **Suggested Readings:** Study of Basic control structures and loops of a motion control system; Study of AC servo and Induction motor Model **Lab Experiments:** 1. Study of Gears and Lead Screw as Transmission Mechanisms in Single and Multi Axis Systems **Software / Equipment Required:** MOVITRAC, MOVIDRIVE, MOVIFIT, MOVITools	**CO - 3** **BTL - 3**
MODULE 4: MOTION CONTROLLERS (6L+ 6P)	
Introduction- Motion Controllers – Standalone – PC based. PLC – Building blocks of PLC - Memory - I/O Modules – I/O section Analog I/O Section Analog I/O modules – digital I/O modules CPU processor memory module – Programming devices – PLC programming Simple instructions - Output control devices - Latching relays PLC ladder diagram. **Suggested Readings:** Instruction Sets and Ladder Programming of DELTA PLC **Lab Experiments:** 1. Study of Delta / ABB/ Siemens PLC and its associated software 2. Design of ladder circuits for ON – OFF control of various loads and drives using PLC. **Software / Equipment Required:** DELTA PLC	**CO - 4** **BTL - 3**
MODULE 5: PLC APPLICATIONS IN INDUSTRIAL AUTOMATION (6L+ 6P)	
Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application. **Suggested Readings:** Design of ladder circuits for ON – OFF control of various loads and drives using PLC. **Lab Experiments:** 1. Design of semi-automated control of tollgate gate using PLC & DC motor **Software / Equipment Required:**PLC Controller	**CO - 5** **BTL - 2**

TEXTBOOKS	
1.	Hakan Gurocak. “Industrial Motion Control – Motor selection, Drives, Controller tuning, Applications”, John Wiley and Sons Ltd., 2016.
2.	Terry L.M. Bartlet. “Industrial Automated Systems Instrumentation and Motion Control”, Delmar Cengage Learning. ISBN-13: 978-1-4354-8888-5, 2011.
REFERENCE BOOKS	
1.	Nathan Ida. “Sensors, Actuators and their Interfaces, A multidisciplinary introduction”, SCI TECH Publications, pp. 1 to 119, 281-324. 2014.
2.	Clarence W. de Silva. “Sensors and Actuators Engineering System Instrumentation”, CRC press. 2016.
E RESOURCES FOR REFERENCE	
1.	https://link.springer.com/book/10.1007/978-1-4302-6014-1
MOOC	
1.	https://ocw.tudelft.nl/course-lectures/5-motion-control/
2.	https://nptel.ac.in/courses/108/108/108108147/

COURSE TITLE	INDUSTRY 4.0 FOR ENGINEERS			CREDITS	3
COURSE CODE	EMD51704	COURSE CATEGORY	NE	L-T-P-S	2-0-2-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE	
First Periodical Assessment (Theory)	Second Periodical Assessment (Theory)	Practical Assessments	Observation / lab records as approved by the Department Examination Committee "DEC"	Attendance*	THEORY	PRACTICAL
15%	15%	10%	5%	5%	25%	25%

Course Description	Fourth Industrial revolution is very much driven by the smarts in automating decision making and processes. Industry 4.0 concerns the transformation of industrial processes through the integration of modern technologies such as sensors, communication, and computational processing. Technologies such as Cyber Physical Systems (CPS), Internet of Things (IoT), Cloud Computing, Machine Learning, and Data Analytics are considered to be the different drivers necessary for the transformation. Advancements in technology has resulted in immense improvements in computational power across nearly all electronic devices and enhanced capabilities in connecting the dots in an increasingly networked society. Industrial Internet of Things (IIoT) is an application of IoT in industries to modify the various existing industrial systems. IIoT links the automation system with enterprise, planning and product lifecycle.
Course Objective	The course should enable the students to 1. Explore various sensors, peripheral devices and networking protocol applied in industries. 2. Realize the challenges faced for the effective implementation of Industry 4.0 in industrial applications. 3. Gain good depth of fundamental knowledge in designing Industrial IOT Systems for various application. 4. Identify the underlying principle of various systems and models to solve engineering problems by using Industrial IoT. 5. Develop solution for Real time problems using acquired skills of Industrial applications with IoT capability.
Course Outcome	Upon completion of this course, the students will be able to 1. Infer knowledge in the basics of sensors, communication and networks commercialized in industries. 2. Analyze the challenges and opportunities brought about by Industry 4.0 and appreciate the smartness in Smart Factories, Smart cities, smart products and smart services. 3. Comprehend the fundamentals of Industrial processes, Business model and architecture deploying industrial IoT. 4. Outline the various systems and models used in a Industries and their role in an Industry 4.0 world. 5. Illustrate the applications of Industry 4.0 with real-time case studies.

Prerequisites: Basic knowledge of computer network and internet

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2

CO -1	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**-**	**2**	**3**	**3**	**-**	**-**	**-**
CO -2	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**-**	**2**	**3**	**3**	**2**	**-**	**-**
CO -3	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**-**	**2**	**3**	**3**	**-**	**-**	**-**
CO -4	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**-**	**2**	**3**	**3**	**-**	**-**	**-**
CO -5	**3**	**3**	**3**	**3**	**2**	**-**	**1**	**-**	**2**	**3**	**3**	**2**	**-**	**-**

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION (6L+ 6P)	
Introduction, Sensing and Actuation, Communication, Networking, Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Topology **Suggested Readings**: Comparison of Industry 4.0 Factory and Today's Factory **Lab Experiments:** 1. Introduction to Arduino 2. Introduction to raspberry Pi **Software/Equipment Required:** Arduino, Raspberry Pi	**CO - 1** **BTL - 3**
MODULE 2: SMART INDUSTRY (6L+ 6P)	
Smart and Connected Business Perspective, Smart Factories, Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Cyber security **Suggested Readings:** Augmented Reality and Virtual Reality, Artificial Intelligence **Lab Experiments:** 1. Measurement of temperature values of the process. 2. Measurement of pressure values of the process. **Software/Equipment Required:** Raspberry pi/Node mcu	**CO - 2** **BTL - 3**
MODULE 3: INDUSTRIAL IoT (6L+ 6P)	
Introduction, Industrial Sensing and Actuation, Industrial Processes, Business Model and Architecture, Industrial IoT Layers, Communication, Networking, Processing **Suggested Readings:** Industrial Internet Systems **Lab Experiments** 1. Modules and Sensors Interfacing (IR sensor, Ultrasonic sensors, Soil moisture sensor) **Software/Equipment Required:** Arduino/Raspberry pi, Sensors	**CO - 3** **BTL - 3**
MODULE 4: IIoT ANALYTICS AND DATA MANAGEMENT (6L+ 6P)	
Introduction, Machine Learning and Data Science, Cloud and Fog Computing, Programming, Data Management with Hadoop, Data center Networks, SDN, Security **Suggested Readings:** R and Julia Programming **Lab Experiments:** 1. Modules and Actuators Interfacing (Relay, Motor, Buzzer) **Software/Equipment Required:** Raspberry pi/node mcu, Relay, Motor, Buzzer	**CO - 4** **BTL - 3**
MODULE 5: APPLICATIONS AND CASE STUDIES (6L+ 6P)	
AIoT Smart Home, AIoT Smart Farm and AIoT Smart Car **Suggested Readings:** Food Industry, Applications of UAVs in Industries, Manufacturing Industries **Lab Experiments:** 1. Smart home applications **Software/Equipment Required:** Embedded PC based development boards	**CO - 5** **BTL - 3**

TEXT BOOKS	
1.	Alasdair Gilchrist, ”Industry 4.0: The Industrial Internet of Things”, Apress, 2016.
2.	Zaigham Mahmood, ”The Internet of Things in the Industrial Sector: Security and Device Connectivity, Smart Environments, and Industry 4”, first edition, Springer, 2019.
3.	Ismail Butun, “Industrial IoT : Challenges, Design Principles, Applications, and Security”, first edition, Springer, 2020.
4.	Sabina Jeschke, Christian Brecher, Houbing Song and Danda B. Rawat, “Industrial Internet of Things: Cyber manufacturing Systems”, Springer, 2017.
REFERENCE BOOKS	
1.	Christoph Jan Bartodziej, “The Concept Industry 4.0: An Empirical Analysis of Technologies and Applications in Production Logistics”, Springer, 2017.
2.	Rajkamal, “Embedded System: Architecture, Programming and Design”, 3rd edition, McGraw Hill Education, 2017.
3.	Dr. OvidiuVermesan and Dr. Peter Friess,” Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers, 2013.
E RESOURCES FOR REFERENCE	
1.	https://www.pdfdrive.com/industry-40-industrial-revolution-of-the-21st-century-e187573163.html
2.	https://download.e-bookshelf.de/download/0007/6832/86/L-G-0007683286-0014731014.pdf
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc20_cs24/preview
2.	https://www.coursera.org/learn/industrial-internet-of-things?

COURSE TITLE	**VIRTUAL REALITY**			**CREDITS**	**3**	
COURSE CODE	**EMD51705**	**COURSE CATEGORY**	**NE**	**L-T-P-S**	**2-0-2-2**	
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL - 6**	
ASSESSMENT SCHEME : PROJECT BASED LEARNING						
CIA					**ESE**	
First Periodical Assessment (Theory)	**Second Periodical Assessment (Theory)**	**Practical Assessments**	**Observation / lab records as approved by the Department Examination Committee “DEC”**	**Attendance**	**THEORY**	**PRACTICAL**
15%	**15%**	**10%**	**5%**	**5%**	**25%**	**25%**
Course Description	This course is designed to provide students with an overview of the basic principles of virtual reality, scripting and rendering virtual environments. The goal is to learn enough about the strengths and limitations of VR technology to be able to construct simple immersive environments. Students in the course will be given an opportunity to interact directly with immersive virtual environment technology and will gain experience by developing a VR-based application. This course is offered as a Theory Integrated Practical course by practicing Project Based Learning (PBL), emphasizing learning by doing, where the objective is to provide the students with the required hands-on exercises/projects that complement the theoretical understanding of the subject matters.					

Course Objective	The course should enable the students to 1. To provide an understanding on the fundamental concepts relating to Virtual Reality such as presence, immersion, and engagement 2. To introduce students to the field of virtual reality (VR) and provide students with hands-on experience developing applications for modern virtual 3. To enable students to explore libraries and tools for creating VR experiences such as Unity
Course Outcome	Upon completion of this course, the students will be able to 1. Discuss Virtual reality concepts. 2. Develop VR applications using Unity3D. 3. Move around the 3D world. 4. Run Unity 3D application in VR on a smart phone.

Prerequisites: Engineering Graphics(CAD tool), Basic Programming language.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	3	3	1	3	2	2	1	2	2	2	2	-	-
CO-2	2	3	3	1	3	1	1	1	1	1	1	1	-	-
CO-3	2	3	3	1	3	1	1	1	1	1	1	1	-	-
CO-4	2	3	3	1	3	1	1	1	1	1	1	1	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO VIRTUAL REALITY (6L+ 6P)	
Virtual Reality – Types – Virtual Reality Vs Augmented Reality – Applications – Technical skills required **Suggested Readings**: Immersive technologies: VR, AR, MR and XR **Lab Experiments:** 1. Introduction to software and hardware tools for VR environment. **Software/Equipment Required:** Virtual Reality IDE.	**CO - 1** **BTL - 2**
MODULE 2: BUILDING SIMPLE SCENES (6L+ 6P)	
Introduction to Unity IDE – Objects and Scale – Creating a simple diorama – VR Device integration **Suggested Readings:** Computer Graphics and Virtual Reality **Lab Experiments:** 1. To create 3D scenes with Unity 3D IDE 2. To work with scenes and objects properties 3. To create movable objects in 3d environment. 4. To perform exercises with scenes and object with script controls. 5. To perform exercises with scenes and object with script controls and dynamically update the environment. **Software/Equipment Required:** Unity 3D IDE, Head Mounted Display for VR visualization.	**CO - 2** **BTL - 3**
MODULE 3: GAZE BASED CONTROL (6L+ 6P)	
First person Controller – Third person controller – Navigation in VR application – World space User Interface **Suggested Readings:** Augmented reality navigation systems **Lab Experiments:**	**CO - 3** **BTL - 6**

1. To create an application where user can navigate around the scene. 2. To create an application where user can navigate around the multiple scene. 3. To work with rigid body objects and work with material properties. 4. To work with colliders of rigid body objects. 5. To create prefabs with assets created in the environment. **Software/Equipment Required:** Unity 3D IDE, Head Mounted Display for VR visualization, 3D glasses.	
MODULE 4: PHYSICS & ENVIRONMENT (6L+ 6P)	
Physics component – physics materials – Raycast – particle effects **Suggested Readings:** Development of Haptic virtual reality systems **Lab Experiments:** 1. To create an application where the user can interact with the objects in the scene using a Teleportation. 2. To demonstrate particle effects upon interaction with objects. 3. To create physics materials and apply the same to objects. 4. To add particle effects to objects. **Software/Equipment Required:** Unity 3D IDE, Head Mounted Display for VR visualization, 3D glasses, Handheld controllers for interaction, Haptic feedback devices.	**CO - 4** **BTL - 6**
MODULE 5: WALK-THROUGHS (6L+ 6P)	
Assembling scenes – Adding photos – Animated walkthrough – optimizing for performance – Using all 360 degrees. **Suggested Readings:** Game engines and VR in film making **Lab Experiments:** 1. To create a virtual reality application for a walkthrough. 2. To design a Mechatronics application using VR. **Software/Equipment Required:** Unity 3D IDE, Head Mounted Display for VR visualization, 3D glasses, Handheld controllers for interaction, Haptic feedback devices.	**CO - 4** **BTL - 6**

TEXT BOOKS	
1.	Jason Jerald, "The VR Book – Human Centered Design for Virtual Reality", Morgan & Claypool,2015
2.	John Williamson, Charles Palmer, "Virtual Reality Blueprints: Create compelling VR experiences for mobile and desktop", Packt Publishing, 2018.
REFEREFERENCE BOOKS	
1.	Erin Pangilinan, Steve Lukas, Vasanth Mohan, "Creating Augmented and Virtual Realities Theory and Practice for Next-Generation Spatial Computing", O'Reilly Media, First edition, 2019
2.	Paul Mealy , "Virtual & Augmented Reality For Dummies", Wiley publishers, 2018
3.	Mario Gutierrez, Mario Arturo Gutiérrez Alonso, F. Vexo, Daniel Thalmann, "Stepping Into Virtual Reality", Springer London, 2009.
4.	Cornel Hillmann, "UX for XR User Experience Design and Strategies for Immersive Technologies", Apress, 2021.
E RESOURCES FOR REFERENCE	
1.	https://learn.unity.com/course/create-with-vr
2.	https://www.vrs.org.uk/virtual-reality/what-is-virtual-reality.html
3.	https://guides.library.utoronto.ca/c.php?g=607624&p=4938314
4.	https://edu.gcfglobal.org/en/thenow/understanding-virtual-reality-and-augmented-reality/1/#
MOOC	
1.	https://in.udacity.com/course/introduction-to-virtual-reality--ud1012
2.	https://www.edx.org/course/creating-virtual-reality-vr-apps-uc-san-diegox-cse190x

SYLLABUS OF ALL COURSES UNDER HONORS

COURSE TITLE	AUTOMATION IN MANUFACTURING			CREDITS	3
COURSE CODE	EMD51900	COURSE CATEGORY	HN	L-T-P-S	3-0-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	End Semester Examination
15%	15%	10%	5%	5%	50%

Course Description	The primary focus of this course is on the design and development of automated systems for modern manufacturing industries. The course introduces various automated systems used in the manufacturing industries. It presents a detail of sensors, actuators, drives and mechanisms, hydraulic and pneumatic systems.
Course Objective	The course should enable the students to 1. Highlight the importance of automation in the manufacturing industry 2. Familiarize various components of an automated system 3. Expose the role of sensors required in automated system for manufacturing 4. Awareness on various drives systems and its types 5. Study on advanced manufacturing management tools employed in industry
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the importance of automation in the manufacturing industry. 2. Select suitable mechanical components of an automated system with standards. 3. Recommend appropriate sensors required for automated systems 4. Compare the various drive system 5. Evaluate the features of advanced manufacturing with manufacturing management tools.

Prerequisites: Manufacturing, Basics of sensors.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	3	3	2	1	2	2	3	2	2	3	3
CO-2	2	2	3	2	2	3	2	1	2	2	2	1	2	3
CO-3	3	3	2	1	1	2	2	2	1	3	1	2	2	2
CO-4	2	2	2	3	2	1	2	1	2	3	1	2	3	2
CO-5	3	2	3	2	3	2	2	2	2	1	2	1	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO AUTOMATION IN MANUFACTURING INDUSTRY (9L)

Introduction: Importance of automation in the manufacturing industry and advanced manufacturing process analysis. The data analysis process: Data collection in different manufacturing setting – discrete manufacturing setting and continuous manufacturing. Introduction to digital thread components and the vision of digital manufacturing and design. **Suggested Readings:** Manufacturing settings and data collection	**CO - 1** **BTL-2**
MODULE 2: DESIGN OF AN AUTOMATED SYSTEM (9L)	
Introduction to designing of an automated system, Building block of an automated system, working principles and examples. Fabrication or selection of various components of an automated system. Specifications of various basic elements with design requirements. Procedure for design of basic elements **Suggested Readings:** Design of basic machine elements	**CO-2** **BTL-2**
MODULE 3: SENSORS AND MICROPROCESSORS (9L)	
Introduction to sensors- Study of various sensor required in a typical automated system for manufacturing. Construction and principle of operation of sensors. Microprocessor Technology: Signal conditioning and data acquisition, use of microprocessor or micro controllers and its configurations. **Suggested Readings:** Various modern sensors and their usage	**CO-3** **BTL-2**
MODULE 4: DRIVES IN AUTOMATION (9L)	
Introduction to drives and its types. Electrical drives – types selection criteria, construction and operating principle. Hydraulic systems: hydraulics power pack, pumps, valves. Designing of various simple hydraulic circuits. Pneumatic systems: configurations, compressors, valves, distribution and conditioning. Designing of various simple pneumatic circuits. **Suggested Readings:** Comparison of hydraulic, pneumatic and electrical drives	**CO-4** **BTL-3**
MODULE 5: MANUFACTURING MANAGEMENT TOOLS (9L)	
Digital technology – Roadmap to success in Digital Manufacturing and Design, Industry opportunities A Bussiness case for digital implementation, SWOT analysis, Future in Digital Manufacturing and design. Finding the Bottleneck, Labor cost and Labor utilization, Inventory turns, Make to stock vs Make to order/ Reasons for inventory, Dealing with multiple flow units, The seven sources of waste, financial value of productivity, Overall equipment effectiveness. **Practical component:** Development of framework for next generation tools with process analysis. **Suggested Readings:** Traditional Vs Digital Manufacturing Roles	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Bolton, W. “Mechatronics: electronic control systems in mechanical and electrical engineering”. Pearson Education, 2003.
2.	Regtien, P. P. “Sensors for mechatronics”. Elsevier, 2012.
REFERENCE BOOKS	
1.	Norton, R. L. “Cam design and manufacturing handbook”, Industrial Press Inc. 2002.
2.	Pearson, R. S. G. P. H. “Microprocessor Architecture Programming and Applications with the 8085, Atilim University Library, 2002
E RESOURCES FOR REFERENCE	
1.	https://libguides.newcastle.edu.au/industrial-design/ebooks
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc21_me120/preview

2.	https://www.mooc-list.com/tags/industrial-design

COURSE TITLE	ENGINEERING PROJECT MANAGEMENT - I			CREDITS	3
COURSE CODE	EMD51901	COURSE CATEGORY	HN	L-T-P-S	3-0-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME					
CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	End Semester Examination
15%	15%	10%	5%	5%	50%

Course Description	This course introduces the tools to initiate a project plan, manage both stakeholders and relationships, organize their team, develop a project charter, and build a business case for a project
Course Objective	The course should enable the students to 1. Develop a project scope, schedule and budget and then status them to predict project performance. 2. Analyze the change in management and techniques. 3. Preparing organization charts, create a Stakeholder Register 4. The key guidance your team needs to understand the scope, requirements and purpose for the project.
Course Outcome	Upon completion of this course, the students will be able to 1. Enumerate the engineering concepts for project identification 2. Comprehend the key deliverable based on business requirements while managing customer expectations 3. Apply the business case for a project and calculate Net Present Value 4. Build a business case on project organization for a specific project 5. Estimate the cost analysis of a specific project

Prerequisites: Project Management, Basics on project ideas.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	3	3	2	1	2	2	3	2	2	3	3
CO-2	2	2	3	2	2	3	2	1	2	2	2	1	2	3
CO-3	3	3	2	1	1	2	2	2	1	3	1	2	2	2
CO-4	2	2	2	3	2	1	2	1	2	3	1	2	3	2
CO-5	3	2	3	2	3	2	2	2	2	1	2	1	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO PROJECT MANAGEMENT (9L)

Introduction to Project Management - Pre-Course Survey Developing a Project Charter - Project Management Plan Manage and Control Work **Suggested Readings:** Challenges in Project Management **Case Study:** Case study on task allocation through MS Project	**CO - 1** **BTL - 1**
MODULE 2: PROJECT MANAGEMENT (9L)	
Key Elements of Project Management - Program and Portfolio Management - Ethics Work Process - Project Organizations Project Management Processes **Practical component:** Prepare a management portfolio **Suggested Readings:** Project Organization in Automobile industry **Case Study:** Case study on tracking progress through MS Project	**CO - 2** **BTL - 2**
MODULE 3: PROJECT COMMUNICATION (9L)	
Identifying Stakeholders - Stakeholder Management - Plan Managing Stakeholder Engagement - Monitoring Stakeholder Engagement **Suggested Readings:** Project Deliverable in steel industry **Case Study:** Case study on stockholders and employee workload through MS Project	**CO - 3** **BTL - 3**
MODULE 4: PROJECT SCOPE MANAGEMENT (9L)	
Introduction to Scope Development - Scope Development - Requirements Development - Scope Control Process - Time Management - Critical Path Method - Overview Types of Diagrams Activity on Node Example. **Suggested Readings:** Project Development in automobile assembly line section **Case Study:** Case study on work in progress details through MS Project	**CO - 4** **BTL - 3**
MODULE 5: COST ESTIMATION (9L)	
Preparing an Estimate - Estimate Bases - Type of Estimates - Cost Baseline - Forward Pass Diagram & Backward Pass Diagram - Strategies for Dealing Tools and Conclusion. **Suggested Readings:** Case study on cost analysis of developed product **Case Study:** Case study on budget allocation through MS Project	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Nicholas, J. M., & Steyn, H. "Project management for engineering, business and technology". Routledge, 2020.
REFERENCE BOOKS	
1.	Goodman, L. J., & Ignacio, R. S., "Engineering project management: the IPQMS method and case histories". CRC Press, 2019.
E RESOURCES FOR REFERENCE	
1.	https://link.springer.com/book/10.1007/978-3-319-56099-1
MOOC	
1.	https://www.coursera.org/learn/initiating-planning?specialization=engineering-project-management
2.	https://www.coursera.org/learn/scope-time-management-cost?specialization=engineering-project-management

COURSE TITLE	**ADVANCED MANUFACTURING**			**CREDITS**	**3**
COURSE CODE	**EMD51902**	**COURSE CATEGORY**	**HN**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	End Semester Examination
15%	15%	10%	5%	5%	50%

Course Description	This course covers the details of the digitally connected advanced manufacturing practices, advanced intelligent machining, advanced metal forming processes and operational complexity of enterprises, business process optimization with the concept of integrated product-process-value chain.
Course Objective	The course should enable the students to 1. Study on different tools and techniques for integration of data for manufacturing 2. Selection on suitable components of intelligent machining 3. Familiarize various sensing techniques in advanced manufacturing 4. Describe computational techniques and platforms 5. Recognition of design, planning and production scheduling of goods and services by applying product life cycle data
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the tools, technologies, and techniques for aggregation and integration of data throughout the manufacturing supply chain and entire product life cycle. 2. Comprehend the various components of intelligent machining. 3. Apply the concept of various sensing techniques in advanced manufacturing. 4. Comprehend the various computational techniques and platforms of advanced manufacturing 5. Perform design, planning and production scheduling of goods and services through digitally connected enterprise

Prerequisites: Manufacturing, Basics of sensors.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	3	3	2	1	2	2	3	2	2	3	3
CO-2	2	2	3	2	2	3	2	1	2	2	2	1	2	3
CO-3	3	3	2	1	1	2	2	2	1	3	1	2	2	2
CO-4	2	2	2	3	2	1	2	1	2	3	1	2	3	2
CO-5	3	2	3	2	3	2	2	2	2	1	2	1	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO ADVANCED MANUFACTURING ENTERPRISE (9L)	
Introduction to advanced manufacturing enterprise, an integrated enterprise, the transparency of product life cycle data, advanced manufacturing defined, advanced manufacturing: Levels of approach. Product life cycle, advanced manufacturing adoption, information sharing infrastructures, Product life cycle management (PLM), The industrial Internet of Things (IIOT) **Suggested Readings:** Challenges and opportunities in advanced manufacturing	**CO - 1** **BTL - 1**
MODULE 2: INTELLIGENT MACHINING (9L)	

Introduction to Intelligent machining, machining basics, the evolution, and components of intelligent machining. Manufacturing and manufacturing systems, Manufacturing trends and challenges, Manufacturing aspects, selection and classification, description and taxonomy of the mfg. Processes **Suggested Readings:** Applications and new trends in 3D manufacturing	**CO - 2** **BTL - 2**
MODULE 3: SENSORS AND SENSING TECHNIQUES (9L)	
Introduction to sensors- Study of various sensor required in a typical advanced manufacturing. Construction and principle of operation of various types of sensors. Microprocessor Technology: Signal conditioning and data acquisition, use of microprocessor or micro controllers and its configurations. Transforming data into information, Practical uses of machine learning **Suggested Readings:** Various modern sensors	**CO - 3** **BTL - 2**
MODULE 4: COMPUTATIONAL TECHNIQUES AND PLATFORMS (9L)	
Introduction to computational techniques and platforms. Sensitivity analysis, anomaly detection, the computational platform, HPC and cloud computing, Industry 4.0 Roadmap Determination of significant variables/factors, computing platform, components, categories and capabilities. Big data, data collection considerations, data storage and data processing, data collection, data storage and organization and data pre-processing. **Suggested Readings:** Traditional data sets versus Big data	**CO - 4** **BTL - 3**
MODULE 5: DIGITALLY CONNECTED ENTERPRISE (9L)	
Infrastructure performance of value chains, New manufacturing paradigms, data security: concerns and solutions, New business models originated from advanced manufacturing, Overview of data security concerns. Introduction to machining process control, adaptive control with optimization, machining force control, manufacturing process control: commonly used software. **Suggested Readings:** Traditional Vs Digital Manufacturing Roles in automobile industry	**CO - 5** **BTL - 3**
TEXT BOOKS	
1.	Bolton, W. "Mechatronics: electronic control systems in mechanical and electrical engineering". Pearson Education, 2003.
2.	Regtien, P. P. "Sensors for mechatronics", Elsevier, 2012.
REFERENCE BOOKS	
1.	Norton, R. L. "Cam design and manufacturing handbook". Industrial Press Inc. 2002.
2.	Pearson, R. S. G. P. H. "Microprocessor Architecture Programming and Applications with the 8085, Atilim University Library, 2002.
E RESOURCES FOR REFERENCE	
1.	https://link.springer.com/book/10.1007/978-3-319-56099-1
MOOC	
1.	https://nptel.ac.in/courses/112/107/112107078/
2.	https://www.coursera.org/learn/advanced-manufacturing-process-analysis?specialization=digital-manufacturing-design-technology
3.	https://www.coursera.org/learn/intelligent-machining?specialization=digital-manufacturing-design-technology
4.	https://www.coursera.org/learn/advanced-manufacturing-enterprise?specialization=digital-manufacturing-design-technology

COURSE TITLE	**ENGINEERING PROJECT MANAGEMENT - II**			**CREDITS**	**3**
COURSE CODE	**EMD51903**	**COURSE CATEGORY**	**H**	**L-T-P-S**	**3-0-0-2**

Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**End Semester Examination**
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	This course helps to explore project governance in theory and practice. Helps to learn the difference between risk and uncertainty and the role of risk register. Identifies the unique challenges of scope management in major projects and employ scope management tools and techniques that will facilitate your project planning.				
Course Objective	The course should enable the students to 1. Familiarize and discriminate about projects, programmes and portfolios 2. Determine the performance parameters of major engineering projects 3. Analyze the role of stakeholders in major projects 4. Study about the governance of major projects and its challenges 5. Appraise the concepts of strategic risk and scope management				
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the key characteristics of major engineering projects and the key phases of a project life cycle 2. Calculate the cost and time performance indicators of major projects 3. Analyze the importance of stakeholder and their management 4. Describe the importance of governance in project management 5. Evaluate the theory and practice of managing opportunities, risk and scope				
Prerequisites: Project Management, Basics on project ideas.					

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	3	2	2	3	3	2	1	2	2	3	2	2	3	3
CO-2	2	2	3	2	2	3	2	1	2	2	2	1	2	3
CO-3	3	3	2	1	1	2	2	2	1	3	1	2	2	2
CO-4	2	2	2	3	2	1	2	1	2	3	1	2	3	2
CO-5	3	2	3	2	3	2	2	2	2	1	2	1	3	3

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: PROJECT PERFORMANCE (9L)

Introduction - Projects, sub-projects and operations - Project life cycle theories - Project manager - Project management - Project management duties - Phases of the infrastructure life cycle. Transaction costs – Programmes and portfolio - Challenges of programme management. **Suggested Readings:** Case study: the Milan Expo Case study: The nuclear industry in the USA and South Korea Analysis: the South Korean nuclear industry Case study: project lifecycle through MS Project	**CO - 1** **BTL - 1**
MODULE 2: TIME AND COST ESTIMATION IN PROJECTS (9L)	
Cost and time performance of major projects - Other reasons to explain over-budget and delay. Major project - Types of risks are involved in major projects - Iron triangle - Error and inaccuracy in major projects: the example of infrastructure projects. Optimism bias - Reduce the impact of optimism bias - Strategic misinterpretation. Measure of success in major project management. Turner and Zolin framework **Suggested Readings:** Case study: Motorola Iridium Case study: the Tower of Pisa Case study: the Thames Barrier Case study: product cost estimation through MS Project	**CO - 2** **BTL - 2**
MODULE 3: PROJECT STAKEHOLDERS (9L)	
Introduction - Identifying stakeholders: public and industrial stakeholders - financial and other stakeholders - roles of stakeholders - Internal and external stakeholders - Stakeholder management theory RACI model. **Suggested Readings:** Case study :stakeholder management Stakeholder mapping Case study: The impact of stakeholder management in HS2 Case study: Establish and manage the project stakeholders list through MS Project	**CO-3** **BTL-3**
MODULE 4: PROJECT GOVERNANCE (9L)	
Governance - Governance of major projects - Governance vs management - Muller's four paradigms - Governance objectives and institutions - challenges to major project governance **Suggested Readings:** Developing critical analysis skills Case study: project team planner view through MS Project	**CO - 4** **BTL - 3**
MODULE 5: RISK AND MANAGEMENT SCOPE (9L)	
Features of risk management - strategic risk – uncertainty - Organizational involvement - risk registers - Socio-technical hexgaon introduction - risk appetite - utility theory. Scope management: internal and external projects - scope creep - gold plating - cost of scope change. Work Breakdown Structure – design. Buildings Information Modelling. **Suggested Readings:** Case study: Risk analysis in food safety Case study: user-controlled scheduling through MS Project	**CO - 5** **BTL - 3**
TEXT BOOKS	
1.	Nicholas, J. M., & Steyn, H. "Project management for engineering, business and technology". Routledge, 2020.
REFERENCE BOOKS	
1.	Goodman, L. J., & Ignacio, R. S. "Engineering project management: the IPQMS method and case histories". CRC Press, 2019.
E RESOURCES FOR REFERENCE	
1.	https://link.springer.com/book/10.1007/978-3-319-56099-1

MOOC	
1.	https://www.coursera.org/learn/major-engineering-project-performance?specialization=managing-major-engineering-projects
2.	https://www.coursera.org/learn/major-engineering-projects?specialization=managing-major-engineering-projects

SYLLABUS OF ALL COURSES UNDER MINORS

COURSE TITLE	DIGITAL MANUFACTURING			CREDITS	3
COURSE CODE	EMD51951	COURSE CATEGORY	MN	L-T-P-S	3-0-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME					
First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	This course will expose you to the transformation taking place, throughout the world, in the way that products are being designed and manufactured. The transformation is happening through digital manufacturing and design (DM&D) – a shift from paper-based processes to digital processes in the manufacturing industry.
Course Objective	1. Highlight the factors and trends motivating the transition from the current state of manufacturing to a DMD model. 2. Expose to learners on the multiple components that integrate to create a future manufacturing enterprise. 3. Study on different strategies and components affecting data storage in the enterprise. 4. Familiarizing the factors that influence the sharing of data both internally and externally. 5. Study on various digital tools to support the manufacturing operations.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the importance of manufacturing technology. 2. Recommend the importance of digital thread in manufacturing 3. Enumerate the different technologies in digital storage. 4. Comprehend the various technology implemented in digital thread. 5. Compare various manufacturing design and its types.

Prerequisites: Manufacturing , Basics of Data storage.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	3	2	2	3	3	2	1	2	2	3	2	2	3	3	
CO-2	2	2	3	2	2	3	2	1	2	2	2	1	2	3	
CO-3	3	3	2	1	1	2	2	2	1	3	1	2	2	2	
CO-4	2	2	2	3	2	1	2	1	2	3	1	2	3	2	

CO-5	3	2	3	2	3	2	2	2	2	1	2	1	3	3	

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO DIGITAL MANUFACTURING	**(9L)**
Digital Manufacturing and Design Impact on Manufacturing-Careers Advantages of Digital Manufacturing and Design Information-Sharing in the Digital Thread-Multiple Organizations in the Manufacturing Process Transition to Digital Manufacturing and Design Data Procurement Standards Manufacturing Supply Chains. **Suggested Readings:** Manufacturing settings and data collection	**CO-1** **BTL-1**
MODULE 2: INTRODUCTION TO DIGITAL THREAD	**(9L)**
Introduction to Digital Thread-The Vision of Digital Manufacturing and Design The Diffusion of Innovation Motivating-Factors Digital Thread Business-Systems Staying Relevant; Being a Player in DMD Diffusion of Innovation. **Suggested Readings:** Design of basic machine elements	**CO-2** **BTL-2**
MODULE 3: DATA STORAGE	**(9L)**
Introduction to Digital storage-Data Singularity Version-Control Data Security and Disaster Recovery Interoperability - Semantic Data Technical Data Packages- 4.0 Road map to Success. **Suggested Readings:** Best practices for Cyber security standards in data storage.	**CO-3** **BTL-2**
MODULE 4: IMPLEMENTATION OF DIGITAL THREAD	**(9L)**
Introduction Digital Thread: Implementation - A Business Case for the Digital Thread Transitioning to the Digital Thread Challenges and Benefits of Implementing the Digital Thread Computing Resource Virtualization Resources for Cloud-based Computing. **Suggested Readings:** Cyber infrastructure in digital thread	**CO-4** **BTL-3**
MODULE 5: DESIGN PROCESS	**(9L)**
Finite Element Analysis - Computational Fluid Dynamics - Mold Design - Additive Manufacturing - Digital Work Instructions - Digital Documents and Records - Digital Metrology Approaches. **Suggested Readings:** Digital Work Instructions , Drawings and Revision Control	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Zhou, Z., Xie, S., & Chen, D. (2012). *Fundamentals of digital manufacturing science*. London, UK:: Springer.
REFERENCE BOOKS	
1	Ian Gibson, I.G. (2015). *Additive manufacturing technologies 3D printing, rapid prototyping, and direct digital manufacturing*. London, UK:: Springer.
E BOOK	
1.	http://www.uou.ac.in/sites/default/files/slm/Introduction-cyber-security.pdf
MOOC	
1	https://www.coursera.org/learn/digital-manufacturing-design?specialization=digital-manufacturing-design-technology
2	https://www.coursera.org/learn/digital-thread-components?specialization=digital-manufacturing-design-technology
3	https://www.coursera.org/learn/digital-thread-implementation?specialization=digital-manufacturing-design-technology

COURSE TITLE	INTELLIGENT MACHINING			CREDITS	3
COURSE CODE	EMD51952	COURSE CATEGORY	M	L-T-P-S	3-0-0-2
Version	1.0	Approval Details	37th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	Manufacturers are increasingly utilizing machine tools that are self-aware, they perceive their own states and the state of the surrounding environment, and are able to make decisions related to machine activity processes. This is called intelligent machining, and through this course students will receive a primer on its background, tools and related terminology.
Course Objective	1. Study on data preparation and data analyze. 2. Awareness on advanced analysis in manufacturing processes. 3. Explore the integration of smart sensors and controls in manufacturing. 4. Study on open architecture systems in intelligent machining. 5. Comprehend various manufacturing management tools used in industry.
Course Outcome	Upon completion of this course, the students will be able to 1. Describe the concepts on advanced machining paradigm. 2. Comprehend the importance on intelligent machining. 3. Study on suitable process controls in manufacturing processes. 4. Analyze the challenges and opportunities of advanced manufacturing enterprise. 5. Evaluate the tools and techniques on product life-cycle in manufacturing

Prerequisites: Manufacturing, Basics of Data storage.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	3	3	2	1	2	2	3	2	2	3	3	-
CO-2	2	2	3	2	2	3	2	1	2	2	2	1	2	3	-
CO-3	3	3	2	1	1	2	2	2	1	3	1	2	2	2	-
CO-4	2	2	2	3	2	1	2	1	2	3	1	2	3	2	-
CO-5	3	2	3	2	3	2	2	2	2	1	2	1	3	3	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO ADVANCED MANUFACTURING PROCESS (9L)

Data Analysis Process Data Collection in Different Manufacturing Settings - DMD Dialogue Discrete Part Manufacturing DMD Dialogue - Continuous Manufacturing Data - Collection Considerations - Anomaly Detection - Computational Platform HPC and Cloud Computing High Performance and Cloud Computing. **Suggested Readings:** Manufacturing Settings And Data Collection	**CO-1** **BTL-1**
MODULE 2: INTRODUCTION TO INTELLIGENT MACHINING (9L)	
Machining Basics - Evolution of Intelligent Machining Components of Intelligent Machining - Signal Processing - Transforming Data into Information Practical - Uses of Machine Learning **Suggested Readings:** Machining process through machine learning	**CO-2** **BTL-2**
MODULE 3: PROCESS CONTROL (9L)	
Programmable logic control - Closed Loop Process Control Systems - Introduction to Adaptive Control - Commercially Available Software - Machining Force Control. **Suggested Readings:** Manufacturing Process Control: Commonly Used Software	**CO-3** **BTL-2**
MODULE 4: ADVANCED MANUFACTURING ENTERPRISE (9L)	
Introduction to advanced manufacturing enterprise - Integrated Enterprise - Transparency of Product Life Cycle - Data Advanced Manufacturing: Levels of Approach Resilient and Adaptable Enterprise - Four Levels of Approach - New Manufacturing Paradigms. **Suggested Readings:** Advanced Manufacturing approaches	**CO-4** **BTL-3**
MODULE 5: PRODUCT LIFE CYCLE (9L)	
Introduction to product life cycle - Challenges and Opportunities In Advanced Manufacturing - Adoption Product Life cycle Management (PLM) - System Manufacturing Process - Management Manufacturing Execution Systems - Enterprise Resource Planning (ERP) - Performance of Value Chains. **Suggested Readings:** Overview of Data Security Concerns in product life cycle.	**CO-5** **BTL-3**
TEXT BOOKS	
1.	Özel, T., & Davim, J. P. (Eds.). (2009). *Intelligent Machining: Modeling and Optimization of the Machining Processes and Systems*. ISTE.
REFERENCE BOOKS	
1	Bonvillian, W. B., & Singer, P. L. (2018). *Advanced Manufacturing: The New American Innovation Policies*. MIT Press.
E BOOK	
1.	https://link.springer.com/book/10.1007/978-3-319-56099-1
MOOC	
1	https://www.coursera.org/learn/advanced-manufacturing-process-analysis?specialization=digital-manufacturing-design-technology
2	https://www.coursera.org/learn/intelligent-machining?specialization=digital-manufacturing-design-technology
3	https://www.coursera.org/learn/advanced-manufacturing-enterprise?specialization=digital-manufacturing-design-technology

COURSE TITLE	**MECHATRONIC SYSTEMS DESIGN**			**CREDITS**	**3**
COURSE CODE	**EMD51953**	**COURSE CATEGORY**	**M**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This course is geared towards developing skills of candidates towards conceiving new mechatronics products based on raw ideas and develop them. The course focuses on hands-on experience along with a project and offers a lot of practical tips to make theory work in practice. Furthermore, the course catalyzes integrated thinking in mechanical and electronics domain, which is crucial to successful product design and development.
Course Objective	1. Study on mechatronics system and system modelling 2. Highlight the importance of controller in system integration 3. Familiarize the mathematical modelling in dynamic system. 4. Study on stability analysis in mechatronic system 5. Comprehend the implementation of dynamic control system
Course Outcome	Upon completion of this course, the students will be able to 1. Compare traditional and mechatronics system 2. Recommend appropriate controllers for electro mechanical systems 3. Describe the dynamics and control in mechatronics system 4. Analyze the stability, control and dynamics of an linear systems 5. Evaluate the concept signal processing for specific measurement applications.

Prerequisites: Knowledge in sensors and hardware.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	2	3	3	2	1	2	2	3	2	2	3	3	-
CO-2	2	2	3	2	2	3	2	1	2	2	2	1	2	3	-
CO-3	3	3	2	1	1	2	2	2	1	3	1	2	2	2	-
CO-4	2	2	2	3	2	1	2	1	2	3	1	2	3	2	-
CO-5	3	2	3	2	3	2	2	2	2	1	2	1	3	3	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO ELEMENTS OF MECHATRONICS SYSTEM (9L)

Introduction: Elements of mechatronics system: Sensor, actuator, plant, and controller. Applications of mechatronics system. Integrated mechanical-electronics design philosophy. Examples of real life systems. Smart sensor concept and utility of compliant mechanisms in mechatronics. **Suggested Readings:** Study of Systems like CDROM, scanner Study of open and closed loop systems	**CO-1** **BTL-1**

MODULE 2: CONTROLLERS (9L)	
Microprocessor building blocks, combinational and sequential logic elements, memory, timing and instruction execution fundamentals with example of primitive microprocessor. Microcontrollers for mechatronics: Philosophy of programming interfaces, setting sampling time, and getting started with TIVA programming. Microcontroller programming philosophy emphasis on TIVA, programming different interfaces PWM, QEI etc. Mathematical modeling of mechatronic systems **Suggested Readings:** Study of embedded systems role in mechatronics Study of interfacing programs with microcontrollers	**CO-2** **BTL-2**
MODULE 3: SYSTEM DYNAMICS (9L)	
Modeling friction, DC motor, Lagrange formulation for system dynamics. Dynamics of 2R manipulator, Simulation using MATLAB, Selection of sensors and actuators. Concept of feedback and closed loop control, mathematical representations of systems and control design in linear domain **Suggested Readings:** Study of mathematical modelling of system. Study of linear system control.	**CO-3** **BTL-2**
MODULE 4: DYNAMICS ANALYSIS (9L)	
Basics of Lyapunov theory for nonlinear control, notions of stability, Lyapunov theorems and their application. Trajectory tracking control development based on Lyapunov theory. **Suggested Readings:** Study of nonlinear systems control Study of stability issues in systems	**CO-4** **BTL-3**
MODULE 5: IMPLEMENTATION (9L)	
Basics of sampling of a signal, and signal processing. Digital systems and filters for practical mechatronic system implementation. **Suggested Readings:** Research example/ case studies of development of novel mechatronics system Study of 3D micro-printer, Hele Shaw system for microfabrication.	**CO-5** **BTL-3**

TEXT BOOKS	
1.	Shetty, D., & Kolk, R. A. (2010). *Mechatronics system design*. Cengage Learning.
2.	Janschek, K. (2011). *Mechatronic systems design: methods, models, concepts*. Springer Science & Business Media.
REFERENCE BOOKS	
1.	Bolton, W. (2003). *Mechatronics: electronic control systems in mechanical and electrical engineering*. Pearson Education.
2.	Cetinkunt, S. (2015). *Mechatronics with experiments*. John Wiley & Sons.
E BOOKS	
1.	https://www.intechopen.com/books/5715
2.	https://www.google.co.in/books/edition/Mechatronics_in_Engineering_Design_and _P/632Gy64SP4MC?hl=en&gbpv=0
MOOC	
1	https://onlinecourses.nptel.ac.in/noc21_me129/preview

MANDATORY COURSES I

COURSE TITLE	INTRODUCTION TO WOMEN AND GENDER STUDIES			CREDITS	Non Credit Course
COURSE CODE	GGE51011	COURSE CATEGORY	MC	L-T-P-S	3--0-0-2
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-3

ASSESSMENT SCHEME

CIA					ESE
First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""	Attendance	
15%	15%	10%	5%	5%	50%

Course Description	This course has been introduced in the light of NEP-2022. It is a mandatory course. The idea is to sensitize the student in understanding gender and women and issues relating to gender in general and women in particular. To dispel 'stigma' shun 'social taboos' and to ensure break the glass ceiling. Change in perceptions through knowledge is the object of this course.
Course Objective	1. To understand the concept of Gender – norms- theories – types etc. 2. To know about Feminism – and the types – jurisprudence of feminism. 3. To have an insight into health and legal issues- specific to women – Social barriers. 4. To make the students – gender sensitized- to shun 'stigma' and 'social taboos'
Course Outcome	Upon completion of this course, the students will be able to 1. enumerate the basis of gender norms and related theories. 2. sensitize on issues relating to gender -orientation- issues therein. 3. appraise the concept of feminism – as a doctrine. 4. classify the types of feminism and highlight the essential features of them 5. summarise women related laws and connect to women centric issues in societal arena

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-2	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-3	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-4	-	-	-	-	-	-	2	3	2	2	-	1	-	-
CO-5	-	-	-	-	-	-	2	3	2	2	-	1	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

Module 1: Basis of Gender norms and theories	**(9L)**
Key concepts in Gender studies - Gender and Sexuality, Sex and Gender, Gender and Socialist theory, Gender and Social order Matriarchy and Patriarchy - Women's Movements – Contemporary Debates- "*Mee Too'* - National Commission for Women.	**CO-1 BTL-3**

MODULE 2: Types of gender	(9L)
Types of gender – 1. Masculine, 2, Feminine, 3, Transgender, 4, Trans-Sexuality, 5, Bi-Sexuality, 6. Inter Sex	**CO-2 BTL-3**
MODULE 3: Sexual Orientation	**(9L)**
Hetro-Sexuality, Homosexuals , 1, Lesbian and their "ism" , 2, Gays and their "Theory", Trans Sexulism , BI - Sexualism	**CO-3 BTL-3**
MODULE 4: Introduction to Feminism	**(9L)**
Feminism Theory, Types of Feminism (More than 12 feminisms) , 1, Social Feminism 2,Radical Feminism , 3, Black Feminism , 4, Dalit Feminism , 5, Queer Theory -	**CO-4 BTL-3**
MODULE 5: Women, Health and Law	**(9L)**
Health – Life Cycle Approach- Health Status – Reproductive Rights-Sex Ratio - Women have always Glass Ceiling, Women Rights as Human Rights- Constitution and Women – Gender Equality – Discrimination- Personal Laws- Family Courts – Crime Against Women-Children-Sexual Harassment at Work Place Act-2013. Human Trafficking - Women as secondary to men in social context / order, Women centric issues in Societal arena	**CO-5** BTL-3

TEXT BOOKS	
1.	Mamatha Rao – 'Law Relating to Women and Child'- EBC Publishers, Lucknow
2.	'Feminist Jurisprudence'- Rosanne Kennedy, 1993
3.	Sexual Harassment and Violence against Women- Charles V. Dale
4.	Sexual Harassment of Working Women- Catharine Mackon
References	
1	Feminist Legal Theory- Rosanne Kennedy, 1993
2	Sexual Harassment of Women at Workplace- R.C. Jiloha, 2021
3	Human Trafficking- Virendra Mishra, 2013
E Resources	
1.	Theory of Feminism- https://en.wikipedia.org/wiki/Feminism
2.	Sexual Harassment of Women at Workplace- https://www.legalservicesindia.com/article/2114/Sexual-Harassment-of-Women-at-Workplace.html
3.	Human Trafficking- https://www.unodc.org/unodc/en/human-trafficking/human-trafficking.html

COURSE TITLE		**PUBLIC AND PERSONAL ADMINISTRATION**			**CREDITS**	**Non Credit Course**
COURSE CODE		**GGE51012**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**		**36th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME						

First Periodical Assessment	Second Periodical Assessment	Seminar/Assignments/Project	Surprise Test / Quiz etc.,	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	Public Administration has gained immense importance since the emergence of the administrative state. In Ancient Greek, Roman and Indian political system gave more importance to the concept of Administration. Kautilys's "Arthasathra" contributed large scale in the administrative system; it deals every aspect of the state and its relation to subjects. Public Administration is state mechanism. In every Political System, administration have a significant role.
Course Objective	● To understand the concept and importance of Public Administration. ● To analyze the Bases and types of Organization. ● To examine the types and functions of executive. ● To identify the Principles of Management. ● To evaluate the control over Public Administration.
Course Outcome	Upon completion of this course, the students will be able to 1. acquire knowledge of public administration. 2. summarize the administrative principles of management. 3. Review the salient features of different theories of administration. 4. Enumerate the roles and responsibilities of District administration and Panchayati raj 5. Identify the societal needs and recommend the strategies for administration of public financial funds.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	-	-	1	-	-	3	1	1	1	1	2	-			
CO-2	2	2	-	-	-	3	-	1	1	1	2	2			
CO-3	-	-	-	-	-	3	1	2	1	1	2	-			
CO-4	-	-	-	-	-	3	2	3	2	2	2	2			
CO-5	2	2	3	-	-	3	2	3	2	2	2	2			

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Components of Public Administration	**9 Hours**
Meaning, Nature and Scope of Public Administration – Public Administration and Private Administration–Public Administration Arts, Science or Both–Public Administration and Its Relations with Other Social Sciences – New Public Administration- Classical & Neo-Classical Theories of Administration.	**CO-1** **BTL-2**
MODULE 2: Principles of Organization	**9 Hours**
Meaning, Nature, Scope and Importance of Organization-Types and kinds of organization - Bases of organization – Steps in Organizational Process- Principles of Organization – Hierarchy- Span of control – Unity of Command – Delegation of Authority – Co-Ordination- Integration Vs. Disintegration – Centralization Vs. Decentralization.	**CO-2** **BTL-2**
MODULE 3: Theories Of Administration	**9 Hours**
Scientific management (Taylor and movement)- Classical theory- Fayol,Urwick and others- Bureaucratic theory- Max Weber- Ideas of Mary Parker Follett- C.I. Barnard- Behavioural Approach - Systems Approach	**CO-3** **BTL-3**
MODULE 4: District Administration And Panchayati Raj	**9 Hours**
District Administration- Block Administration- Constitutional Body under 73rd and 74th Constitutional Amendment- Planning and Development- Rural and Urban	**CO-4** **BTL-3**
MODULE 5: Financial Administration	**9 Hours**

Budget concept and forms - Formulation - Enactment of Budget - Execution of Budget - Deficit Financing- Public Debt	**CO-5** **BTL-3**

TEXTBOOKS	
1	Avasthi, A. and Maheswari, S.R.- Public Administration, Laxshmi Narain Publications, 2017.
2	Dr.G. Venkatesan, Public Administration, VC Publishers, Rajapalayam,2009.
3	Mohit Bahattacharya, New Horizons of Public Administration, Macmillan Publishers, 2002
REFERENCE BOOKS	
1	Shriram Maheswari, Administrative Theory: An Introduction, New Delhi, Macmillan India Ltd.,1984.
2	Vishnoo Bhagwan and – Public Administration, Chand & co., New Delhi1994
3	Bhambhri, C.P – Public administration – Theory and Practice, Jain Prakash, Nath&co., Meerut, 2002.
E BOOKS	
1	Sapru, Administrative Theories and Management Thought, Prentice Hall of India, New Delhi, 2005.
2	Sharma. M. P.: Public Administration in theory and practice, Kithab Mahal, Allahabad ,2006.

COURSE TITLE	**CONSTITUTION OF INDIA**			**CREDITS**	**Non Credit**
COURSE CODE	**GGE51013**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	The very purpose of the course is to learn basic law of the land- to know about constitutional values- to carry our constitutional legacy and to imbibe constitutional discipline. To make the student as an informed citizen about his rights and duties expecting a vibrant role in democratic polity of the nation.
Course Objective	1. To understand the Constitution and Governance of our country. 2. To inspire the students towards -Constitutionalism and its core values 3. To imbibe the values cherished in our Constitution.
Course Outcome	Upon completion of this course, the students will be able to 1. summarize the basic notions on which the Indian Constitution is based. 2. appraise the functioning of democracy and related systems in place. 3. classify the center and state relations and various Constitutional forums. 4. identify and discuss upon Governor's rule and related amendments 5. interpret Indian Polity and its challenges for modern India

CO, PO AND PSO MAPPING

CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

Module 1: Indian Constitution and Governance **(9L)**

Constitution – salient features, Preamble, - Core values – Democratic - Secular, Socialist, Republic, Sovereign, - Basic structure – Constitutional Morality – Federal Features – Fundamental Rights – Fundamental duties	**CO-1 BTL-3**
MODULE 2: Democracy – in functioning	**(9L)**
Democracy- Elections - Union Government- State Governments - Systems in place – Legislative- Executive- Judiciary- Constitutional Bodies: Election Commission – UPSC- Controller and Auditor General of India.	**CO-2 BTL-3**
MODULE 3: Center -State Relations	**(9L)**
Legislative powers of the Central Government – State Government – Center-State Relations – Roll of Governor - Niti Ayog – National Integration Council	**CO-3 BTL-3**
MODULE 4: Emergency – and Amendments	**(9L)**
Governors Rule – National Emergency – Financial Emergency- Constitutional Amendments – 42nd Amendment - Procedures- Number of Amendments	**CO-4 BTL-3**
MODULE 5: Indian Polity	**(9L)**
Roll of the Civil Society –Roll of the Youth - – Major Challenges before the nation - Political parties – Programs- in the Country – Indian polity at cross roads.	**CO-5** BTL-3

TEXT BOOKS	
1.	M.P. Jain *Indian Constitutional Law*, Wadhwa & Co. 2005
2.	'Indian Parliament' –National Book Trust of India publications – New Delhi , 2007
3.	'Indian Judiciary'- National Book Trust of India publication., 2013
REFERENCES	
1	Constitution of India – visit Union Ministry of Law and Justice website – for latest text.
2	Lectures on Administrative Law – C.K. Takwani, 2021
3	Separation of Powers and Independence of Judiciary- Steve Cann, 2013.
E Resources for Reference	
1.	Constitution of India- Administrative & Adjudicatory process- https://www.strath.ac.uk/research/subjects/law/constitutionaladministrativelaw/
2.	Lectures on Administrative Law- http://msrlawbooks.in/file/ADMINISTRATIVE_LAW_FF.pdf
3.	Separation of powers & Independence of Judiciary- https://blog.ipleaders.in/separation-of-powers-and-its-relevance/

COURSE TITLE	**LAW FOR ENGINEERS**			**CREDITS**	**Non Credit**
COURSE CODE	**EGE51006**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessme	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the**	**Attendance**	

nt			Department Examination Committee "DEC""		
15%	15%	10%	5%	5%	50%

Course Description	Every one of us should know the Law of the land. This is truer when it comes to engineers, wherein they are expected to work in a legal environment. Basic knowledge about the legal systems, the redressal mechanism in place. Legal knowledge will help them to start their own enterprise/startup/and also when it comes to IPR relate issues.
Course Objective	1. To understand the Constitution and Governance of our country. 2. To apprise the students of their rights - local to national redressal mechanism. 3. To have an insight into general laws in general, labour and employment law in particular. 4. To familiarize with intellectual property laws and practices.
Course Outcome	Upon completion of this course, the students will be able to 1. Classify the basic concepts of Indian Constitution, Governance and the role of citizens. 2. acquire knowledge in significant legislations that affect their lives. 3. enumerate the laws that governs corporate and business world along with legislations that govern management – worker relations. 4. relate to Intellectual Property Rights and related aspects.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

Module 1: Indian Constitution and Governance	**(9L)**
Constitution – salient features, Preamble, - Fundamental Rights and duties. Democracy- Elections Union Government- State Governments – Systems in place - Judiciary- the Supreme Court and High Courts, Good Governance.	**CO-1 BTL-3**
MODULE 2: Significant Legislations	**(9L)**
Consumer Protection Act -2019; Right to information Act 2005. Provident Fund Act – ESI – Employment (Standing Orders) Act 1946 **Maternity Benefit Act-2017, Labor Codes- Courts**	**CO-2 BTL-3**
MODULE 3: Industrial, Corporate and Labour laws	**(9L)**
Business Laws in general – Partnership Act - Companies Act – 2013- Private and Public Limited Companies, LLP, OPC, Corporate Governance – Directors position.	**CO-3 BTL-3**
MODULE 4: Laws related to IPR	**(9L)**
Introduction to IPR – meaning and scope, Patents- Copy Right – Trade Marks – Industrial Design- GI – Trade Secrets – WIPO.	**CO-4 BTL-3**
MODULE 5: Law of Contracts	**(9L)**
Essentials of a Contract – Enforceability. Various Legal forums that provide relief in various matters.	**CO-5** BTL-3
TEXT BOOKS	

1.	M.P. Jain (2005) *Indian Constitutional Law*, Wadhwa & Co.
2.	Rao, Meena (2006), *Fundamental Concepts in Law of Contract*, 3rd edn., Professional offset.
3.	Ramappa (2010), *Intellectual Property Rights Law in India*, Asia Law House.
4.	Singh, Avtar (2007), *Company Law*, Eastern Book Co.
5.	R.F, Rustamji (1967), *Introduction to the Law of Industrial Disputes*, Asia Publishing House.
REFERENCES	
1	Acts: Right to Information Act, Industrial Employees (standing order) Act, Factories Act, Workmen Compensate Act. Maternity Benefit Act – Provident Fund Act – ESI Act – etc.
2	R.F, Rustamji (1967), *Introduction to the Law of Industrial Disputes*, Asia Publishing House.
3	Copyrights Act,1957, Trademarks Act 1999.
E Resources for Reference	
1.	Intellectual Property rights and Competition Law- https://en.wikipedia.org/wiki/Intellectual_property
2.	Patent search for engineers and Lawyers - https://www.wipo.int/patents/en/

COURSE TITLE	**INDIAN KNOWLEDGE SYSTEM (IKS)**			**CREDITS**	**Non Credit**
COURSE CODE	**GGE51015**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL - 2**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	The course provides an appreciation of Indian Knowledge System and its relevance to contemporary society. Indian Knowledge System encompass a wide range of ancient wisdom, including traditional medicine, astrology, yoga, meditation, and more. These systems have been passed down through generations and have played a significant role in shaping India's history and culture.				
Course Objective	To provide a general introduction to Indian Knowledge System (IKS) and sensitize the students to the contributions made by ancient Indians in the field of Science, Philosophy and related applications and concepts.				
Course Outcome	Upon completion of this course, the students will be able to ● Explain the salient features of Indian Knowledge System and Vedic Corpus ● Summarize the concepts of Philosophical systems and wisdom through puranas ● Describe the Indian Knowledge Framework and Linguistics ● Brief on ancient strategies to focus on Health, Wellness and Psychology ● Appreciate Town Planning and Architecture, Governance and Public Administration				
CO, PO AND PSO MAPPING					

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Indian Knowledge Systems and Vedic Corpus	**(9L)**
India Knowledge Systems – Organization, History and Salient features – synopsis of the four Vedas - Sub-classification of Vedas - Messages in Vedas - Introduction to Vedangas - Prologue on Siksa and Vyakarana - Basics of Nirukta and Chandas - Introduction to Kalpa and Jyotiṣa - Vedic Life: A Distinctive Feature	**CO-1 BTL-2**
MODULE 2: Philosophical Systems and Wisdom	**(9L)**
Philosophical systems - Development of philosophy - Features of philosophy - Sankhya approach of philosophy - Introduction to Yoga - Tenet of Nyaya philosophy - Principles of Vaiseṣika - Doctrine of Purva Mimamsa Darsana - Thesis of Vedanta and synopsis of Advaita - Philosophy of Visistadvaita - Ideology of Dvaita - Tenets of Jaina - Doctrine of Buddhism - Notions of Carvaka Gateways of ancestral wisdoms - Introduction to Purana - The Puranic repository - Issues of interest in Puranas - Introduction to Itihasas - Key messages in Itihasas - Wisdom through Niti-sastras 8. Wisdom through Subhaṣita	**CO-2 BTL-2**
MODULE 3: Knowledge Framework and classifications, Linguistics	**(9L)**
Indian scheme of knowledge - The knowledge triangle – Prameya - A vaiseṣikan approach to physical reality - Dravyas - the constituents of the physical reality – Attributes - the properties of substances and Action - the driver of conjunction and disjunction - Samanya, viseṣa, samavaya - Pramana -the means of valid knowledge - Saṃsaya - ambiguities in existing knowledge - Framework for establishing valid knowledge - Deductive or inductive logic framework - Potential fallacies in the reasoning process - Siddhanta: established tenets in a field of study Linguistics - Aṣṭadhyayi - Phonetics - Word generation - Computational aspects – Mnemonics - Recursive operations - Rule based operations - Sentence formation -Verbs and prefixes - Role of Sanskrit in natural language processing	**CO-3 BTL-2**
MODULE 4: Number Systems, Health Wellness and Psychology	**(9L)**
Number systems in India - Historical evidence - Salient aspects of Indian Mathematics - Bhuta-Samkhya system - Kaṭapayadi system - Measurements for time, distance, and weight - Pingala and the Binary system Ayurveda: approach to health - Sapta-dhatavaḥ: seven-tissues - Role of Agni in health - Tri-dosas - Ayurveda: definition of health - Psychological aspects of health - Disease management elements - Dinacarya: daily regimen for health & wellness - Importance of sleep - Food intake methods and drugs - Approach to lead a healthy life - Indian approach to psychology - The tri guṇa system & holistic picture of the individual - The Nature of Consciousness - Consciousness studies and issues	**CO-4 BTL-2**
MODULE 5: Town Planning and Architecture, Governance and Public Administration	**(9L)**
Perspective of Arthasastra on town planning - Vastu-sastra - The science of architecture - Eight limbs of Vaastu - Town planning -Temples in India: marvelous stone architecture for eternity - Temple architecture in India - Iconography Introduction to raja dharma - Arthasastra: a historical perspective - Elements of a kauṭilyan state	**CO-5 BTL-2**

- The king & the amatya - Janapada & durga - Treasury and the State Economy (Kosa) - Danda 8. Mitra - The Administrative Setup - Relevance of Arthasastra - Public Administration in Epics	

REFERENCE BOOKS	
1	"Introduction to Indian Knowledge System: Concepts and Applications", Mahadevan B., Bhat Vinayak Rajat, Nagendra Pavana R.N., PHI Learning Private Ltd., 2022.
MOOC Source	
1.	https://onlinecourses.swayam2.ac.in/imb23_mg55/preview

MANDATORY COURSES II

COURSE TITLE	**TRADITIONAL INDIAN SYSTEMS OF MEDICINE AND THERAPIES**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51021**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL – 2**

ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance**	**End Semester Exam**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This comprehensive course aims to provide students with a deep understanding of various aspects of health and well-being while incorporating traditional healing systems like Ayurveda and Siddha medicine. Participants will explore the importance of maintaining physical, mental, emotional, social, and spiritual health for overall well-being.
Course Objective	1. Understand the importance of maintaining various aspects of health for overall well-being. 2. Explore the unique approach of Ayurveda and its focus on balance and well-being 3. Understand the principles and concepts of Siddha medicine. 4. Understand the importance of a balanced diet in maintaining overall health and preventing diseases. 5. Learn and practice various yogic exercises and postures (Asanas) for physical fitness.
Course Outcome	1. To identify and prioritize different aspects of health such as physical, mental, social, emotional, etc. 2. To apply Ayurvedic concepts to enhance their well-being and make informed decisions for better health. 3. To explain the underlying philosophy and the use of natural remedies in Siddha medicine for maintaining health and treating various ailments 4. To comprehend the significance of a balanced diet in providing essential nutrients for growth, repair, and overall health. 5. To gain practical experience in performing various yogic exercises and asanas

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	1	-	-	-	-	2	1	-	1	-	1	-			
CO-2	2	1	-	-	-	2	1	-	1	-	1	-			
CO-3	2	2	-	-	-	2	1	-	1	-	2	-			
CO-4	1	1	-	2	1	2	2	2	1	-	2	-			

CO-5	3	1	-	3	1	2	2	2	1	-	2	-			

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Health and Importance of Prevention	**9 Hours**
Health: Definition - Importance of maintaining health - More importance on prevention than treatment. Ten types of health one has to maintain - Physical health - Mental health - Social health - Financial health - Emotional health - Spiritual health - Intellectual health - Relationship health - Environmental health - Occupational / Professional heath. Present health status - The life expectancy - present status - mortality rate - dreadful diseases - non-communicable diseases (NCDs) the leading cause of death - 60% - heart disease – cancer - diabetes - chronic pulmonary diseases - risk factors - tobacco - alcohol - unhealthy diet - lack of physical activities.	**CO 1** **BTL 1**
MODULE 2: Ayurveda and Holistic Wellness	**9 Hours**
Origin of Ayurveda - Aim and importance of Ayurveda, Philosophy and goals of Ayurveda, Unique Approach of Ayurveda - Ayurveda texts, chakra samhita, Sushruta Samhita, Kashyapa Samhita, Rasatantra, Unique features of Ayurveda - Hygienic principles of Ayurveda (Dhinacharya) - Five elements of Ayurveda Doshas, Gunas, Dhatus, Upahatus, Eight Categories or branches of treatment - Nadisvijnana - Nadis and Chakras, - Characteristics of different prakritis - Ayurveda diet.Ayurveda effects of yogic principles & therapies - Ayurvedic purification practices - Panchakarma - vamanam, virechanam, basti, Anuvasana, Nasya, RaktaMoksana - Abhyanga, Swedanam, Nasayam, Njavarakizhi, Pizhichil.	**CO 2** **BTL 1**
MODULE 3: Siddha Medicine and Naturopathy	**9 Hours**
History and concepts of Siddha medicine: Principles of Siddha Medicine System, Five Elements Theory, Three Biological Humars, Seven Physical Constituents, Pancha Bhudas, Pancha Koshas, Types of Siddha Medicine, Importance of Karakalpak, Kitchen and herbal medicine, Diet Regulations, Varmam and Thokkanam, Treatment of Siddha Medicine for lifestyle diseases.Concept of Naturopathy, Principles of Naturopathy, Methods of Naturopathy: Diet, Fasting, Treatment by earth, water treatment, Treatment by rays, Massage.Acupuncture, Acupressure, Exercise therapy, Physiotherapy, Music therapy, Color therapy, Magneto Therapy, Reiki.	**CO 3** **BTL 1**
MODULE 4: Role of Diet, Emotional Health, and Stress Management	**9 Hours**
Role of diet in maintaining health - energy one needs to keep active throughout the day -nutrients one needs for growth and repair - helps one to stay strong and healthy - helps to prevent diet-related illness, such as some cancers - keeps active and - helps one to maintain a healthy weight - helps to reduce risk of developing lifestyle disorders like diabetes - arthritis - hypertension - PCOD - infertility - ADHD - sleeplessness - helps to reduce the risk of heart diseases – keeps the teeth and bones strong. Balanced Diet Stress management - Stress definition - Stress in daily life – How stress affects one's life - Identifying the cause of stress - Symptoms of stress -Managing stress (habits, tools, training, professional help) – Complications of stress mismanagement. Sleep - Sleep and its importance for mental wellness-Sleep and digestion. Immunity- Types and importance – Ways to develop immunity	**CO 4** **BTL 1**
MODULE 5: Yogic Practices for Physical and Mental Well-being	**9 Hours**
Essentials of Yogic Practices: Emptying the bowels and stomach counter pose, contra-indications,duration, straining, special provisions for women and patients, fitness, posture, side effects,pregnancy women, Group yoga, Individual yoga.Loosening Exercise (Pawana muktasana series 2) and Surya Namaskar (Surya Namaskar: for children 10 Steps, Vivekananda Kendra Model) - Meaning, Definition, Guidelines, Procedure, Breathing technique, Awareness, Contra-indication, and Benefits.Asana: Name, Meaning, Definition, Guidelines, Procedure, Breathing technique, Awareness, Contra-indication, Benefits, Type and Category of each asana. Pranayama and Kriyas: Name, Meaning, Definition, Guidelines, Procedure, Breathing technique, Awareness, Contra-indication, Benefits, Type and Category of each one..Bandhas: Mudras:.Meditation: Rajayoga meditation, Trataka Meditation, Soham Meditation, Walking Meditation.	**CO 5** **BTL 1**

Skill Development Activities:	
TEXT BOOKS	
1	Kumar, D. S. (Ed.). (2020). Ayurveda in the New Millennium: Emerging Roles and Future Challenges. CRC Press.
REFERENCE BOOKS	
1	Balakrishnan Acharya(2006) Ayurveda its principles and philophies, Hardwar, Divya Prakashan.
2	AtharaleV.B.(1980) basic principles of Ayurveda, Bombay, Pediatric Clinics.
E-BOOKS / MAGAZINE / ARTICLES	
1	Micozzi, M. S. (2014). *Fundamentals of complementary and alternative medicine-E-book*. Elsevier Health Sciences.
2	Chaudhry, B. (2019). *A handbook of common medicinal plants used in Ayurveda*. Kojo Press.
ONLINE RESOURCES	
1.	https://cdn.ayush.gov.in/wp-content/uploads/2021/06/Introduction.pdf
2.	https://www.ism.kerala.gov.in/index.php/downloadss/iec-materials

COURSE TITLE	**HISTORY OF SCIENCE AND TECHNOLOGY IN INDIA**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51022**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36TH ACM**	**LEARNING LEVEL**	**BTL - 2**
ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	This course covers the richness of ancient India and their notable contributions in the field of Science and Technology. Details on the living styles of ancient Indians and their application of science and technology in day-to-day life is briefed. Covers the notable contributions of eminent Indian scientists and their contributions to the field of Science and Technology in building a modern India.				
Course Objective	• This course aims to educate upon the notable contributions of ancient indian scientists to the field of Science and Technology • This course details the contributions made by eminent Indian scientists in the various fields of Science and Technology.				

Course Outcome	Upon completion of this course, the students will be able to 1. summarize the notable contributions in ancient India in the field of Science and Technology 2. explain the different techniques adapted by ancient Indians in the field of Irrigation, Water resources and Ship Building 3. appreciate the noteworthy contributions of Indians in the field of Mathematics and Science 4. describe the role of Indians in the field of Biotechnology, Space technology and Nanotechnology 5. report on the prominent scientists of India and present a survey on their noteworthy contributions to the world.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-2	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-3	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-4	-	-	-	-	-	2	2	2	2	1	-	1	-	-
CO-5	-	-	-	-	-	2	2	2	2	1	-	1	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Contributions made by Ancient Indians to the world of Science and Technology	**(9L)**
Ancient India's contribution to science and technology – Mathematics – Sulvashutra - Ganita– Medicine - Atharva Veda - Charak Samhita - Sushruta Samhita – Chemistry - iron pillar of Mehrauli – Nagarjuna – Ras Ratnakar - Wootz Steel – Smelting of Zinc – Seamless metal globe – Physics – Kanad – Anu – Pancha Bhootas – Vikramaditya – Medicine - Plastic Surgery, *Sushruta Samhita – Cataract Surgery*, Jabamukhi Salaka – Ayurveda, Charaka Samhita	**CO-1 BTL-2**
MODULE 2: Irrigation, water resources and Ship Building	**(9L)**
20 traditional water conservation systems of India - 7 Ways Indian Villages Adopted Water Management to Combat Drought - Ship building - Mukti Kalptaru – Sarvamandir – Madhyamandir – Agramandir	**CO-2 BTL-2**
MODULE 3: Mathematics and Science	**(9L)**
Idea of Zero, Aryabhata – The Decimal System – Numerical Notations and numerals– Fibonacci numbers, Pingala, Virahanka, Gopala and Hemacandra – Binary Numbers - Chhanda Shastra, Chakravala method of Algorithms – Ruler Methods – Heliocentric Theory, Aryabhatiya , quantum physics in *Vaisheshika* Atomic theory	**CO-3 BTL-2**
MODULE 4: Biotechnology, Defence Technology and Nanotechnology	**(9L)**
Biotechnology, Genome sequencing initiatives by India, DNA technology regulation Bill – Space Technology, GAGANYAN, Seven Mega Missions by ISRO, Nuclear Technology, India's three stage Nuclear Programme, India's Nuclear Policy – Defence Technology, Vikrant, Vikramaditya – Nano Technology, India's Mission on Nano Science and Technology -	**CO-4 BTL-2**
MODULE 5: CONTRIBUTIONS OF INDIANS IN SCIENCE AND TECHNOLOGY	**(9L)**

JC Bose, Homi J. Baba, Vikram Sarabhai, Satyendranath Bose, CV Raman, APJ Abdul Kalam **Suggested Activity:** To submit a detailed report on Recent contributions by India in the field of Science and Technology	CO-5 BTL-3

REFERENCE BOOKS	
1	"Science and Technology | UPSC | Civil Services Exam | State Administrative Exams", Ravi P. Agrahari, McGraw Hill Publications, ISBN-10 935532555X, 7th Edition, 2023
2	"A Brief History of Science & Technology In India", Dr. P Lathwal, Indu Book Services Pvt Ltd., ISBN: 9789391377205, First Edition, 2022

E Resources for Reference	
1.	https://www.thebetterindia.com/63119/ancient-india-science-technology
2.	https://www.ijsdr.org/papers/IJSDR2210086.pdf
3.	https://www.insightsonindia.com/science-technology/

COURSE TITLE	**POLITICAL AND ECONOMIC THOUGHT FOR A HUMANE SOCIETY**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51023**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-2**

ASSESSMENT SCHEME					
CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz etc.,**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	The students shall develop an intuitive understanding of the political and economic thoughts of thinkers from various ages to have an explicit insight into the ideas, values and ethics provided by them.
Course Objective	• This course aims to equip the students with value building through analyzing the ideas of the thinkers of various ages • This course also equips students with an ability to critically analyse the social, economic and political conditions.
Course Outcome	Upon completion of this course, the students will be able to ● Brief on the historic background of economic issues in India. ● Summarize the theories emerging from western economic and political thought. ● Describe the emergence of the welfare state and their security implications. ● Appreciate the significance of Gandhian thoughts and Ambedkar thoughts and the impact on the progress of the nation. ● Debate on current trends of secularism and their effects on building a nation.

CO, PO AND PSO MAPPING

CO	**PO -1**	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	-	-	-	-	-	-	1	1	-	-	1	-			
CO-2	-	-	-	-	-	1	-	-	1	-	1	-			
CO-3	-	-	-	1	-	1	1	1	-	-	2	-			
CO-4	-	-	-	-	-	1	2	3	-	-	2	-			
CO-5	2	1	1	-	-	2	1	3	2	2	2	1			

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Historical background of Economic Issues in India	**9L**
Impact of colonial rule on Indian Economy; Dadabhai Naoroji- Drain Theory; Post Independence- Nehru and Idea of Socialism, Evolution of Public sector in India.	**BTL-1,2**

MODULE 2: Western Economic and Political thought	**9L**
Liberalism- Free market, Laissez Faire, Industrial revolution. Communism- Mode of production, theory of Surplus value, Class struggle; Gramsci- Theory of Hegemony	**BTL-1,2**
MODULE 3: Emergence of Welfare State	**9L**
Welfare state- Meaning, Womb to Tomb concept and its current state; Security- Shift from traditional security to non-traditional security threats: Human security, Food security and social security	**BTL-1,2**
MODULE 4: Gandhian and Ambedkar Thought	**9L**
Gandhi: Swaraj, Decentralization and Ramarajya; Ambedkar: Cultural hegemony.	**BTL-1,2**
MODULE 5: Current trends	**9L**
Secularism: Positive and Negative secularism; Affirmative actions, Public distribution system.	**BTL-1,2**

TEXT BOOKS	
1.	Subrata Mukherjee,Sushila Ramasamy,"A history of Political Thought- Plato to Marx",PHI learning private limited,2nd edition,2011
2.	Shefali Jha,"Western Political Thought: From the Ancient Greeks to Modern Times", 2nd Edition by Pearson
REFEREFERENCE BOOKS	
1	Indian Political Thinkers:Modern Political Thought,Atlantic Publishers & Dist, 2000
2	Marx, Karl, 1818-1883. The Communist Manifesto. London; Chicago, Ill. :Pluto Press, 1996.
3	Nehru, Jawaharlal, 1889-1964. The Discovery of India. Garden City, N.Y. :Anchor Books,
4	Gandhi, Mahatma, 1869-1948. The Collected Works of Mahatma Gandhi. New Delhi :Publications Division, Ministry of Information and Broadcasting, Govt. of India,

COURSE TITLE	**State, Nation-Building and Politics in India**			**CREDITS**	**Non Credit Course**
COURSE CODE	**EGE51024**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL – 3**

ASSESSMENT SCHEME

First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**End Semester Exam**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	After studying the course, the students should be able to gain knowledge of Nation building and the constituents of Indian politics
Course Objective	• This course will enlighten the students to learn about the basics of nation building • Indian secularism and the salient features of Secular India. • To brief on the principles of federalism and its working • To understand the administrative framework of Indian Government
Course Outcome	• Summarize the basics of nation building with a special reference to Indian constitution. • Identify and relate the components that constitute Indian constitution • Appraise the salient features of Indian secularism. • Classify the principles of Federalism and its relation to central and state autonomy. • Illustrate the Indian central administration system and the hierarchy of operations.

Prerequisites: Nil

CO, PO AND PSO MAPPING

CO	**PO -1**	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**	**PSO -3**
CO-1	-	-	1	1	-	3	2	3	2	2	2	-			
CO-2	-	-	-	1	-	2	2	2	2	1	2	-			
CO-3	-	-	-	-	-	2	2	2	2	1	2	-			
CO-4	-	-	-	-	-	2	2	2	2	1	2	-			

CO-5	1	1	1	1	-	3	2	3	2	2	2	-			

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: Basic of Nation Building	**9 Hours**
Indian government and politics: basics Nation-Building in India: Theoretical, Historical, Cultural perspective, National Movements in India	**CO-1 BTL-1,2**
MODULE 2: Indian Constitution	**9 Hours**
Making of the Indian Constitution: The Constituent Assembly - Background, Composition, Nature and its working, Ideological Contents: Preamble, fundamental Rights and Directive Principles of State Policy.	**CO-2 BTL-2,3**
MODULE 3: Indian Secularism	**9 Hours**
Distinctiveness of Indian Secularism, Constitution as an instrument of social change: Constitutional Amendments.	**CO-3 BTL-3**
MODULE 4: Federalism	**9 Hours**
Federalism and its working: Nature, the Areas of Tension in Centre-State relations, Demands for State Autonomy, Separatist Movements.	**CO-4 BTL-3**
MODULE 5: Central Administration	**9 Hours**
Executive and Central Administration: President, Prime Minister, and council of ministers, Union Territories: Administration, Critical Appreciation.	**CO-5 BTL-3**

TEXT BOOKS	
1.	Indian Government and Politics: Basics / Political Ideologies/ Nation Building, Dr. Jayanta Kumar Dash & Dr. Ratnaprava Barik, Geetanjali Publication 2012
2.	An Introduction to the Constitution of India. New Delhi: Vikas, 1998. Sikri, S.L. **Indian Government and Politics**. New Delhi: Kalyani Publishers, 1999 (Reprint).
REFERENCE BOOKS	
1.	R.N Gilchrist, Principles of Political Science, Bombay: Orient Longmans, Seventh Edition, 1952
2.	Andrew Heywood, Political Theory: An Introduction, United Kingdom: Palgrave Mac Milan, 4th Edition, 2015.
E-BOOKS / MAGAZINE / ARTICLES	
1.	https://cepr.org/voxeu/columns/nation-building-new-ebook

COURSE TITLE	**INDUSTRIAL SAFETY**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51025**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**01**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					**ESE**
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approved by the Department Examination Committee "DEC""**	**Attendance**	
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	Upon completion of the Industrial Safety course, participants will be equipped with the knowledge and skills necessary to foster a safer and healthier workplace, thereby safeguarding workers, assets, and the environment. Whether the students are an industry

	professional seeking to enhance their safety expertise or a manager responsible for the well-being of their team, this course will empower them to make informed decisions and contribute to a culture of safety excellence within their organization.
Course Objective	The objective of this course is to equip students with the knowledge, skills, and mind set necessary to promote a safe and healthy work environment, protect workers and assets, and contribute to the overall success and sustainability of industrial operations. It provides / covers 1. comprehensive understanding of safety protocols, standards, and practices within industrial settings. 2. course covers a wide range of safety terminologies used in the industry, enabling students to effectively communicate and engage with safety professionals and colleagues. 3. delve into the fundamental principles of safety regulations, ensuring compliance with the highest safety standards
Course Outcome	Upon completion of this course, the students will be able to 1. Realize the importance and basic Terminologies of safety. 2. Enable the students to learn about the Important Statutory Regulations and standards. 3. Enable students to Conduct and participate the various Safety activities in the industry. 4. Appreciate about Workplace Exposures and Hazards. 5. Assess the various Hazards and consequences through various Risk Assessment Techniques.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	
CO-1	3	3	2	-	-	2	2	-	-	1	1	2			
CO-2	3	3	2	-	-	2	2	-	-	1	1	2			
CO-3	3	3	2	-	-	2	2	-	-	1	1	2			
CO-4	3	3	2	-	-	2	2	-	-	1	1	2			
CO-5	3	3	2	-	-	2	2	-	-	1	1	2			

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION	**(9L)**
Need for safety. Safety and productivity. Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. Theories of accident causation. Safety organization- objectives, types, functions, Role of management, supervisors, workmen, unions, government, and voluntary agencies in safety. Safety policy - Safety Officer-responsibilities, authority. Safety committee-need, types, advantages. **Suggested Reading:** ● Importance of Safety, Health and Environment policies at Workplace	**CO-1** **BTL-2**
MODULE 2: STANDARDS AND REGULATIONS	**(9L)**
Indian Factories Act-1948- Health- Safety- Hazardous materials and Welfare- ISO 45001:2018 occupational health and safety (OH&S) - Occupational Safety and Health Audit IS14489:1998- Hazard Identification and Risk Analysis- code of practice IS 15656:2006 **Suggested Readings:** ● Industrial Safety Signs: Types of Signs, Regulations, Standards and Best Practices to	**CO-2** **BTL-3**

Promote Safety in the Workplace	
MODULE 3: SAFETY ACTIVITIES	**(9L)**
Toolbox Talk- Role of safety Committee- Responsibilities of Safety Officers and Safety Representatives- Safety Training and Safety Incentives- Mock Drills- On-site Emergency Action Plan- Off-site Emergency Action Plan- Safety poster and Display- Human Error Assessment. Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate. Housekeeping: Responsibility of management and employees. Advantages of good housekeeping. 5 s of housekeeping. **Suggested Readings:** ● Roles and Responsibilities of Safety Officers and Safety Representatives	**CO-3** **BTL-3**
MODULE 4: HAZARDS AND RISKS	**(9L)**
Hazard and risk, Types of hazards- Mechanical Hazard, Electrical Hazard, Noise hazard and Fire Hazard - Particulate matter- musculoskeletal disorder improper sitting poster and lifting Ergonomics RULE & REBA- Unsafe act & Unsafe Condition. Classification of Fire, Types of Fire extinguishers, fire explosion and toxic gas release, Structure of hazard identification and risk assessment. Identification of hazards: Inventory analysis, Fire and explosion hazard rating of process plants **Suggested Readings / Activities:** ● Personal Protective Equipment (PPE), Types of PPE and their appropriate use, PPE selection, maintenance, and training, Assessing PPE effectiveness in hazard control	**CO-4** **BTL-3**
MODULE 5: HAZARD IDENTIFICATION TECHNIQUES	**(9L)**
Job Safety Analysis-Preliminary Hazard Analysis-Failure mode and Effects Analysis- Hazard and Operability- Fault Tree Analysis- Event Tree Analysis Qualitative and Quantitative Risk Assessment- Checklist Analysis- Root cause analysis- What-If Analysis- and Hazard Identification and Risk Assessment **Suggested Readings:** ● Guidelines for safe handling, storage, and disposal of hazardous materials in various industries	**CO-5** **BTL-3**

TEXTBOOKS	
1.	R.K. Jain and Prof. Sunil S. Rao, Industrial Safety, Health and Environment management systems, Khanna Publications, 2000.
2.	L. M. Deshmukh, Industrial Safety Management: Hazard Identification and Risk Control, McGraw-Hill Education, 2005.
REFERENCE BOOKS	
1	Frank Lees, 'Lees' Loss Prevention in Process Industries, Butterworth-Heinemann publications, UK, 4th Edition, 2012.
2	John Ridley, John Channing, Safety at Work, 7th edition, Routeledge, 2007.
3	Das Akhil Kumar, Principles of Industrial Safety Management Understanding the Ws of Safety at Work, PHI Learning Pvt Ltd, 2020.
E Resources for Reference	
1.	https://hsseworld.com/wp-content/uploads/2020/08/Industrial-Safety-Management.pdf
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc20_mg43/preview

MANDATORY COURSES III

COURSE	**PRINCIPLES OF MANAGEMENT**	**CREDITS**	**Non Credit**

TITLE					Course
COURSE CODE	GGE51031	COURSE CATEGORY	MC	L-T-P-S	3-0-0-2
Version	1.0	Approval Details	36th ACM	LEARNING LEVEL	BTL-4

ASSESSMENT SCHEME

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	To have an in-depth knowledge in basic concepts of management, and also to understand about the functions of Management and their implications in an effective manner.
Course Objective	1. To make the students to understand the basic concepts of management. 2. To illustrate and evaluate the importance of planning and decision making techniques. 3. To study the different Organizational structures. 4. To understand leadership and the foundation of leadership theories. 5. To know the dimensions of the controlling framework.
Course Outcome	1. Understand the basic concepts and significance of management in business. 2. Apply and analyze the techniques of planning and apply the Decision-making process in Business organizations. 3. Identify the difference between Centralization and Decentralization and functions of Line and Staff. 4. Explain and critically analyse the theories and concepts of leadership and management and their application in organisations. 5. Apply different controlling techniques in different situations

Prerequisites: Basic understanding of business and business communication.

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	2	-	3	-	-	-	-	-	-	-	-	-	2	-	-
CO-3	-	-	-		-	-	-	-	-	-	-	-	-	-	-
CO-4	-	3	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-5	-	-	-	3	-	-	-	-	-	-	-	-	2	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1: INTRODUCTION	**(9L)**
Definition – Importance – Nature and Scope of Management – Process of Management - Role and functions of Managers - Levels of Management- Managerial Skills- Scientific Management Contributions to Management by different Schools of thought.	**CO-1 BTL-2**
MODULE – 2: PLANNING AND DECISION MAKING	**(9L)**
Nature and purpose of planning - Planning process – Objectives - Management by objective (MBO)- Strategic Planning - Decision Making - Decision Making Process.	**CO-2 BTL-3**
MODULE – 3: ORGANIZING	**(9L)**
Structure, Nature, Types of Organizations, Principles of Organizing; Departmentalization; Delegation; Decentralization of Authority; Span of Control - Line and Staff Functions	**CO-3 BTL-4**
MODULE – 4: LEADING	**(9L)**
Introduction, Characteristics of a Leader, Functions of a Leader; Leadership and	**CO-4**

Management; Principles of Leadership, Styles of Leaders.	**BTL-4**
MODULE – 5: CONTROLLING	**(9L)**
Introduction, Concept of Controlling, Purpose of Controlling; Types of Control; Steps in Controlling; Techniques in Controlling in ethical aspects of management problems.	**CO-5** **BTL-3**
TEXT BOOKS	
1	phen P. Robbins, David A. Decenzo, Fundamentals of Management,11th edition, Pearson Education, 2020.
2.	rold Koontz, O'Donnell and Heinz Weihrich, Essentials of Management. New Delhi, 11th edition, Tata McGraw Hill, 2020.
REFERENCE BOOKS	
1	l.Prasad, Principles and Practice of Management ,20th Edition, Sultan Chand & Sons, 2020.
2	l Gupta,Principles of Management, 2nd Edition, Sultan Chand Ltd. 2005.
E BOOKS	
1.	https://d3bxy9euw4e147.cloudfront.net/oscmsprodcms/media/documents/PrinciplesofManagement-OP.pdf
2.	https://open.lib.umn.edu/principlesmanagement/
MOOC	
1.	https://onlinecourses.nptel.ac.in/noc21_mg30/

COURSE TITLE	**HUMAN RESOURCE MANAGEMENT**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51032**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**
Course Description	To train the students on management of Human Resources by exposing them to theories and practices on HR management				
Course Objective	1. To understand and appreciate the importance and functions of the human resources. 2. To distinguish between Recruitment and Selection. 3. To study the training practices and performance appraisal. 4. To develop an understanding about basics of compensation management. 5. To identify and appreciate the significance of the ethical issues in HR				
Course Outcome	1. Conceptualize, the basic concept of Human Resource Philosophy to changing Environment. 2. Applying the Recruitment and Training methods. 3. Determine the effectiveness with which goals are defined and achieved in team environments to assess the contributions of Managers. 4. Creating and selecting, and apply appropriate techniques, in compensation and quality. 5. Applying ethical principles and commit to professional ethics and responsibilities in labour laws, relations and security				
Prerequisites:					
CO, PO AND PSO MAPPING					

CO	PO - 1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO - 10	PO-11	PO-12	PSO -1	PSO -2	PSO -3
CO-1	2	-	2	-	-	2	-	-	-	-	-	1			
CO-2	2	2	-	1	1	2	1	2	-	-	2	2			
CO-3	2	1	2	2	-	2	1	3	-	-	2	3			
CO-4	2	1	-	2	1	2	1	3	-	-	2	3			
CO-5	2	2	-	2	-	2	1	3	-	-	2	3			

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1: HUMAN RESOURCE FUNCTION	**(9L)**
Human Resource Philosophy- Changing environments of HRM-Strategic Human Resource Management-Using HRM to attain competitive advantage-managing migrated workforce-Organization of HR departments- Line and staff functions-Role of Managers. Personnel Management, HRM, HCM-Differences.	**CO-1 BTL-2**
MODULE – 2: RECRUITMENT & PLACEMENT	**(9L)**
Man Power Planning and Forecasting-Job analysis: Methods-IT and computerized skill inventory-Job Description-Writing job Specification-HR and the responsive organization. Recruitment: Recruitment Sources-Internal and External-Building employee commitment: Promotion from within-Sources, Developing and Using application forms-E-Recruitment. Employee Testing & Selection: Selection process, basic testing concepts, types of test, work samples & simulation, selection techniques, interview, common interviewing mistakes, Designing & conducting the effective interview, small business applications, computer aided interview.	**CO-2 BTL-3**
MODULE – 3: TRAINING & DEVELOPMENT	**(9L)**
Orientation & Training: Orienting the employees, the training process, need analysis, Training techniques, special purpose training, Training via the internet. Developing Managers Management Development-on-the-job Development techniques using HR to build a responsive organization. Key factor for success, Management Development Programs-Objectives and Methods. Performance Appraisal: Methods-problems and solutions- MBO approach- The appraisal interviews- Performance appraisal in practice, Potential appraisal system. Managing Careers: Career planning and development- Managing promotions and transfer. Succession Planning: Family Businesses.	**CO-3 BTL-4**
MODULE – 4: COMPENSATION & MANAGING QUALITY	**(9L)**
Establishing Pay Plans: Basics of compensation-factors determining pay rate-Current trends in compensation-Job evaluation-pricing managerial and professional jobs-Computerized job evaluation. Pay for Performance and Financial Incentives: Money and motivation-incentives for operations employees and executives-organization wide incentive plans- Practices in Indian Organizations. Benefits and Services: Statutory benefits-non-statutory (voluntary) benefits-Insurance benefits-retirement benefits and other welfare measures to build employee commitment.	**CO-4 BTL-4**
MODULE – 5: LABOUR RELATIONS AND EMPLOYEE SECURITY	**(9L)**
Labour Relations and Employee Security: Industrial Relation-Collective bargaining; Discipline administration; Labour Welfare; Whistle Blowers; Performance Management, HR Accounting, Auditing HR functions, Challenges of HRM function, Absenteeism- Causes of Attrition. Human Resource Audit. Contemporary HR Concepts.	**CO-5 BTL-3**

TEXT BOOKS

1	Gary Dessler, "Human Resource Management", 16th edition, Prentice-Hall of India.2020
2.	David A. DeCenzo, Stephen P. Robbins , David A. DeCenzo, Stephen P. Robbins, Personnel/Human Resource Management,3rd edition, Pearson.2022.

REFERENCE BOOKS

1	John Bernardin H & Joyee E.A Russel, Human Resource Management- An experimental approach, 6th edition, McGraw-Hill International Edition.,2012.

2	Aswathappa, Human Resource Management, 9th edition, Tata McGraw Hill, New Delhi, 2021
E BOOKS	
1.	https://www.ascdegreecollege.ac.in/wp-content/uploads/2020/12/Human-Resource-Management-by-Pravin-Durai.pdf
2.	https://www.yyu.edu.tr/images/files/Turizmde_Insan_Kaynaklari_Gelisimi_Doc_Dr__Zekeriya_NAS (1).pdf
MOOC	
1.	https://www.coursera.org/specializations/human-resource-management

COURSE TITLE	**GREEN TECHNOLOGY**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51033**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-3**

ASSESSMENT SCHEME

CIA					
First Periodical Assessment	**Second Periodical Assessment**	**Seminar/Assignments/Project**	**Surprise Test / Quiz etc., as approvedby the Department Examination Committee "DEC""**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This course aims to equip the students with a basic understanding of concept of sustainable development including different perspectives, consequences of societal resource use and strategies for changing this concept towards a sustainable direction. This course also equips students with an ability to understand the principles of Green Technology and demonstrate how chemical production could be achieved without posing hazard to human health and environment.
Course Objective	1. To guide the students in understanding the concepts of green technology and its need. 2. To ensure that the students understand the term green oxidation and nanotechnology. 3. To enable the students to explore the Green industrial processes. 4. To enable the student's ability to describe Cleaner Production measures applicable to differentindustries 5. To guide the students in the application of green chemistry using advanced technologies.
Course Outcome	Upon completion of this course, the students will be able to 1. examine the principles of green chemistry and engineering 2. evaluate the approach on green technology towards the new discovery and innovation 3. gain knowledge on Green industrial processes 4. analyze the concept of sustainable development and its importance 5. analyze and select the different principles of green chemistry and sustainable development for variousapplications.

CO, PO AND PSO MAPPING

CO	**PO-1**	**PO-2**	**PO-**	**PO-4**	**PO-5**	**PO-**	**PO-**	**PO-**	**PO-9**	**PO-**	**PO-11**	**PO-**	**PSO**	**PSO-**	

			3			6	7	8		10		12	-1	2	
CO-1	2	2	3	1	1	1	2	3	1	2	1	3	1	1	
CO-2	-	-	3	2	2	1	2	3	1	2	1	2	1	1	
CO-3	-	-	3	2	2	1	2	3	1	2	1	2	3	2	
CO-4	-	-	3	2	2	1	2	3	1	2	1	1	1	1	
CO-5	-	-	3	2	2	1	2	3	1	2	1	1	3	2	

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE 1: INTRODUCTION TO GREEN TECHNOLOGY	**(9L)**
Principles of green technology, concepts of green chemistry and process intensification.	**CO-1 BTL-3**
MODULE 2: GREEN SYNTHESIS AND CATALYSIS	**(9L)**
Green oxidation and photochemical reactions, Microwave and Ultrasound assisted reactions, Synthesis of Green Reagents, Green solvents, Green nanotechnology and Ionic liquids.	**CO-2 BTL-3**
MODULE 3: GREEN INDUSTRIAL PROCESSES	**(9L)**
Pollution statistics from various industries like polymer, textile, pharmaceutical, dyes, pesticides and wastewater treatment. A greener approach towards all these industries.	**CO3 BTL-3**
MODULE 4: GREEN CHEMISTRY & SUSTAINABLE CHEMICAL PROCESSES	**(9L)**
Resources/Tools for Green Alternatives, Green laws compliance, Examples and impact ofgreen chemistry, Development of Specialized Synthetic Techniques.	**CO-4 BTL-3**
MODULE 5: CHALLENGES AND PRACTICAL IMPLEMENTATION	**(9L)**
Responsibilities and potentials of companies for action. Green Productivity and emerging technologies. Implementation of the practical applications of Green emerging technologies andsustainable development with Case studies.	**CO5 BTL-3**

BOOKS	
1	Bishop P. L. McGraw-Hill, Pollution Prevention: Fundamentals and Practice, Boston, 2000.
2	Anastas P.T. and Warner J.C, Green Chemistry: Theory and Practice, Oxford University Press, 1998.
3	Marcel Dekker, Introduction to Green Chemistry, A.S. Publisher, Newyork, 2001.
4	Modak P., Visvanathan C. and Parasnis M, Cleaner Production Audit Environmental System Reviews, Asian Institute of Technology, Bangkok, 1995.
5	Clark J.H. and Macquarrie D.J, Handbook of Green Chemistry and Technology, Wiley-Blackwell Publishers, 2002
REFERENCE BOOKS	
1	Ahluwalia, Green Chemistry: Environmentally Benign Reactions, V.K. Ane Books India, New Delhi, India, 2006.
2	Sawyer C.N, McCarty P.L and Parkin G.F, Chemistry for Environmental Engineering and Science, 5th ed. McGraw-Hill Professional, 2003.
3	Lancaster M, Green Chemistry: An Introductory Text, Royal Society of Chemistry, Cambridge,

	2002.
E Resources for Reference	
1.	https://link.springer.com/article/10.1007/s11356-022-20024-4
2.	https://iopscience.iop.org/article/10.1088/1755-1315/94/1/012115/pdf
3.	**https://iaeme.com/MasterAdmin/Journal_uploads/IJMET/VOLUME_9_ISSUE_3/IJMET_09_03_113.pdf**
MOOC	
1.	https://onlinecourses.swayam2.ac.in/aic21_ge16/preview

COURSE TITLE	**INDUSTRIAL MANAGEMENT**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51034**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**37th ACM**	**LEARNING LEVEL**	**BTL-4**

ASSESSMENT SCHEME

First Periodical Assessment	**Second Periodical Assessment**	**Seminar/ Assignments/ Project**	**Surprise Test / Quiz**	**Attendance**	**ESE**
15%	**15%**	**10%**	**5%**	**5%**	**50%**

Course Description	This course provide brief introduction about the management principles and their functions.
Course Objective	1. To provide brief introduction about the management principles and their functions. 2. To study the concepts of product design, product layout and PPC functions. 3. To know the material requirement planning and store keeping procedure. 4. To explain the basic principles of TQM. 5. To understand the social responsibilities of engineer and ways to protect our environment
Course Outcome	1. Interpret given organization structure, and acquire major management skills, familiarize with different leadership styles. 2. Implement product design, and explain different types of plant layout, production modes and PPC functions. 3. Understand the material requirement planning and store keeping procedure and analyze importance of inventory control. 4. Analyze the need of Total Quality management and appreciate the usage of TQM tools in quality control. 5. Incorporate the social responsibilities of engineer and ways to protect our environment

Prerequisites: Knowledge of English Communication

CO, PO AND PSO MAPPING

CO	**PO-1**	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	
CO-1	**1**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	
CO-2	**2**	**-**	**-**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	
CO-3	**-**	**1**	**2**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	
CO-4	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	
CO-5	**-**	**-**	**-**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1: BASICS OF MANAGEMENT **(9L)**

Management - Definition – Administration- Definition – Henry-Fayol's principles of management- Business Organisation -Types- Proprietorship-Partnership- Joint stock-	**CO-1 BTL-2**

Cooperative Society-Advantages and disadvantages - Organisation-Definition- types of organisation –Line-Functional-Line & staff-advantages and disadvantages- Leadership -Types –Quality of good leader -Motivation - Maslow's Theory of Motivation -Hierarchy of needs-Communication - Process of Communication – Barriers for effective communication.	
MODULE – 2: PRODUCTION MANAGEMENT	**(9L)**
Project planning -Market survey- Project capacity-selection of site for project- Plant layout-Types of Plant layout- Product design-Material requirement-Production-definition-Job, Batch & Mass production with their advantages and disadvantages-Productivity-definition factors to improve productivity- Production planning and Control (PPC)-definition-Functions of PPC-planning, routing, scheduling, dispatching and Inspection.	**CO-2 BTL-3**
MODULE – 3: MATERIALS MANAGEMENT	**(9L)**
Material management - functions- different methods of purchasing - classification of stores - Functions of store keeper.Inventory Management- Definition - functions of Inventory Control- Advantages of Inventory Control Enterprise resource planning - concept, features and applications - Material Requirement Planning (MRP)-concept, applications -Just in Time (JIT)-concept and benefits-Supply chain management-concept and benefits.	**CO-3 BTL-4**
MODULE – 4: TOTAL QUALITY MANAGEMENT	**(9L)**
Quality–Concept-Quality control- Definition - Factors affecting quality- Different types of inspection - Principles of total quality management- Quality Circles-definition-Function. TQM Tools- Flow charts, Control charts, Histograms, Pareto charts, Cause and effect diagram-5-S-Kaizen, and Six-sigma Quality Certification Systems- ISO 9000 series quality standards, QS14000– ISO 9000, ISO 9001,ISO9002,ISO9003 & ISO 9004- ISO9000 quality certification procedure.	**CO-4 BTL-4**
MODULE – 5: SOCIAL ISSUES AND THE ENVIRONMENT	**(9L)**
Water conservation and rain water harvesting. Climate change: global warming, acid rain, ozone layer depletion-environment and human health-role of information technology in environment and human health.	**CO-5 BTL-3**

TEXT BOOKS	
1	T.R.Banga & S C Sharma, Industrial Engineering and Management, 12th edition,Khanna.Publishers.2008
2.	Buffa,Modern Production Management,8th edition, Wiley.2008.
REFERENCE BOOKS	
1	O. P. Khanna,Industrial Engineering & Management, Dhanpat Rai Publications, 2018.
2	L.C.Jhamb , Savitri Jhamb , Industrial Management – I , Everest Publishing House,2017
E BOOKS	
1.	https://ftp.idu.ac.id/wp-content/uploads/ebook/ip/BUKU%20INDUSTRIAL%20ENGINEERING/Industrial%20Engineering%20And%20Management%20by%20Kumar,%20Pravin%20(z-lib.org).pdf
2.	https://www.booksfree.org/the-principles-of-industrial-management-by-john-c-duncan-pdf-free-download/
MOOC	
1.	https://ufuture.uitm.edu.my/mooc/course_detail.php?course=MEM575

COURSE TITLE	**FINTECH AND FINANCING NEW BUSINESS**			**CREDITS**	**Non Credit Course**
COURSE CODE	**GGE51035**	**COURSE CATEGORY**	**MC**	**L-T-P-S**	**3-0-0-2**
Version	**1.0**	**Approval Details**	**36th ACM**	**LEARNING LEVEL**	**BTL-4**
ASSESSMENT SCHEME					

First Periodical Assessment	Second Periodical Assessment	Seminar/ Assignments/ Project	Surprise Test / Quiz	Attendance	ESE
15%	15%	10%	5%	5%	50%

Course Description	FinTech, is a combination of traditional financial techniques with technology and innovation. It aims at the application of new technological advancements to the financial industry. At the core, FinTech is used by companies to manage their financial operations in a better way.
Course Objective	1. To study the overview of Fin Tech. 2. To understand the role of FinTech in financial markets 3. To Identify the key cybersecurity challenges facing FinTech companies. 4. To provide exposure to various banking services and understand various Ancillary Services. 5. To take stock of the technological trends sweeping the financial services sector.
Course Outcome	1. To identify the key trends driving the growth of FinTech and analyze the challenges and opportunities facing FinTech companies. 2. Analyze the impact of FinTech on the efficiency and liquidity of financial markets. 3. Develop strategies to mitigate cybersecurity risks in FinTech. 4. Use banking services with clear understanding about the various delivery channels. 5. Outline the current global landscape of financial technology Industry.

Prerequisites: Knowledge of English Communication

CO, PO AND PSO MAPPING

CO	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	-	1	-	-	-	-	-	-	-	-	-	-	1	-
CO-2	2	-	-	2	1	-	-	-	-	-	-	-	1	-
CO-3	2	1	-	-	-	2	-	-	-	-	-	-	-	1
CO-4	1	1	2	-	1	-	-	-	-	-	-	-	-	1
CO-5	-	-	-	2	-	-	-	-	-	-	-	-	-	-

1: Weakly related, 2: Moderately related and 3: Strongly related

MODULE – 1: INTRODUCTION TO FIN TECH	**(9L)**
Introduction to FinTech, history of FinTech-key trends driving the growth of FinTech, challenges and opportunities facing FinTech companies- future of FinTech	**CO-1 BTL-2**
MODULE – 2: FIN TECH AND FINANCIAL MARKETS	**(9L)**
Primary markets and Secondary market an overview-FinTech and payments, FinTech and lending-FinTech and investments-FinTech and insurance- regulatory landscape for FinTech in financial markets	**CO-2 BTL-3**
MODULE – 3: FIN TECH AND CYBERSECURITY	**(9L)**
Cybersecurity threats to FinTech-Cybersecurity best practices for FinTech companies-role of government in regulating FinTech cybersecurity.	**CO-3 BTL-4**
MODULE – 4: BRANCHLESS BANKING	**(9L)**
Branchless Banking: Management of alternate delivery channels -Automated Teller Machine (ATM), Phone Banking, Mobile Banking, Card technologies, Internet Banking, Ancillary Services: Interbank Transfer - Electronic Clearing Services (ECS), Electronic Funds Transfer -	**CO-4 BTL -4**

NEFT, RTGS, SWIFT, Electronic cheques; New payment settlement systems- IM PS -Safe Deposit Lockers; FOREX service; DEMAT and Custodial service.	
MODULE – 5: TECHNOLOGY DISRUPTIONS ENABLING FINTECH INNOVATION	**(9L)**
4 G and 5 G networks fueling Fin Tech opportunities, transforming customer experience using Mobile Application and smart phones ,embedded sensors and social media, cloud computing, web 2.0/3.0/4.0,rapid web design, Java Script, Technologies, IoT, Big Data analytics and AI and Block chain.	**CO-5** **BTL-3**
TEXT BOOKS	
1	Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, John Wiley & Sons. 2016
2.	Parag Y Arjunwadkar, Fintech: The Technology Driving Disruption in the financial service industry CRC press.
REFERENCE BOOKS	
1	Jonathan Aronson and Peter F. Cowhey, Digital DNA: Disruption and the Challenges for Global Governance, OUP USA, 2017
2	Rajesh, R., & Sivagnana Siddhi T., “Banking Theory Law & Practice”,Tata Mc Graw Hill.2009.
E BOOKS	
1.	https://www.amazon.in/Fintech-Founders-Inspiring-Entrepreneurs-Changing-ebook/dp/B08295NZ2T?asin=B08295NZ2T&revisionId=e61ddfa1&format=1&depth=1
2.	https://www.ebooknetworking.net/ebooks/banking-theory-and-law-practice-by-gurusamy.html
MOOC	
1.	https://www.edx.org/course/introduction-to-fintech