

F/CDD/004 Rev.00.dt.20.03.2020

FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

Curriculum and Syllabus

B.Tech - Robotics and Automation

(Full time) 2022

DEPARTMENT OF MECHANICAL ENGINEERING



Department

Vision:

To educate, nurture and motivate the upcoming Engineering professionals with moral and ethical values to become a committed punctilious Engineers to the Nation.

Mission:

M1: Providing quality education through well structured curricula supplemented with practicaltraining, guest lectures by eminent professionals, field visits to leading industries and also in-plant training.

M2: Enhancing skills through faculty development programmes.

M3: Providing ambience for innovative projects and extra-curricular activities

M4: Equipping the department with contemporary infra-structure and the state of art R&D centre to cater to the needs of research scholars and industries

M5: Providing training to students in emerging areas like robotics and CAD/CAM.

M6: Nurturing students having creative ideas to adopt innovative projects which can be subsequently commercialized.



PROGRAMME EDUCATIONAL OBJECTIVES (PEO's)

PEO1: Graduates will learn and utilize the basics of science and engineering knowledge to excel in their Industrial, Academic, Research and entrepreneurship career.

PEO2: Graduates will contribute to the society as technically educated, ethical and responsible citizens with proven expertise.

PEO3: Graduates will fulfil their goals with thrive to pursue lifelong learning with creativity and innovation.



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

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



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

PO9: Individual and 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 and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

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

PSO1: Students will gain the knowledge of Mechanical, Electronics and Computer Science Domains and their applications.

PSO2: Students will have the ability to Design, develop and maintain robotics and automation systems for various applications

PSO3: Students will acquire the knowledge to utilize various modern simulation software and computational tools in the field of Robotics System

PSO4: Students will have the ability to undertake various research projects and entrepreneurship in the field of automation and robotics for the societal benefit.



Table 1: Components of Curriculum and Credit distribution for E&T Programmes

Course	Description	No. of		Credit		Contact
Component	-	Courses	Credits	Total	Weightage(%)	hours
Basic	Theory	5	19	25	15	285
Science	Lab					
	ETL	2	6			120
Engineering	Theory			3	1.8	
Science	Lab					60
	ETL	1	3			
Humanities	Theory	1	2		2.4	30
and Social	Lab	2	2	4		60
Science	Lao	4	4	-		
	ETL					
Program	Theory	17	56		41.5	840
Core	Lab	10	10	69		450
	ETL	1	3			60
Program	Theory	5	15		9	225
Electives	Lab			15		
	ETL					
Open	Theory	2	6		4.2	90
Elective	Lab	1	1	07		45
	ETL					
Inter-	Theory	5	16		15.6	240
disciplinary						
	Lab	4	4	26		165
	ETL	3	6			125
						135
Skill		5	5	5	3.0	150
Component						
Online	Theory	1	1	1	0.60	15
course	-					
Project		3	11	11	6.62	105
Audit	Environment	2	0	0	0	60
Course	Science, The					
	Indian					
	Constitution/The					
	Traditional					
	Knowledge	-	1.55		1000/	
	TOTAL	70	166	166	100%	3135

Note:

Basic Science: Mathematics, Physics and Chemistry.

Engineering Science: Engineering Graphics, Basics of Mechanical and Civil Engineering, Basics of Electrical and Electronics Engineering, C Programming and MS office tools, Python Programming Humanities and Social sciences:

English, Foreign language, Environmental Studies, Management, Entrepreneurship, Indian Constitution and Indian Traditional Knowledge, Universal Human Values.

Skill Component: Technical Skill, Soft Skill, internship.

Note:

Following categories should be available in the mapping page of each subject

B.Tech Robotics and Automation-2022 Regulation



Table 2: Revision/modification done in syllabus content:

O NI	C				0/ 6
S.No	Course (Subject) Code	Course (Subject) Name	Concept/ topic if any, removed in current Curriculum	Concept/topic added in the new curriculum	% of Revision/ Modificati
1.	EBRA22002		Unit-III-Fabrication, Process parameters for MOS and CMOS, Electrical properties of CMOS circuits and device modeling.	Unit-III- Introduction to Diodes- PN, Zener and Avalanche Diodes - Half Wave Rectifier, Full Wave Rectifier (Centre Tapped and Bridge Type), Filters and its Types - Load and Line Regulation-Zener Diode as Voltage Regulators	20%
			Unit-IV-Transistor biasing - CE, CB and CC – Amplifiers - Current gain - Voltage gain - Frequency response - Power amplifiers - Feedback Amplifiers –	Unit –IV- Transistor biasing - CE, CB and CC – Amplifiers - Current gain - Voltage gain - Frequency response - Power amplifiers - Types of Feedback Amplifiers	20%
		Electrical and Electronics Circuits	Oscillators - RC Phase shift - Wein Bridge – Hartley - Collpit's analysis Oscillator topic removed from IV unit		
			Unit-V-Operational amplifier ideal characteristics – Applications - Current to voltage - Voltage to current converters – Arithmetic circuit – Adder – Subtractor – Multiplier – Differentiator – Integrator - Inverting and Non inverting amplifiers - Buffer - 555 Timer - Block diagram – Multi vibrators	Unit-V- Positive Feedback- Barkhausen Criterion for Oscillators - Low Frequency Oscillators (RC Phase shift &Wein Bridge) – High Frequency Oscillators (Hartley &Collpit's)	20%
2.	EBRA22003	Electrical Machines	Unit-IV and Unit-V were previously titled as SYNCHRONOUS MACHINES ,SPECIAL MACHINES	Unit- IV and Unit –V renamed as SPECIAL MACHINES –I and SPECIAL MACHINES – II Unit IV and Unit V were modified accordingly Construction of Synchronous machines-types–induced emf–	

		EDUCA	Dr. M.G TIONAL AND RESE DEEMED TO BE UN University with Graded Auto (An ISO 21001 : 2018 Certifie r E.VB. High Road Madurayoyal, Che	ARCH INSTITUTE IVERSITY Phony Status ed Institution) pnai-95. Tamilnadu, India.	
		i ci iyu	Construction of	Equivalent circuit of excited-	
			Construction of Synchronous machines- types – induced emf – Equivalent circuit of excited-rotor synchronous motor- Equivalent circuit of excited-rotor synchronous motor - Starting - Permanent magnet synchronous	Equivalent circuit of excited- rotor synchronous motor- Starting- Permanent magnet synchronous motors-Applications of Synchronous motors Brushless alternators–Switched reluctance motor–control differential receiver-stepper motor- servomotor-Hysteresis motors- Synchros and its types.	40%
			Brushless alternators – reluctance motor – stepper motor servo motor - Hysteresis motors. Additional topics like Applications of Synchronous motors and Synchros and its types were added in new curriculum		
3.	EBRA22004	Basics of Robotics	UNIT III: END EFFECTORS AND SENSORS Mechanical gripper, vacuum cups, magnetic gripper, Tools as end effectors, Tactile sensors, proximity and range sensors, vision sensors.	UNIT III: END EFFECTORS, SENSORS AND ROBOT PROGRAMMING Mechanical gripper, vacuum cups, magnetic gripper, Tools as end effectors, Tactile sensors, proximity and range sensors, Machine vision –The sensing and Digitizing Function in Machine Vision-Image Processing and Analysis-Training and Vision System-Robot Programming— methods-motion interpolation- WAIT,SIGNAL and DELAY Commands-Branching-Robot Language Structure-motion commands-computations and Operations-monitor mode commands	40%
4	EBEC22ID4	Analog and Digital Electronics		New Course has been introduced	100%

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5	EBMA22008	Statistical and Numerical methods	New Course has been introduced	100%
6	EBEC22IL4	Analog and Digital Electronics Lab	New Course has been introduced	100%
7	EBRA22L03	Basics of Robotics Lab	New Course has been introduced	100%
8	EBCS22ID5	Artificial intelligence and Machine Learning	New Course has been introduced	100%
9	EBEC22ID6	Processors and Controllers	New Course has been introduced	100%
10	EBEC22IL5	Processors and Controllers Lab	New Course has been introduced	100%
11	EBCS22IL4	Artificial Intelligence and Machine Learning Lab	New Course has been introduced	100%
12	EBEC22ID7	Embedded System Design	New Course has been introduced	100%
13	EBRA22010	Machine Vision System	New Course has been introduced	100%
14	EBRA22011	Autonomous Mobile Robots	New Course has been introduced	100%
15	EBRA22L05	Robot Programmi ng and Simulation	New Course has been introduced	100%

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		Lab		
16	EBRA22L06	Product Design Lab	New Course has been introduced	100%
17	EBRA22E12	Aerial Robots	New Elective Course has been introduced	100%
18	EBRA22E18	Neural Networks	New Elective Course has been introduced	100%
19	EBRA22E14	Digital TWIN Technology	New Elective Course has been introduced	100%
20	EBRA22E16	IoT for Electrical Engineering	New Elective Course has been introduced	100%
21	EBRA22E27	Natural Language Processing	New Elective Course has been introduced	100%



Table3: List of New courses/value added courses//life skills/Electives/interdisciplinary/courses focusing on employability/entrepreneurship/skill development

SL.N O	New courses (Subjects)	New Courses	Value added courses	Life skill	Electives	Inter Disciplinary	Focus on employability/ entrepreneurs
			courses				hip/ skill development.
1	Analog and Digital Electronics	Yes				Yes	Yes
2	Basics of Robotics Lab	Yes	Yes				Yes
3	Statistical and Numerical Methods	Yes					Yes
4	Artificial Intelligence and Machine Learning	Yes	Yes			Yes	Yes
5	Artificial Intelligence and Machine Learning Lab	Yes	Yes			Yes	Yes
6	Analog and Digital Electronics Lab	Yes				Yes	Yes
7	Processors and Controllers	Yes	Yes			Yes	Yes
8	Processors and Controllers Lab	Yes	Yes			Yes	Yes
9	Embedded System Design	Yes	Yes				
10	Machine Vision System	Yes	Yes				Yes
11	Autonomous Mobile Robots	Yes	Yes				Yes
12	Robot Programming and Simulation Lab	Yes	Yes				Yes
13	Product Design Lab	Yes	Yes				Yes
14	C Programming and MS office tools	Yes				Yes	Yes
15	Communicative English Lab						Yes
16	Python Programming	Yes				Yes	Yes
17	Technical Skill I (Internal Evaluation)		Yes	Yes			Yes
18	Soft Skill I (Career & Confidence Building) (Internal Evaluation)			Yes			Yes
19	Technical Skill II (Internal Evaluation)		Yes	Yes			Yes
20	Soft Skill II (Qualitative and Quantitative Skills)(Internal Evaluation)			Yes			Yes
21	Mini Project/Internship		Yes	Yes			Yes
22	Technical Skill III		Yes	Yes			Yes
23	CAD/CAM Lab		Yes				Yes
24	Industrial Automation						Yes
25	Industrial Automation Lab						Yes
26	Project Phase – 1						
27	Foreign Language (Internal Evaluation)		Yes				Yes

28	Project Phase – 1		Yes		Yes
29	Aerial Robotics	Yes		Yes	Yes
30	Neural Networks	Yes		Yes	Yes
31	Digital Twin Technology	Yes		Yes	Yes
32	IoT for Electrical Engineering	Yes		Yes	Yes
33	Natural Language Processing	Yes		Yes	Yes



DEPARTMENT OF MECHANICAL ENGINEERING B.Tech.Robotics and Automation Curriculum-2022 Regulation

		SEMESTER I						
S.NO.	SUBJECT	SUBJECT NAME	Ty/	L	Τ/	P/R	С	Category
	CODE		Lb/		SLr			
			ETL/IE					
1	EBEN22001	Technical English	Ту	2	0/0	0/0	2	HS
2	EBMA22001	Mathematics – I	Ту	3	1/0	0/0	4	BS
3	EBPH22ET1	Engineering Physics	ETL	2	0/0	2/0	3	BS
4	EBCH22ET1	Engineering Chemistry	ETL	2	0/0	2/0	3	BS
5	EBEE22ET1	Basic Electrical & Electronics Engineering	ETL	2	0/0	2/0	3	ES
6	EBCC22I01	Orientation to Entrepreneurship& Project lab.	IE	1	0/0	1/0	1	ID
7	EBCS22ET1	C Programming and MS office tools	ETL	1	0/0	2/0	2	ID

Credits Sub Total: 18

Note:Ty/Lb/ETL/IE: Theory/Lab/Embedded Theory and lab/Internal evaluation L/T/SLr/P/R/C: Lecture/Tutorials/Supervised Learning/Practical/Research/Credit HS: Humanities and Social Science,

ES:Engg.Science.BS:BasicScience,PC:ProgramCore,PE:ProgramElective,OE: Open Elective,P:Project

	SEMESTER II								
S.N	SUBJECT	SUBJECT NAME	Ty/	L	Τ/	P/R	С	Category	
0.	CODE		Lb/		SLr				
			ETL/IE						
1	EBMA22003	Mathematics – II	Ту	3	1/0	0/0	4	BS	
2	EBPH22002	Engineering Mechanics	Ту	3	0/0	0/0	3	BS/PC	
3	EBCH22002	Industrial Chemistry	Ту	3	0/0	0/0	3	BS	
4	EBME22001	Engineering Graphics	Ту	2	0/0	2/0	3	ES/PC	
5	EBRA22001	Manufacturing Processes	Ту	3	0/0	0/0	3	PC	
6	EBCC22I02	Communicative English Lab	IE	1	0/0	1/0	1	HS	
7	EBCS22ET2	Python Programming	ETL	1	0/0	2/0	2	ID	
8	EBCC22I03	Environmental Science (Audit Course)	IE	1	0/0	1/0	0	HS	

Credits Sub Total: 19

TOTAL CREDITS FOR I YEAR: 37

	SEMESTER III										
S.N	SUBJECT	SUBJECT NAME	Ty/	L	Τ/	P/R	С	Category			
О.	CODE		Lb/		SLr						
			ETL/IE								
1	EBMA22005	Mathematics III for Mechanical	Ту	3	1/0	0/0	4	BS			
1		and Civil Engineers									
2	EBRA22002	Electrical and Electronics Circuits	Ту	3	1/0	0/0	4	PC			
3	EBRA22003	Electrical Machines	Ту	3	0/0	0/0	3	PC			
4	EBME22005	Machine Drawing	Ту	2	0/0	2/0	3	PC			
5	EBME22006	Strength of Materials	Ту	3	1/0	0/0	4	PC			
6	EBEC22ID4	Analog and Digital Electronics	Ту	3	0/0	0/0	3	ID			
7	FBCC22FT1	Universal human values :	FTL	1	0/0	2/0	2	ID			
	LDCC22LTT	Understanding harmony		1	0/0	210	4				
		PRACTI	CALS								
1	EBRA22L01	Electrical and Electronics Circuits	Lb	0	0/0	3/0	1	PC			
		Lab									
2	EBRA22L02	Electrical Machines Lab	Lb	0	0/0	3/0	1	PC			
3	EBME22L03	Strength of MaterialsLab	Lb	0	0/0	3/0	1	PC			
			Cre	edits Su	ub Total		26				

SEMESTER IV									
S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL/IE	L	T/ S.Lr	P/R	C	Category	
1	EBMA22008	Statistical and Numerical Methods	Ту	3	1/0	0/0	4	BS	
2	EBRA22004	Basics of Robotics	Ту	3	0/0	0/0	3	PC	
3	EBRA22005	Kinematics and Dynamics of Machinery	Ту	3	1/0	0/0	4	РС	
4	EBRA22006	Instrumentation and Control Engineering	Ту	3	0/0	0/0	3	РС	
5	EBCC22I04/ EBCC22I05	TheIndian Constitution/ TheIndian Traditional Knowledge(Audit Course)	IE	2	0/0	0/0	0	ID	
		PRACTICAL	S						
1	EBEC22IL4	Analog and Digital Electronics Lab	Lb	0	0/0	3/0	1	ID	
2	EBME22L04	Dynamics Lab	Lb	0	0/0	3/0	1	РС	
3	EBRA22L03	Basics of Robotics Lab	Lb	0	0/0	3/0	1	РС	
4	EBRA22L04	Instrumentation and Control Lab	Lb	0	0/0	3/0	1	РС	
5	EBRA22I01	Technical Skill I	IE	0	0/0	2/0	1	SC	
6	EBCC22I06	Soft Skill I –Employability Skill	IE	0	0/0	2/0	1	SC	

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SEMESTER V											
S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/ Lb/ ETL/IE	L	T/ S.Lr	P/R	C		Category		
1	EBCS22ID5	Artificial Intelligence and Machine Learning	Ту	3	0/0	0/0	3		ID		
2	EBRA22007	Design of Machine Elements	Ту	3	1/0	0/0	4		PC		
3	EBEC22ID6	Processors and Controllers	Ту	3	0/0	0/0	3		ID		
4	EBRA22ET1	Power Electronics and Drives	ETL	2	0/0	2/0	3		PC		
5	EBRA22EXX	Program Elective I	Ту	3	0/0	0/0	3		PE		
6	EBXX22OEX	Open Elective I	Ту	3	0/0	0/0	3		OE		
7	EBOL22I01	Online Course (NPTEL/SWAYAM/MOOC) Any MOOC Online course Approved by AICTE /UGC	IE	1	0/0	1/0	1		ID		
		PRACTICALS	5				•				
1	EBEC22IL5	Processors and Controllers Lab	Lb ()	0/0	3/0	1		ID		
2	EBCS22IL4	Artificial Intelligence and Machine Learning Lab	Lb ()	0/0	3/0	1		ID		
3	EBRA22I02	Technical Skill II	IE ()	0/0	2/0	1		SC		
				Cre	dits Su	ıb Tota	I		23		
		SEMESTER	VI								
S.NO.	SUBJECT CODE	SUBJECT NAME	Ty Lb ETL	/ / /IE	L	T/ S.Lr	P/R	С	Category		
1	EBME22011	CAD,CAM&CIM	Ту		3	0/0	0/0	3	PC		
2	EBME22013	Industrial Automation	Ту		3	0/0	0/0	3	PC		
3	EBEC22ID7	Embedded System Design	Ту		3	1/0	0/0	4	ID		
4	EBRA22EXX	Program Elective II	Ту		3	0/0	0/0	3	PE		
5	EBXX22OEX	Open Elective II	Ту		3	0/0	0/0	3	OE		
		PRACTICA	LS								
1	EBME22L09	Industrial Automation Lab	Lb		0	0/0	3/0	1	PC		
2	EBME22L07	CAD/CAM Lab	Lb		0	0/0	3/0	1	PC		
3	EBCC22I07	Soft Skill II-Qualitative and Quantitative Skills	IE	IE		0/0	2/0	1	SC		
4	EBRA22I03	Technical Skill III	IE		0	0/0	2/0	1	SC		
5	EBRA22I04	Mini Project/Internship	IE		0	0/0	3/0	1	SC		
			Credits Sub Total								

SEMESTER VII									
S.NO.	SUBJECT	SUBJECT NAME	Ty/	L	T /	Category			
	CODE		Lb/		S.Lr				
			ETL/IE						
1	EBRA22008	Kinematics and Dynamics of Robots	Ту	3	1/0	0/0	4	РС	
2	EBRA22EXX	Program Elective III	Ту	3	0/0	0/0	3	PE	
3	EBRA22009	Industrial Applications of Robots	Ту	3	0/0	0/0	3	PC	
4	EBRA22010	Machine Vision System	Ту	3	0/0	0/0	3	PC	
5	EBRA22011	Autonomous Mobile Robots	Ту	3	0/0	0/0	3	PC	
		PRACTICALS							
1	EBXX22OL1	Open Lab	Lb	0	0/0	3/0	1	OL	
2	EBRA22L05	Robot Programming and	Lb	0	0/0	3/0	1	PC	
		Simulation Lab							
3	EBRA22L06	Product Design Lab	Lb	0	0/0	3/0	1	PC	
4	EBRA22I05	Project Phase – I	IE	0	0/0	3/3	2	Р	
5	EBFL22IXX	Foreign Language	IE	1	0/0	1/0	1	HS	
				Cree	lits Sub	Total		22	

SEMESTER VIII										
S.NO.	SUBJECT	SUBJECT NAME	Ty/	Ty/ L T/ P/R C						
	CODE		Lb/		S.Lr					
			ETL/I							
			Ε							
1	EBCC22ID1	Engineering Economics and	Ту	3	0/0	0/0	3	ID		
		Industrial Management								
2	EBRA22EXX	Program Elective IV	Ту	3	0/0	0/0	3	PE		
3	EBRA22EXX	Program Elective V	Ту	3	0/0	0/0	3	PE		
PRACTICALS										
1	EBRE22L07	Project Phase – II	Lb	0	0/0	12/12	8	Р		
					Credit	ts Sub T	otal:	17		

TOTAL CREDITS: 166

C:CreditsL:LectureT:TutorialS.Lr:SupervisedLearningP:Problem/Practical R: ResearchTy/Lb/ETL:Theory/Lab/EmbeddedTheoryandLab *InternalEvaluation Contraction of the second second

PROGRAM ELECTIVE-I									
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	Τ/	P/R	С	Category	
	CODE		/ETL		SLr				
1	EBRA22E01	Maintenance and Safety	Ту	3	0/0	0/0	3	PE	
		Engineering							
2	EBRA22E02	Micro Electro Mechanical Systems	Ту	3	0/0	0/0	3	PE	
3	EBRA22E03	Advanced Strength of Materials	Ту	3	0/0	0/0	3	PE	
4	EBRA22E04	Computer Integrated Manufacturing	Ту	3	0/0	0/0	3	PE	
5	EBRA22E05	Finite Element Analysis	Ту	3	0/0	0/0	3	PE	

		PROGRAM ELECTIVE-II						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	С	Category
	CODE		/ETL/IE		SLr			
1	EBRA22E06	Industrial Networking	Ту	3	0/0	0/0	3	PE
2	EBRA22E07	Total Integrated Automation	Ту	3	0/0	0/0	3	PE
3	EBRA22E08	Micro Robotics	Ту	3	0/0	0/0	3	PE
4	EBRA22E09	Cognitive Robotics	Ту	3	0/0	0/0	3	PE
5	EBRA22E10	Cloud Robotics	Ту	3	0/0	0/0	3	PE
6	EBRA22E11	Medical Robotics	Ту	3	0/0	0/0	3	PE
7	EBRA22E12	Aerial Robots	Ту	3	0/0	0/0	3	PE
		PROGRAM ELECTIVE-III						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	Τ/	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBRA22E13	Virtual Instrumentation	Ту	3	0/0	0/0	3	PE
2	EBRA22E14	Digital TWIN Technology	Ту	3	0/0	0/0	3	PE
3	EBRA22E15	Digital Control System	Ту	3	0/0	0/0	3	PE
4	EBRA22E16	IoT for Electrical Engineering	Ту	3	0/0	0/0	3	PE
	l	PROGRAM ELECTIVE-IV						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	Τ/	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBRA22E17	Digital Signal Processing	Ту	3	0/0	0/0	3	PE
2	EBRA22E18	Neural Networks	Ту	3	0/0	0/0	3	PE
3	EBRA22E19	Wireless Communication	Ту	3	0/0	0/0	3	PE
4	EBRA22E20	VLSI Design	Ту	3	0/0	0/0	3	PE
5	EBRA22E21	Internet of Things	Ту	3	0/0	0/0	3	PE

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		PROGRAM ELECTIVE V						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	Τ/	P/R	С	Category
	CODE		/ETL		SLr			
1	EBRA22E22	Human Computer Interaction	Ту	3	0/0	0/0	3	PE
2	EBRA22E23	Advanced Machine Learning	Ту	3	0/0	0/0	3	PE
3	EBRA22E24	Randomized Algorithms	Ту	3	0/0	0/0	3	PE
4	EBRA22E25	Graph Algorithms	Ту	3	0/0	0/0	3	PE
5	EBRA22E26	System Software	Ту	3	0/0	0/0	3	PE
6	EBRA22E27	Natural Language Processing	Ту	3	0/0	0/0	3	PE

Open Elective courses offered to Robotics and Automation Students

	COMPUTER S	CIENCE AND ENGINEERING						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	С	Category
	CODE		/ETL/IE		SLr			
1	EBCS22OE1	Cyber security & Forensics	Ту	3	0/0	0/0	3	OE
2	EBCS22OE2	Artificial Intelligence	Ту	3	0/0	0/0	3	OE
3	EBCS22OE3	Data Base Concepts	Ту	3	0/0	0/0	3	OE
4	EBCS22OE4	Software Engineering	Ту	3	0/0	0/0	3	OE
	IN	FORMATION TECHNOLOGY						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBIT22OE1	Web Design	Ту	3	0/0	0/0	3	OE
2	EBIT22OE 2	Digital Marketing	Ту	3	0/0	0/0	3	OE
3	EBIT22OE3	Cyber Security Essentials	Ту	3	0/0	0/0	3	OE
4	EBIT22OE4	Introduction to Multimedia	Ту	3	0/0	0/0	3	OE
EL	ECTRONICS A ENG	AND COMMUNICATION INEERING						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBEC22OE1	Internet of Things and its Applications	Ту	3	0/0	0/0	3	OE
2	EBEC22OE2	Cellular Mobile communication	Ту	3	0/0	0/0	3	OE
3	EBEC22OE3	Satellite and its Applications	Ту	3	0/0	0/0	3	OE
4	EBEC22OE4	Fundamentals of Sensors	Ту	3	0/0	0/0	3	OE
5	EBEC22OE5	Microprocessor Based System Design	Ту	3	0/0	0/0	3	OE
6	EBEC22OE6	Industry 4.0 Concepts	Ту	3	0/0	0/0	3	OE

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	ELF	CCTRICAL AND ELECTRONICS	ENGINEE	RINC	J			
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	С	Category
	CODE		/ETL/IE		SLr			
1	EBEE22OE1	Electrical Safety for Engineers	Ту	3	0/0	0/0	3	OE
2	EBEE22OE2	Energy Conservation Techniques	Ту	3	0/0	0/0	3	OE
3	EBEE22OE3	Electric Vehicle Technology	Ту	3	0/0	0/0	3	OE
4	EBEE22OE4	Biomedical Instrumentation	Ту	3	0/0	0/0	3	OE
5	EBEE22OE5	Industrial Instrumentation	Ту	3	0/0	0/0	3	OE
6	EBEE22OE6	Solar Energy Conversion System	Ту	3	0/0	0/0	3	OE
7	EBEE22OE7	Wind Energy Conversion System	Ту	3	0/0	0/0	3	OE
8	EBEE22OE8	Energy Storage Technology	Ту	3	0/0	0/0	3	OE
9	EBEE22OE9	Electrical Machines	Ту	3	0/0	0/0	3	OE
		CIVIL ENGINEERING	T T					
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBCE22OE1	Water Pollution and Its management	Ту	3	0/0	0/0	3	OE
2	EBCE22OE2	Air Pollution Control	Ту	3	0/0	0/0	3	OE
3	EBCE22OE3	Green Building and Vastu Concepts	Ту	3	0/0	0/0	3	OE
4	EBCE22OE4	Climate Change and Sustainable Development	Ту	3	0/0	0/0	3	OE
5	EBCE22OE5	Intelligent Transportation Systems	Ту	3	0/0	0/0	3	OE
6	EBCE22OE6	Environment, Health and Safety in Industries	Ту	3	0/0	0/0	3	OE
7	EBCE22OE7	Industrial Pollution Prevention and Cleaner Production	Ту	3	0/0	0/0	3	OE
8	EBCE22OE8	Fundamentals of nanoscience	Ту	3	0/0	0/0	3	OE
		BIOTECHNOLOGY						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBBT22OE1	Food and Nutrition	Ту	3	0/0	0/0	3	OE
2	EBBT22OE2	Human Physiology	Ту	3	0/0	0/0	3	OE
3	EBBT22OE3	Clinical Biochemistry	Ту	3	0/0	0/0	3	OE
4	EBBT22OE4	Bioprocess Principles	Ту	3	0/0	0/0	3	OE
5	EBBT22OE5	Biosensors and Biomedical Devices in Diagnostics	Ту	3	0/0	0/0	3	OE
6	EBBT22OE6	Basic Bioinformatics	Ту	3	0/0	0/0	3	OE

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CHEMICAL ENGINEERING

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S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	Τ/	P/R	С	Category
	CODE		/ETL/IE		SLr			
1	EBCT22OE1	Fundamentals of Nanoscience	Ту	3	0/0	0/0	3	OE
2	EBCT22OE2	Electrochemical Engineering	Ту	3	0/0	0/0	3	OE
3	EBCT22OE3	Alternative Fuels And Energy System	Ту	3	0/0	0/0	3	OE
4	EBCT22OE4	Petrochemical Unit Processes	Ту	3	0/0	0/0	3	OE
5	EBCT22OE5	Principles of Desalination Technologies	Ту	3	0/0	0/0	3	OE
6	EBCT22OE6	Piping Design Engineering	Ту	3	0/0	0/0	3	OE
7	EBCT22OE7	E- Waste Management	Ту	3	0/0	0/0	3	OE
		Dr APJ Abdul Kalam Center For	Research					
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	Τ/	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBMG22OE1	Technical Entrepreneurship	Ту	3	0/0	0/0	3	OE
2	EBMG220E2	Advanced Program in Entrepreneurship	Ту	3	0/0	0/0	3	OE

Open labs offered to Robotics and Automation Students

(COMPUTER SC	CIENCE AND ENGINEERING						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	Τ/	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBCS22OL1	Artificial Intelligence Lab	Lb	0	0/0	3/0	1	OL
2	EBCS22OL2	PHP/My SQL Programming Lab	Lb	0	0/0	3/0	1	OL
3	EBCS22OL3	Database Lab	Lb	0	0/0	3/0	1	OL
	INFORMATI	ON TECHNOLOGY						
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	С	Category
	CODE		/ETL/IE		SLr			
1	EBIT22OL1	Visual Programming Lab	Lb	0	0/0	3/0	1	OL
2	EBIT22OL2	Web Design Lab	Lb	0	0/0	3/0	1	OL
3	EBIT22OL3	Digital content creation Lab	Lb	0	0/0	3/0	1	OL
4	EBIT22OL4	Computer Network Lab	Lb	0	0/0	3/0	1	OL
5	EBIT22OL5	PHP/My SQL Programming Lab	Lb	0	0/0	3/0	1	OL
	ELECT	TRONICS AND COMMUNICATIO	ON ENGINI	EERI	NG			
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	C	Category
	CODE		/ETL/IE		SLr			
1	EBEC22OL1	Sensors and IoT Lab	Lb	0	0/0	3/0	1	OL
2	EBEC22OL2	Robotics Control Lab	Lb	0	0/0	3/0	1	OL
3	EBEC22OL3	Basics of MATLAB	Lb	0	0/0	3/0	1	OL

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	ELI	ECTRICAL AND ELECTRONICS	ENGINEEI	ang				
S.NO.	S.NO. SUBJECT SUBJECT NAME Ty/Lb L T/ P/R C							Category
	CODE		/ETL/IE		SLr			
1	EBEE22OL1	Transducer Lab	Lb	0	0/0	3/0	1	OL
2	EBEE22OL2	PLC and SCADA Lab	Lb	0	0/0	3/0	1	OL
3	EBEE22OL3	Electrical Maintenance Lab	Lb	0	0/0	3/0	1	OL
4	EBEE22OL4	Power Electronics Lab	Lb	0	0/0	3/0	1	OL
5	EBEE22OL5	Bio Medical Instrumentation Lab	Lb	0	0/0	3/0	1	OL
6	EBEE22OL6	Electrical Machines Lab	Lb	0	0/0	3/0	1	OL
		CIVIL ENGINEERING	ר ד					
S.NO.	SUBJECT	SUBJECT NAME	Ty/Lb	L	T /	P/R	С	Category
	CODE		/ETL/IE		SLr			
1	EBCE22OL1	Building Drawing Practice using Auto CADD	Lb	0	0/0	3/0	1	OL
2	EBCE22OL2	Geographical Information System And Mapping Lab	Lb	0	0/0	3/0	1	OL
3	EBCE22OL3	Environmental Engineering Laboratory	Lb	0	0/0	3/0	1	OL

BIOTECHNOLOGY												
S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	С	Category				
1	EBBT22OL1	Basic Biochemistry Lab	Lb	0	0/0	3/0	1	OL				
2	EBBT22OL2	Basic Bioprocess Lab	Lb	0	0/0	3/0	1	OL				
3	EBBT22OL3	Basic Microbiology Lab	Lb	0	0/0	3/0	1	OL				
4EBBT22OL4Basic Bioinformatics LabLb00/03/01												
CHEMICAL ENGINEERING												
S.NO.	SUBJECT CODE	SUBJECT NAME	Ty/Lb/ ETL	L	T/ SLr	P/R	С	Category				
1	EBCT22OL1	Chemical Separation Lab	Lb	0	0/0	3/0	1	OL				
2	EBCT22OL2	Chemical Composition Analysis Lab	Lb	0	0/0	3/0	1	OL				
3	EBCT22OL3	Alternate Fuel Lab	Lb	0	0/0	3/0	1	OL				
4	EBCT22OL4	Food Testing Laboratory	Lb	0	0/0	3/0	1	OL				



CREDIT SUMMARY

- Semester:1 : 18Credits
- Semester:2 : 19Credits
- Semester:3 : 26Credits
- Semester:4 : 20Credits
- Semester:5 : 23Credits
- Semester:6 : 21Credits
- Semester:7 : 22Credits
- Semester:8 : 17 Credits

TOTALCREDITS: 166 Credits



SEMESTER I



Subject Code : EBEN22001	Subject Nam TECHNICA	ne :	ENG	LISH		uvoju	i) ener			,	Ty/Lb / ETL/I	L	T/S	SLr	P/ R	C
	Draraquisita	·Niji									E Tr	2	0/0		0/0	2
	riciequisite	.1111									I y	4	0/0		0/0	4
C: Credits, L:	Lecture, T: T	utor	ial, S	Lr: Su	pervis	sed L	earr	ning, P:	Pro	blei	m / Pract	ical				
R: Research,	1 y/L0/E1L/1E 7 S	2: 10	eory	/Lau/E	linded	aea	Theo	ory and	Lao	/ 111	ernal Ev	aluatic	011			
To refresh an	d stimulate st	uder	nts' F	Inolish	learn	ino t	hron	10h Con	ntent	t In	teorated	Lanou	age Lea	rnin	σ to ha	ive
an in-depth u	nderstanding of	of th	e cor	nponer	ts of l	Engl	ish l	anguag	e and	d it	s use in o	commi	inication	tha	t they a	are
competent in	inter-personal	and	acad	emic c	ommu	inica	tion	for a si	ucces	ssfu	il career.				e eneg e	
COURSE OU	UTCOMES (Cos)														
Students com	pleting this co	ourse	wer	e able t	0											
CO1	Refresh and	stim	ulate	their H	Englisl	n lea	rning	g throu	gh C	ont	ent Integ	rated I	Languag	e Le	arning	
CO2	Have an in-	-dep	th u	ndersta	nding	of	the	compo	nent	s o	f Englis	h lang	guage an	nd i	ts use	in
	communicat	ion.			U			1			U	2	0			
CO3	Strengthen t	their	voc	abulary	and	syn	tacti	c know	vledg	ge	for use	in aca	ademic a	and	techni	cal
	communicat	ion														
CO4	Learn to neg	earn to negotiate meaning in inter-personal and academic communication for a successful														
	career	career														
CO5	Engage in or	gani	zed a	academ	ic and	l pro	fessi	ional w	riting	g fo	or life-lor	ng lear	ning and	rese	earch	
Mapping of O	Course Outco	ome	with	Progr	am O	utco	me ((POs)			-					
Cos/POs	PO1	PO	2 P	O P	O P	0	PO	PO7	' P0	0	PO9	PO1	PO1	PC	012	
			3	4	5		6		8			0	1			
CO1	1	-	1	1	3		1	1	2		3	3	1	3		
CO2	-	1	-	2	3		2	1	1		3	3	-	3		
CO3	1	1	1	1	2		I	-	2		3	3		3		
C04	1	2		1	3		-	1	-		2	2	1	2		
CO_{S}/PSO_{S}	1	Z	DS()1		2	1	- 	PSO	13	3	ן ב	1	3		
CO1			3	71	150	2			1	,5		1	504			
CO^2			3						1			1				
CO3			3		2				1			1				
CO4			3		2				1			1				
CO5			3		2				1			1				
3/2/1 Indicates	s Strength Of	Corr	elatio	on, 3 – 1	High, 2	2- M	ediu	m, 1- L	ow	T				·		
Category	Basic Science		Engineeri no	Humanities and	social Science	Program	Core	Program elective	Open Elective	Inter	Disciplinary	Skill Component	4		Practical /Project	

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Subject Code	Subject Name :	Ty/Lb/	L	T/SLr	P/R	С
	TECHNICAL ENGLISH	ETL/IE				
EBEN22001	Prerequisite :Nil	Ту	2	0/0	0/0	2

Unit I Vocabulary Development:

Affixes: prefixes and suffixes and word formation-synonyms and antonyms-nominal compounds, expanding using numbers and approximation - preposition, prepositional phrases, preposition + relative pronoun- adjective: degrees of comparison, formation of adjectives, irregular comparatives- Infinitive and Gerunds

Unit II Grammar

Tenses- auxiliary and modal -voice: active, passive and impersonal passive - Questions: Wh-pattern, Yes/no questions, tag questions - adverbs and adverbial clauses- 'If' clause, 'cause and effect', 'purpose'- Concord: subjectverb agreement

Unit III Reading

Comprehension: extracting relevant information from the text, by skimming and scanning and inferring, identifying lexical and contextual meaning for specific information, identifying the topic sentence and its role in each paragraph, comprehension exercises - Note - making - Précis writing-instructions, suggestions and recommendations.

Unit IV Writing

Jumbled sentences- paragraph writing coherence devices- discourse markers. Essay writing- Letter writing, Informal and formal: seeking permission to undergo practical training, letter to an editor of a newspaper complaining about civic problems and suggesting suitable solutions

Unit V Visual Aids in Communication

Interpretation of diagrams - tables, flow charts, pie charts and bar charts, and their use in Business reports Total no.of Periods: 30

Text book

1. Panorama : Content Integrated for Engineers, Language Learning M. ChandrasenaRajeswaran&R.Pushkala,, Vijay Nicole Imprints Pvt. Ltd., Chennai

References

- 1. Bhatnagar&Bhatnagar, Communicative English for Engineers and Professionals, Pearson
- 2. Wren and Martin: Grammar and Composition, Chand & Co, 2006
- 3. https://learnenglish.britishcouncil.org
- 4. www.better-english.com/grammar/preposition.



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SubjectC	ode:	Subject	Name:N	ЛАТНЕ	MATIC	S–I	Ty/I /ET	Lb L	L	T/ SLr	P/R	С			
EBMA22	2001	Prerequ	uisite:Ni	il			Ту		3	1/() 0/0	4			
L:Lecture]	Tutoria	dSLr:Su	pervised	Learni	ng										
P:ProjectR	:Researc	hC:Cred	litsT/L/I	ETL:Th	eory/Lat)/Embed	dedTh	eoryan	dLab						
OBJECTIV	VES:				-										
•	Apply	the Basic	concepts	s in Alge	ebra										
•	Use the	e Basic co	oncepts i	n Matric	ces										
•	Identif	y and solv	ve proble	em sinTi	rigonome	try									
•	Unders	stand the	Basic co	ncept si	n Differei	ntiation									
•	Apply	the Basic	concept	sin Fun	ctions of	Several	variable	s							
COURSEC	OUTCON	IES(Cos)	:(3 –5)												
Students co	mpleting	the cours	e were a	ble to											
CO1	Find the	e summati	ion of th	e given :	series of l	oinomial	,expone	ntial&	logarith	ımic					
CO2	Transfo	rmation-	diagonal	matrix i	nto an eq	uivalent	diagona	l matri	x using	orthogon	al				
	Transfo	rmation.													
CO3	Find ex	pansion o	f trigono	ometric f	function i	nto an in	finite se	eries an	d to sep	arate a co	omplex fu	nction			
	Into real and imaginary parts.														
CO4	Apply knowledge and concepts in finding the derivative of given function and to find the maxima/														
	Minima of the given function.														
CO5	Evaluat	e theparti	al/ total	different	tiation an	d maxim	a/minin	na of a	function	n of sever	ral variabl	es.			
Mappingof	CourseO	utcomes	withPro	ogramO	utcomes	(POs)									
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
<u>CO1</u>															
	3	3			2	2			3	3		3			
CO3	3	3			2				2	3		3 1			
CO4	3	3			1				2	3		2			
CO5	3	3				2			2	2		3			
3/2/1 Indicat	tes Stren	gth Of Co	orrelatio	on, 3 – I	ligh, 2- N	Aedium,	1- Low	7							
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D rono quigito Nil	SubjectCode: EBMA22001	SubjectName:MATHEMATICS-I	Ty/Lb /ETL	L	T/ SLr	P/R	С
Ty 3 1/0 0/0		Prerequisite:Nil	Ту	3	1/0	0/0	4

UNIT I ALGEBRA

Binomial,Exponential,Logarithmic Series(without proof of theorems)–Problems on Summation,Approximation and Coefficients.

UNIT II MATRICES

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values – Cayley –Hamilton theorem (without tproof) –Orthogonal reduction of asymmetric matrix to Diagonal form.

UNIT III TRIGONOMETRY

Expansions of Sin \square , Cos \square in powers of Sin \square and Cos \square Expansion of Tan \square – Expansions of Sin \square and Cos \square in terms of Sines and Cosines of multiples of \square – Hyperbolic functions –Separation into real and imaginary parts.

UNIT IV DIFFERENTIATION

Basic concepts of Differentiation–Elementary differentiation methods–Parametric functions –Implicit function–Leibnitz theorem (without proof)– Maxima and Minima– Points of inflection.

UNIT V FUNCTIONS OF SEVERAL VARIABLES

Partial derivatives–Total differential–Differentiation of implicit functions–Taylor's expansion –Maxima and Minimal by Lagrange'sMethod of undetermined multipliers–Jacobians.

Total no.of periods: 60

Text & Reference Books:

1. Kreyszig E., Advanced Engineering Mathematics (10th ed.), John Wiley & Sons, (2011).

- 2. Grewal B.S., *Higher Engineering Mathematics*, Khanna Publishers, (2012).
- **3.** John Bird, *Basic Engineering Mathematics* (5th ed.), Elsevier Ltd, (2010).
- 4. Veerarajan T., Engineering Mathematics (for first year), Tata McGraw Hill Publishing Co., (2008).
- **5.** P.Kandasamy, K.Thilagavathy and K. Gunavathy, *Engineering Mathematics Vol. I (4th Revised ed.)*, S.Chand& Co., Publishers, New Delhi (2000).
- **6.** John Bird, *Higher Engineering Mathematics* (5th ed.), Elsevier Ltd, (2006).

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Subject Co	ode		Subject	Name :	ENGI	NEERI	ING I	PHYS	Ty/ ET	Lb/ L	L	T/ SLr	P/R	С		
EBPH22E	T1		Prerequ	isite :N	il					ET	L	2	0/0	2/0	3	
C: Credits	s, L: Leo	cture,	, T: Tuto	rial, SI	Lr: Sup	pervise	ed Le	earnir	ig, P	: Probl	em / Pr	actical				
R: Resear	ch, Ty/l	Lb/E	ΓL/IE: T	heory /	/Lab/Ei	nbedd	led T	heory	y and	Lab/I	nternal	Evaluat	ion			
OBJECTI	VES	1				. .		0		1 1						
• Ot	ween S	science	, Engi	neeri	ng &	Tec	hnolog	y.								
 Demonstrate competency in understanding Apply fundamental laws of Physics in Engine 							basi	c con	cepts	S.	~ * *					
• Al	ppiy iun		ental law	'S OI PI	lysics 1	n Eng		ing o		chnolog	gy.					
• 10 • Dr	oduce a	$y \propto s$	solve pro	tivitios		mysic atod u	s con	he co).	throug	h affact	ive tech	nical co	mmunic	ention	
COURSE	uvines	associ	aleu w	'iui u		uise	unoug				Jiiiiiuiiic	ation				
Students completing this course were able to																
CO1Demonstrate competency in understandi						tandin	g bas	sic co	ncep	ots.						
CO2 Utilize scientific methods for formal inve						estig	ation	s &	demon	strate o	compete	ncy wit	h experi	mental		
methods and verify the concept to content knowledge								ge.			-	-	-			
CO3 Identify and provide solution						nginee	ering	prob	lems	•						
CO4 Relate the technical concepts to day to day						y life	e and	to pr	actical	situati	ons.					
CO5 Think analytically to interpret concepts.																
Mapping of Course Outcome with Program Outcom							<u>ne (P</u>	Os)								
Cos/POs	PO1	PO2	2 PO3	PO4	PO5	O5 PO6		07 F	PO8	PO9	PO10	PO11	PO12			
C01 C02	3	3	1	2	2	2	1			1	2	1	1		-	
CO_2	3	3	2	$\frac{2}{2}$	$\frac{2}{2}$	$\frac{2}{2}$	1	1		2	2	1	2			
CO4	3	3	2	2	1	2	2	1		2	2	1	2			
CO5	3	3	2	1	1	2	1	2 J		1	2	1	1			
COs/PSOs			PSO1		PSO2	D2 PSO3					PSO4					
CO1			3		2	1				1						
CO2			3	2				1			1					
<u>CO3</u>			3		2			1			1					
CO4 CO5			3		2			1		1						
3/2/1 India	rates Sti	rengt) h Of Cor	relatio	_∠ n 3_H	ligh 2	- Mer	lium	1. L	ow	1					
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SubjectCode EBPH22ET1	SubjectName:ENGINEERING PHYSICS	Ty/Lb /ETL	L	T/ SLr	P/R	C	
	Prerequisite:Nil	ETL	2	0/0	2/0	3	

UNIT I **PROPERTIES OF MATTER**

Elasticity - stress, strain and Hook's law - Poisson's ratio - three moduli of elasticity - twisting couple on a wire - Shafts - Solid & Hollow Shafts - Bending moment - Youngs Modulus Determination -I form of girders.

viscosity - flow of liquid through a narrow tube: Poiseuille's law - Ostwald's viscometer - Lubrication Lab Component – 1. Torsional Pendulum – Determination of Rigidity Modulus

2. Coefficient of Viscosity determination using Poiseuille's Method

UNIT II **ACOUSTICS & ULTRASONICS**

Fundamentals of acoustics - reverberation- reverberation time - factors affecting acoustics.Ultrasonics -Production of ultrasonic waves - detection of ultrasonic waves - acoustic grating - application of ultrasonic waves.

Lab Component – 3. Ultrasonic Velocity Determination UNIT III WAVE OPTICS

Huygen's principle - interference of light – wave front splitting and amplitude – air wedge - Newton's rings - Michelson interferometer and its applications - Fraunhofer diffraction from a single slit - diffraction grating

Lab Component – 4. Spectrometer – Grating UNIT IV LASER

Laser principle and characteristics - amplification of light by population inversion - properties of laser beams: mono-chromaticity, coherence, directionality and brightness - different types of lasers - Ruby laser-Nd-YAG laser-He-Ne laser-CO₂ laser - semiconductor laser - applications of lasers in science, engineering and medicine.

Lab Component – 5. Determination of Wavelength of the given Laser source UNIT V FIBER OPTIC COMMUNICATION

Total Internal Reflection - Propagation of Light in Optical Fibers - Numerical aperture and Acceptance Angle – Types of Optical Fibers (material, refractive index, mode) – Fiber Optical Communication system (Block diagram) - Attenuation-Transmitter, Receiver, Dispersion, Modulation/Demodulation Advantages of Fiber Optical Communication System - IMT, PMT, Wavelength Modulated & Polarization Modulated Sensors – Endoscope Applications.

Lab Component - 6. Determination of Numerical Aperture of Optical Fiber

TEXT BOOKS

1Brijlal, M.N.Avadhanulu&N.Subrahmanyam, TextBookofOptics, S.ChandPublications, 25thedition, 20 2.R. Murugeshan, Electricity and Magnetism, S. ChandPublications, 10th edition, 2017

3.R.Murugeshan&KiruthigaSivaprasath, ModernPhysics, S.ChandPublications, 2016

REFERENCE BOOKS

- 1. Dr.SenthilKumarEngineering PhysicsIVRBPublishers, 2016
- 2. N Subrahmanyam&Brijlal, Waves and Oscillations, Vikas Publications, NewDelhi, 1988
- 3. NSubrahmanyam&Brijlal, Properties of Matter, S. ChandCo., NewDelhi, 1982
- 4. NSubrahmanyam&Brijlal,TextbookofOptics,S.ChandCo.,NewDelhi,1989
- 5. R.Murugeshan, Electricity and Magnetism, S. Chand & Co., New Delhi, 1995

6. ThygarajanK&AjayGhatak,LaserTheoryand Applications,Macmillan,NewDelhi,1981

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Total No of Periods: 60

31

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EDUCATIONAL AND RESEARCH INSTITUT	
University with Graded Autonomy Status	
(An ISO 21001 : 2018 Certified Institution)	

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CO1	Apply re	elevant i	nstrume	ntation t	echniques to solve complex problems												
CO2	Recall th	and der	nonstrate by understanding the first principles of Engineering sciences.														
CO3	Examine	the app	oropriate	e techniq	ues to i	nter	pret da	ata 1	to pro	ovide	valid con	clus	ion				
CO4 Demonstrate the collaboration of science and Engineering to recognize the need for life long learning.																	
CO5	5 Analyse the impact of contextual knowledge to access the health and society issues.																
Mapping of Course Outcome with Program Outcome (POs)																	
Cos/POs	PO4	PO5	P	06	PO	07	PO8	PO9	PC	010	PO11	PC	012				
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SubjectCode: EBCH22ET1	Subject Name:ENGINEERING CHEMISTRY	Ty/Lb /ETL	L	T/ SLr	P/R	С
	Prerequisite:Nil	ETL	2	0/0	2/0	3

UNIT -I CHEMICAL THERMODYNAMICS

Introduction, Terminology in thermodynamics -System, Surrounding, State and Path functions, Extensive and intensive properties.Laws of thermodynamics - I and II laws-Need for the II law.Enthalpy, Entropy, Gibbs free energy, Helmholtz free energy - Spontaneity and its criteria.Maxwell relations, Gibbs -Helmholtz equation (relating E & A) and (relating H & G). 12

UNIT -II TECHNOLOGY OF WATER

Water quality parameters – Definition and expression. Analysis of water – alkalinity, hardness and its determination (EDTA method only).Boiler feed water and Boiler Troubles-Scales and sludges, Caustic embrittlement, Priming and Foaming and Boiler corrosion. Water softening processes – Internal conditioning, external conditioning – Demineralization methods. Desalination processes-RO and Electrodialysis.

Lab Component-1. Analyze the water quality parameters for the given water sample.

UNIT -III ANALYTICAL AND CHARACTERIZATION TECHNIQUES

Chromatographic techniques - column, thin layer and paper. Instrumentation-working with block diagram- UV-Visible Spectroscopy, IR Spectroscopy, Scanning electron microscope, Transmission electron microscope.

Lab Component-2.Determination of Rf values of various components using thin layer chromatography.

3. Compute and interpret the structures of the given molecules using Chem Draw.

UNIT – IV ELECTROCHEMISTRY

Conductance – Types of conductance and its Measurement. Electrodes and electrode potential, Nernst equation – EMF measurement and its applications-Electrochemical series- Types of electrodes- Reference electrodes-Standard

hydrogen electrode- Saturated calomel electrode-Determination of P^H using these electrode.

Lab Component-4.Studies on acid-baseconductometric titration.

5. Determination of redox potentials using potentiometry

UNIT - VPOLYMERS AND NANO COMPOSITES

Polymers-Introduction-Monomers - Functionality - Degree of polymerization-Tacticity. Classification- Plastics -Thermoplastics and thermosetting plastics, Compounding of plastics – Compression moulding, injection moulding and extrusion processes. Nano composites:particulates, clay and carbon nanotubes. Graphenenano composites and its applications.

Lab Component-6.Polymeric analysis using capillary viscometer

References

1. Jain & Jain Engineering Chemistry 17th Edition, DhanpatRai Publishing Company

2. Vasant R. Gowariker, N. V. Viswanathan, JayadevSreedhar, Polymer Science, New Age International, 1986

3. B.K. Sharma, Polymer Chemistry, Goel Publishing House

4. Y. R. Sharma , *Elementary Organic Spectroscopy*, S. Chand& Company Ltd.

5. N.Krishnamurthy, K.Jeyasubramanian, P.Vallinayagam, Applied Chemistry, Tata McGraw-Hill Publishing Company Limited, 1999.

6. Chichester, polymer-clay-nano composites, Johnwiley (2000)

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Total No.of periods: 60

12



EBEE22ET1 Prerequisite : Nil ETL 2 0/0 2/0 3 C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation OBJECTIVES • Understand the concepts of circuit elements, circuit laws and coupled circuits. • Gain information on measurement of electrical parameters													
 C: Credits, L: Lecture, T: Tutorial, SLr: Supervised Learning, P: Problem / Practical R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation OBJECTIVES Understand the concepts of circuit elements, circuit laws and coupled circuits. Gain information on measurement of electrical parameters. 													
 R: Research, Ty/Lb/ETL/IE: Theory /Lab/Embedded Theory and Lab/Internal Evaluation OBJECTIVES Understand the concepts of circuit elements, circuit laws and coupled circuits. Gain information on measurement of electrical parameters. 													
 OBJECTIVES Understand the concepts of circuit elements, circuit laws and coupled circuits. Gain information on measurement of electrical parameters. 													
 Understand the concepts of circuit elements, circuit laws and coupled circuits. Gain information on measurement of electrical parameters. 													
Gain information on measurement of electrical parameters.													
• Gain information on measurement of electrical parameters.													
• Acquire knowledge on conventional & non-conventional energy production.													
• Identify basic theoretical principles behind the working of modern electronic gadgets.													
 Demonstrate digital electronic circuits and assemble simple devices 													
COURSE OUTCOMES (Cos)													
Students completing this course were able to													
CO1 Compute the electric circuit parameters for simple problems													
CO2 Elaborate the concepts of Electrical machines and measurement principles													
CO3 Identify conventional and Non-conventional Electrical power Generation, Transmission and													
Distribution													
CO4 Analyze the working principles and characteristics of analog electronic devices													
CO5 Understand basics of digital electronics and solving problems and design combinational circuits													
Mapping of Course Outcome with Program Outcome (POs)													
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SubjectCode: EBEE22ET1	Subject Name : BASIC ELECTRICAL & ELECTRONICS ENGINEERING	Ty/Lb/ ETL	L	T/ SLr	P/R	С
	Prerequisite:Nil	ETL	2	0/0	2/0	3

UNIT I ELECTRIC CIRCUITS

Electrical Quantities – Ohms Law – Kirchhoff's Law – Series and Parallel Connections – CurrentDivision and Voltage Division Rule - Source Transformation – Wye (Y) – Delta (Δ) , Delta (Δ) – Wye (Y) Transformation – Rectangular to Polar and Polar to Rectangular

Lab Components – Measurement of Electrical Quantities

EDUCATIO

UNIT II MACHINES & MEASURING INSTRUMENTS

Construction & Principle of Operation of DC motor & DC Generator – EMF equation of Generator – Torque Equation of Motor – Construction & Principle of operation of Transformer –Operating principles and Types of measuring instruments – Moving coil, Moving iron – Principle of Energy meter

Lab Component – Measurement of Energy Using energy meter

UNIT III BASICS OF POWER SYSTEM

Generation of Electric Power (Thermal, Hydro, Wind and Solar) – Basic structure of Power system – Types of Transmission & Distribution Schemes – Representation of Substation.

Lab Component – Residential house wiring

Stair case wiring

UNIT IV ELECTRON DEVICES

Semiconductor Materials: Silicon and Germanium – PN Junction Diode, Zener Diode – Characteristics and Applications – Bipolar Junction Transistor - JFET, SCR, MOSFET, IGBT –Characteristics and Applications – Operating principle - Rectifiers and Inverters

Lab Component – Resistor colour coding -Resistance Measurement

UNIT V DIGITAL SYSTEM

Number System – Binary, Decimal, Octal, Hexadecimal – Binary Addition, Subtraction, Multiplication & Division – Boolean Algebra – Reduction of Boolean Expressions – Logic Gates - De-Morgan's Theorem - Adder – Subtractor Lab Component - Soldering practice, Logic Gates

Total no of Periods: 60

TEXT BOOKS:

- 1. D P Kothari, I J Nagrath, 2017, Basic Electrical Engineering, Second Edition, Tata McGraw-Hill Publisher
- 2. A.K. Sawhney, 2015 A Course in Electrical and Electronic Measurements and Instrumentation, DhanpatRai& CO publisher
- 3. B.L. Theraja, A.K. Theraja, Text Book of Electrical Technology: Volume 3: Transmission, Distribution and Utilization, S. Chand publisher
- 4. Morris Mano, M, 2016 Digital Logic and Computer Design, Prentice Hall of India
- 5. Millman and Halkias 2015, Electronic Devices and Circuits, Tata McGraw Hill

REFERENCE BOOKS:

1. R. Muthusubramanian, S. Salivahanan, K A Muraleedharan, Basic Electrical, Electronics and Computer Engineering, Second Edition, Tata McGraw-Hill publisher



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CO4	Analyze	the lo	cal ma	rket en	vironme	ent & d	len	nonst	rate tl	ne abili	ty to fi	nd an a	attract	ive
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CO5	or entre	preneu	rsh	ip &	deve	lop								
Mapping of	Course C	Outcom	e with	Progra	m Outc	ome (P	Os)						
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CO4		3	2	2	2	2	2		3	2	2	3	1	
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ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India. TO Ty/Lb/ SubjectCode: L T/SLr P/R С SubjectName:ORIENTATION **EBCC22I01** ETL/IE **ENTREPRENEURSHIP & PROJECT LAB Prerequisite:Nil** IE 1 0/0 1/0 1

STITUTE

CHARACTERISTICS OF A SUCCESSFULL ENTREPRENEUR UNITI

Introduction to entrepreneurship education – Myths about entrepreneurship – How has entrepreneurshipchanged the country - Dream it. Do it - Idea planes - Some success stories - Global Legends - Identifyyourownheroes -

UNIT II ENTREPRENEURIAL STYLE

EDUCAT

Entrepreneurial styles - Introduction, concept & Different types - Barrier to Communication -Bodylanguage speakslouderthanwords

UNIT III DESIGN THINKING

Introduction to Design thinking - Myth busters - Design thinking Process - Customer profiling -Wowing your customer – Personal selling – concept & process – show & tell concept – Introduction to the concept of Elevator Pitch

UNIT IV RISK MANAGEMENT

Introduction to risk taking & Resilience – Managing risks (Learning from failures, Myth Buster) – Understandingrisksthroughrisktakers -WhydoIdo?-whatdoIdo?

UNIT V PROJECT

How to choose a topic - basic skill sets necessary to take up a project- creating a prototype -Pitchyourproject-Projectpresentation.

IDEA GENERATION, EVALUATION & PROJECT PRESENTATION

37

Total No.of Periods: 30



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Subject Code:	C PR	OGRAM	IING A	ND MS	OFFIC	E TOOL	S	T	y/Lb/	L	T /	P/F	R	С
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	Prerec	quisite: Nil							ETL	1	0/0	2/0		2
C: Credits, L: Le	cture,	T: Tutoria	l, SLr:	Supervi	ised Lea	rning, P:	Problem	n / Prac	tical					
R: Research, Ty/	Lb/ET	L/IE: Theo	ory /Lat	/Embe	dded Th	eory and	Lab/Int	ernal Ev	aluation					
OBJECTIVES :														
The student shou	ıld be r	nade to:												
• learn a pro	ogramm	ing langua	ge.											
 learn prob 	lem sol	ving techni	ques.											
• write prog	rams in	C and to s	olve the	problem	ıs.									
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COURSE OUTC	OMES	(COs):Af	ter Con	pleting	the cour	rse, the s	tudent ca	in be ab	le to					
COI	Under	rstand and t	race the	execution	on of pro	grams wr	ritten in C	languag	ge.					
CO2	Write	the C code	for a gi	ven algo	orithm.									
CO3	Apply	Arrays an	d Funct	ions con	cepts to	write Pro	grams							
CO4	Apply	/ Structure	s and po	inters co	oncepts fo	or writing	Program	IS	1					
<u>CO5</u>	pertor	rm docume	ntation,	account	ing opera	ations and	l presenta	tion ski	ls					
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CO3	2	2	3	2	1	1	1	1	1	1	3		2	
CO4	2	2	3	3	1	1	1	1	1	1	3		2	
CO5	1	1	1	1	1	1	0	0	2	3	2		0	
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Subject Code:	C PROGRAMMING AND MS OFFICE TOOLS	Ty/Lb/	L	Τ/	P/R	С
EBCS22ET1		ETL		S.Lr		
	Prerequisite: Nil	ETL	1	0/0	2/0	2

UNIT I INTRODUCTION

Basic Structure of C programme- Constants, Variables and data types, Keywords, Identifiers- Operators and expressions- executing a C Program

UNIT IIDECISION MAKING STATEMENTS AND LOOPING STATEMENTS3

Decision making with if statement, Simple if statement, else-if statement, Nesting if-else statement, The else if ladder, The switch statement, The goto statement, The while statement, The do while statement, The for statement, jumps in loops

UNIT III ARRAYS AND FUNCTIONS

Introduction to Arrays- One dimensional arrays, Two dimensional array, and Multidimensional array- Introduction to Functions- calling a function, category of functions- arguments with return values, argument with no return values-parameter passing Mechanism: Call by Value and Call by Reference. Recursion.

UNIT IV STRUCTURES& POINTERS

Structures definition, giving values to members, Structure initialization, comparison of structure variables, Structure within structures, Understanding pointers, accessing the address of the variable, declaring and initializing pointer, accessing a variable through its pointer and arrays

UNIT V MS-OFFICE

Introduction to MS-Word- Menus- Introduction to MS-Excel: features of MS- Excel, spread sheet/worksheet, parts of MS-excel window, functions in excel sheet, chart, Introduction to MS-Power point

TEXT BOOKS:

- 1. E.Balaguruswamy, Programming in ANSI C
- 2. Padma Reddy ,Computer Concepts & 'C' Programming
- 3. ShobhaHangirke,Computer Application For Business List of Experiments : C PROGRAMMING
- 1. Find the factorial of a given positive number using function.
- 2. Calculate X raisedto y using function.
- 3. Find GCD and LCM of two given integer numbers using function.
- 4. Find the sum of N natural numbers using function.
- 5. Book information using Structure.
- 6. Student information using Structure.
- 7. Print the address of a variable and its value using Pointer
- 8. Find area and perimeter of a circle
- 9. Check whether the given number is palindrome or not
- 10. Check whether the given number is prime or not
- 11. Calculate sum of the digits of the given number
- 12. Display Fibonacci series up to N terms
- 13. Check whether a given character is alphabetic, numeric or special character
- 14. Count vowels and consonants in a given string
- 15. Find product of two matrices
- **MS-OFFICE**
- 16. Preparing a news letter:
- 17. To prepare a newsletter with borders, two columns text, header and footer and inserting a graphic image and page layout.
- 18. Creating and editing the table
- 19. Printing envelopes and mail merge.
- 20. Using formulas and functions: To prepare a Worksheet showing the monthly sales of a company in different branch offices
- 21. Prepare a Statement for displaying Result of 10 students in 5 subjects

39

30 periods

Total No. of Periods: 45

3

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SEMESTER II



Subject Code: EBMA22003	Subject	t Name :	MATH	ЕМАТ			Ty E1	/Lb/	L		T/ S Lr	P/R	. (С		
	Prerequ	uisite: M	athemati	ics -I					Ту		3		1/0	0/0	4	4
C: Credits, L:	Lecture	e, T: Tut	orial, Sl	Lr: Su	pervis	ed Lea	arning	g, P:	Proble	m / Pra	octical					
R: Research, 7	Гу/Lb/E	TL/IE: '	Theory ,	/Lab/E	mbedo	ded Th	neory	and	Lab/Int	ternal	Evalua	ation				
OBJECTIVES	5:															
The student s	hould be	e made t	0:													
To be able to unc	lerstand b	asic conc	epts in in	tegratio	n											
To understand in	concept	in ordina	ry differen	grais ntial equ	ations											
To be able to apr	olv concer	of ana	lytical ge	ometry	anons											
To be able to und	lerstand th	he basic c	concept of	f vector	calculu	S										
COURSE OU	ГСОМЕ	COS):													
CO1	Integrat	e the give	en functio	on by usi	ng metl	hods of	integr	atior	n and to fi	ind the a	area un	der cu	rve an	d the v	olume	of a
	solid by	revaluati	ion													
CO2	Evaluat	e the mul	tiple integ	grals /ar	ea/volu	me and	to cha	nge	the order	of integ	ration					
CO3	Apply c	oncepts i	n Ordinaı	ry Diffei	rential e	equatior	ns and	to sc	lveeulers	differe	ntial eq	uatio	n			
CO4	Find eq	uation of	planes,lir	nes and s	sphere	and sho	ortest d	istar	nce betwe	en skev	v lines					
CO5	Verify g	green/stok	kes/gauss	diverge	nce the	orem										
Mapping of Co	ourse Ou	utcomes	with Pr	POs)												
COs/POs	PO1	PO2	PO3	PO4	PO5	PO) 6	PC	PO	P 8 P	09	POI	10	PO11	PC	D12
CO1	3	3	2	2	2	2		1	2	2		2		1	3	
CO2	3	3	1	2	2	3		2	2	3		3		2	2	
CO3	3	3	1	2	2	3		1	1	3		3		2	2	
CO4	3	3	2	2	1	2		2	2	2		3		2	2	
CO5	3	3	1	2	2	2		2	1	2		3		1	2	
COs / PSOs	PSO1			PSC	02				PSO3				PS	04		
CO1	3			2					1				2			
CO2	3			2					1				2			
CO3	3			2					1				2			
CO4	3			2					1				2			
CO5	3			2					1				2			
3/2/1 Indicates	Strengt	h Of Co	rrelatio	<u>n, 3 – I</u>	High, 2	- Med	ium, 1	l- L	ow							
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	lce	ac	s ar enc	ore			ive									
	cier	s	Scie	Ū		- S	ect		1/	ips al S	lls					
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UNIT I INTEGRATION

Basic concepts of Integration – Methods of Integration– Integration by substitution –Integration by parts – Definite integrals– Properties of definite integrals – Problems on finding Area and Volume using single integrals(simpleproblems).

UNIT II MULTIPLE INTEGRALS

Double integral in Cartesian and Polar Co-ordinates– Change of order of integration – Triple integral in Cartesian Co-ordinates–Spherical Polar Co-ordinates–Change of variables (simple problems).

UNIT III ORDINARY DIFFERENTIAL EQUATIONS

First order differential equations–Second and higher order linear differential equations with constant coefficients and with RHS of the form: e^{ax} , x^n , Sin ax, Cos ax, $e^{ax}f(x)$, x f(x) where f(x) is Sin bx or Cos bx –Differential equations with variable coefficients(Euler'sform) (simple problems).

UNIT IV THREE DIMENSIONAL ANALYTICAL GEOMETRY

Direction Cosines and Ratios – Equation of a straight line – Angle between two lines – Equation of a plane – Coplanar lines–Shortest distance between skew lines–Sphere–Tangentplane.

UNIT V VECTOR CALCULUS

Scalar and Vector functions – Differentiation – Gradient, Divergence and Curl – Directional derivatives– Irrotational and Solenoidal fields– Line, Surface and Volume integrals – Green's, Stoke's and Gauss divergence theorems(statement only)–Verification.

Total no.of Periods: 60

Reference Books:

- 1. Kreyszig E., Advanced Engineering Mathematics (10th ed.), John Wiley & Sons, (2011).
- 2. Grewal B.S., Higher Engineering Mathematics, Khanna Publishers, (2012).
- **3.** John Bird, *Basic Engineering Mathematics* (5th ed.), Elsevier Ltd, (2010).
- 4. Veerarajan T., Engineering Mathematics (for first year), Tata McGraw Hill Publishing Co., (2008).
- 5. P.Kandasamy, K.Thilagavathy and K. Gunavathy, *Engineering Mathematics Vol. I (4th Revised ed.)*, S.Chand& Co., Publishers, New Delhi (2000).
- 6. John Bird, *Higher Engineering Mathematics (5th ed.)*, Elsevier Ltd, (2006).



SubjectCode: EBMA22003	SubjectName:MATHEMATICS–II	Ty/Lb /ETL	L	T/ SLr	P/R	С
	Prerequisite: Mathematics -I	Ту	3	1/0	0/0	4

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SubjectCode	:	Sub	jectNa	me:ENG	INEERI	NG MH	ravoyal, C	ICS	Tamilnadi	Tv/Lb/	L	T /	P/R	C
			0							ETL		SLr		
EBPH22002	2	Pre	requisi	te:Engine	ering Pl	nysics				Tv	3	0/0	0/0	3
C: Credits, I	L: Lec	ture	e, T: Ti	utorial, S	Lr: Sup	ervised	Learni	ing, P: F	Problem	/ Practica	al			
R: Research	, Ty/]	Lb/l	ÉTL/IE	E: Theory	y /Lab/E	Embedd	led The	eory an	d Lab/I	nternal				
Evaluation														
OBJECTIVI	E:													
• B	Basic p	rinc	iples of	stress, str	ain and e	elastic c	onstant	s.						
• 1 • T	o drav	v sh def	ear forc	e and ben of beams	ding mo	ment di	agram							
	omu	uer			TCOM	ES(CO	s):(3-5)							
CO1	Artic	ula	te a stro	ong found	dation ir	under	standin	g kinen	natics &	Kinetics				
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	Idem	.11 y	and us		Jamenta	18 01 11	lechanno	cs, static		manne eq	lumonu			
CO3	Enha	nce	the pr	oblem so	lving sk	ill in st	atics ar	nd dynai	mics					
CO4	Deve	elop	analyt	ical skills	s to iden	tify dif	ferent t	ypes of	motion					
CO5	Artic	ula	te mod	els to acq	luire kno	owledg	e on ma	athemat	ical, and	alytical sk	xills			
			Ma	ppingofC	CourseOu	itcome	s withP	rogram	Outcom	es (POs)				
Cos/Pos	PO	1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	12
CO1	3		3	2	2	2	1	1			2			1
CO2	3		3	1	2	2	1	1		1	2			1
CO3	3		3	3	3	2	2	2	1		2	1		1
CO4	3		3	3	3	2	2	1	1	3	2	1		1
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CO1 CO2		3		3	,		1		2					
CO3		3		3	, }		1		2					
CO4		3		3	}		1		2					
CO5		3		3	3		1		2					
3/2/1 Indicates	s Strei	ngth	n Of Co	rrelation	, 3 – Hig	h, 2- M	ledium,	1- Low		•		•		
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B.Tech Robotics and Automation-2022 Regulation

dor	SubjectNome: ENCINEERING MECHANICS	Tr/Ib/	T	T /	T
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: 2018 Certified Institution

SubjectCode:	Subjectname: ENGINEERING MECHANICS	Ty/Lb/ FTI	L	1/ SI r	P/K	C
EBPH22002				SLI		
	Prerequisite:Engineering Physics	Ту	3	0/0	0/0	3

UNIT ISTATICS OF PARTICLE

Introduction - units and Dimensions - Laws of mechanics - concurrent forces in a plane-resolution and Composition of forces – equilibrium of the particle-resultant force. Forces in space – Equilibrium of a particle in space - Rigid body - Moments and couples -moment of a force about a point and about an axis -Equilibrium of rigid bodies

UNIT IIPROPERTIES OF SURFACE AND SOLIDS

Determination of Area and volume - Determination and derivation of First moment of area (Centroid), Second moment of area (Moment of Inertia) geometrical area Mass moment of inertia and polar moment of inertia.Principal moments of inertia of plane areas

UNIT III FRICTION

C--1----

Introduction - Laws of Dry Friction - Coefficient of friction - friction of a body lying on an inclined plane. Application of friction-Ladder friction-Wedge friction-Screw friction.

UNITIVDYNAMICS OF PARTICLES

KINEMATICS: Displacement, Velocity-Constant and variable Acceleration, their relationship – linear and curvilinear motion- Projectile motion, relative motion.

KINETICS: Linear and Curvilinear motion- Impulse and Momentum, Impact-collision of Elastic bodies. Newton's law-D'Alemberts principle.

UNITV DYNAMICS OF RIGID BODIES

KINEMATICS: Introduction-Rotation-Linear and Angular Velocity as well as acceleration. General plane motion-Absolute and Relative velocity in plane motion.

KINETICS: Relation between Translatory and Rotary motion of the body-Work energy equation of particles -D'Alemberts principle.

TEXT BOOKS & REFERENCE BOOKS

- 1) R.S.Khurmi. (2008), "A Textbook of Engineering Mechanics", S.Chand& co Ltd.
- 2) S.Rajasekaran et.al. (2009), "Fundamentals of Engineering Mechanics", Vikas Publishing House Pvt Ltd., 3rd Edition.
- 3) Arthur.P.Boresi, Richard.J.Schmidt, "Engineering Mechanics : Statics & Dynamics", Thomson Brooks/Cole, Chennai.
- 4) Palanichamy M.S, Nagan.S, (2001), "Engineering Mechanics Statics and Dynamics" TataMcGraw Hill.
- 5) Beer & Johnson et.al, (2010) "Vector Mechanics for Engineers (Statics and Dynamics)", Tata McGraw Hill



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Total No.of Periods:45

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Subject Code	e	Su CI	bject I HEMI	Name : STRY	INDUS	<u>,</u>			Ty/ E	/Lb/ TL	Ι	<u>_</u>	T/\$	SLr	P /1	R	С	
EBCH22002	2	Pre	erequi	site :Er	ngg. Che	emistry				Ty		3	;	0)/0	0/0		3
C: Credits,	L: Le	cture	, T: T	utoria	l, SLr:	Superv	vised	Lea	rning	g, P:	Pro	blem	/ P1	racti	cal			
R: Research	n, Ty/l	Lb/E	TL/IE	E: Theo	ory /La	b/Embe	eddec	d Th	eory	and	Lab	/Inter	nal	Eva	luati	on		
OBJECTIV	ES				•				ľ									
OBJECTIVE	ES :																	
1.Toundersta	and and	d app	ly the	basic co	oncepts	of fuels	and c	ombi	ustior	ı in a	uton	nobiles						
2. To analyze	the m	oistu	re and	proteir	n in food	l throug	h phy	sical	and	chem	ical	metho	ds.					
3. To detect the	he indu troto ti	istria	l devel	opmen	t aiming	at job (creato	ors.										
5. To illustra	te the f	ie op funda	menta	ls of pu	ip and p dustrial	wastew:	ater fi	y. reatr	nent.									
COURSE O		OME	CS (Co	(s)	austi iui	waste wa		r cuth	iiciit.									
Students con	npletin	ng thi	s cour	se were	e able to)												
CO1	Repro	duce	the un	dersta	nding of	industr	y orie	ented	chen	nical	scier	ıce						
CO2	Analy	ze tł	ne sol	utions	for in	dustry	based	l pro	oblen	ns fo	or s	ustaina	able	dev	velop	ment	folle	owing
	profes	siona	l ethic	s.														
CO3	Apply	appr	ropriat	te techn	iques fo	r indust	trial d	levelo	opme	nt as	a re	source	of	lifelo	ng lea	irnin	g.	
CO4	Develo	op the	e reaso	oning na	ature by	the kno	wledg	ge ac	quire	d to	asses	s the h	leal	th an	id saf	ety is	sues.	
<u>CO5</u>	Descri	ibe th	e tools	s used to	b apply	the engi	neern	$\frac{ng kr}{DO}$	nowle	dge								
Mapping of	f Course Outcome with Program Outcome (PC									DO	0		D	10	DO		DO 10	
Cos/POs		<u>)</u>	PO2	PO3	PO4	PO5	POt		0/	PO	8.	PO9	PC	010	PO		PO12	
	3	· ·	3	2	2												<u> </u>	
<u>CO2</u>	3			3	3		2									-	5	
CO3	3			2			2	3		2						-	3	
C04	2			3		2		2		3							2	
COS/PSOs	3		DCO	1				3		DC	22			DSC	24		3	
COL			2	1		F302				2	55			2	<i>J</i> 4			
CO_1			3 2							3 2				3				
CO_2			3							3				3				
CO4			3							3				3				
C05			3							3				3				
3/2/1 Indica	tes Sti	rengt	h Of (Correl	ation. 3	– High	. 2- N	Medi	um.	1- Lo	ow			U				
		8'																
Category	 					Program Core		Program elective	Open Elective		Inter Disciplinary			Skill Component			Practical /Project	

(An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

Subject Code EBCH22002	Subject Name : INDUSTRIAL CHEMISTRY	Ty/Lb/ ETL	L	T/SLr	P/R	С
	Prerequisite :Engg. Chemistry	Ту	3	0/0	0/0	3

UNIT I FUELS & COMBUSTION

Fuels - classification, calorific value, GCV, NCV, Solid fuels-coal – varieties and ranking, analysis –Proximate Carbonisation of coal, Coke –manufacture, Beehive coke oven method, Otto Hoffmann method – recovering by - products - Liquid fuels – petrol –refining-cracking- thermal & catalytic, Synthetic petrol – Hydrogenation of coal (Fischer Tropsch Process and Bergius process) – Polymerization, Knocking properties of Gasoline –octane number, cetane number – Ignition lag, Leaded petrol, Reforming, Gaseous fuels- manufacture and uses Combustion - Flue gas analysis – Orsatapparatus.Alternative fuel-Electric vehicles

UNIT II FOOD ANALYSIS

Food analysis-Introduction. Moisture Analysis-Introduction-Moisture content of foods-Sample collection and handling-Forms of water in foods- Distillation procedure-Reflux distillation with immiscible solvent,-Physical methods-Direct method-Hydrometer, -Refractometry –Chemical method-Karl Fischer titration- Protein analysis-Kjeldahl method-Dumas combustion method.

UNIT III APPLICATIONS IN PAPER INDUSTRY

Introduction-Manufacture of pulp-Mechanical process-Chemical process-Beating,Refining,Filling,Sizing and Colouring-Manufacture of paper-Calendering-Bagasse utilization in paper industry.

UNIT IV BUSINESS CHEMICALS 9

Toiletry formulations-Soaps and detergent, shampoo, Shaving cream, production. Preparation of cosmeticsmoisturizing cream, talcum powder, Nail enamel, Lipstick. Disinfectants- phenyl, hand sanitizer,bleach,causticsoda,naphthalene balls production.

UNIT V INDUSTRIAL WASTES AND TREATMENT PROCESS

Introduction-Characteristics of industrial waste-Types of industrial wastes-Solid industrial wastes-Principles of industrial waste treatment-Treatment and disposal of industrial waste-Sanitary-Chemical analysis of industrial effluents or sewage-Method of treating industrial sludge.

References

- 1. Rama RaoNadendla, Principles of Organic Medicinal Chemistry, New Age International (P) Limited, Publishers.
- 2. H.D.Belitz, W.Grosch, P.Schieberle, *Food Chemistry* Springer
- 3. Industrial chemistry by B.K.Sharma,KrisnaPrakashan Media(P) Ltd,Publishers.
- 4. Industrial Chemistry C. S. Unnithan, T. Jayachandran & P. Udhayakala, Sree Lakshmi Publications 2010
- 5. John A.Tyrell, Fundamentals of Industrial Chemistry, , Wiley.
- 6. Ernest M. Flick, *Cosmetic and Toiletry Formulations*, 2nd Edition, Volume 8, Noyes Publications, William Andrew Publishing, LLC.

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TotalNo.ofPeriods: 45



Subject Cod	le S	Subje	ect Na	ame : I	ENGINE	ERINO	G GRA	PHIC	S		Ty/Lb/ ETL	L	T/\$	SLr	P/R	0	1
EBME2200)1	Preree	quisi	te : Nil	l						Ty	2	0	/0	2/0	3	6
C: Credits,	L: Lec	ture,	T: 7	Futoria	al, SLr:	Supe	rvised	Lear	ning, l	P: P	roblem /	' Pra	octica	al			
R: Researc	h, Ty/L	b/E7	ΓL/II	E: The	ory /La	ıb/Eml	bedded	l The	ory an	nd L	.ab/Inter	nal l	Evalı	uatio	n		
OBJECTIV	/ES				•												
• To	acquire	e kno	wled	lge in	geome	trical d	lrawin	g.									
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COURSE O	DUTCO	ME	S (Co	os)													
Students con	mpleting	g this	coui	rse wer	e able t	0											
CO1	Utilize	the c	conce	ept of E	Engineer	ring Gr	aphics	Tech	niques	to c	lraft letter	rs, N	lumb	ers, D	limen	sioning	g in
	Indian	Stand	dards	5 1 C.			1		1 .		1 '11	C	1.0		•	• 1 •	
002	Demor	istrati	e the	arattin	ig pract	ice visi	ializati	on an	u proje	ectic	on skills u	iseru	11 IOr	conve	eying	ideas 1	n
CO3	Identif	v hae	ic eb	etching	is. x techni	aues of	engin	erino	equin	mer	nts						
CO3	Demor	y bas istrat	e the	projec	tions of	Points	Lines	Plan	es and		lids And						
CO5	Draw t	the se	ection	al viev	v of sim	nple bui	lding o	lrawii	19.		ilds. 7 illd						
Mapping of	f Cours	e Ou	tcom	ne with	Progra	am Ou	tcome	(POs)								
Cos/POs	PO	D1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12															
CO1	3	3		3	2	2	2				3	3			3		
CO2	3	3		3	2	2	2				3	3			3		
CO3	3	3		3	1		2				2	2			2		
CO4	3	3		2	2		3		2		3	3			3		
CO5	3	3		3	2	3	1		2		3	3			3		
COs/PSOs]	PSO	1		PSO2			PSO)3			PSO	94			
COl						2											
CO2						2											
CO3						2											
C04						2											
3/2/1 Indics	ates Str	enotł	h Of	Corre	lation.	 3 Hio	h. 2- N	/Jediu	m. 1-	Lov	v						
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Category	Basic Science		Engineering	 ✓ Science 	Humanities and social Science	∠ Program Core			Open Elective	Inter Disciplinary	· ·		экш сошропен			Practical /Project	

B.Tech Robotics and Automation-2022 Regulation

Subject Code	Subject Name : ENGINEERING GRAPHICS	Ty/Lb/ ETL	L	T/SLr	P/R	С
EBME22001	Prerequisite : Nil	Ту	2	0/0	2/0	3

CONCEPTS AND CONVENTIONS (Not for examination)

Introduction to drawing, importance and areas of applications - BIS standards - IS: 10711 - 2001 : Technical products Documentation - Size and layout of drawing sheets - IS 9606 - 2001: Technical products Documentation -Lettering – IS 10714 & SP 46 – 2003: Dimensioning of Technical Drawings – IS : 15021 – 2001 : Technical drawings – Projections Methods – drawing Instruments, Lettering Practice – Line types and dimensioning – Border lines, lines title blocks Construction of polygons – conic sections – Ellipse, Parabola, Hyperbola and cycloids. UNIT I PROJECTION OF POINTS, LINES AND PLANE SURFACES 10

Projection of points and straight lines located in the first quadrant – Determination of true lengths and true inclinations – projection of polygonal surface and circular lamina in simple position only.

UNIT II PROJECTION OF SOLIDS

Projection of simple solids like prism, pyramid, cylinder and cone in simple position Sectioning of above solids in simple vertical position by cutting plane inclined to any one of the reference plane and perpendicular to the other.

UNIT III DEVELOPMMENT OF SURFACES

Development of lateral surfaces of simple and truncated solids – prisms, pyramids, cylinders, and cones.

UNIT IV ISOMETRIC PROJECTION

Principles of isometric projection – isometric scale – isometric projections of simple solids, like prisms pyramids, cylinders and cones.

UNIT V ORTHOGRAPHICS PROJECTIONS Orthographic projection of simple machine parts – missing views **BUILDING DRAWING** Building components - front, Top and sectional view of a security shed.

(Basic Auto CAD commands to be taught- not for Examinations)

Total No.of Periods: 60

Note: First angle projection is to be followed. **TEXT BOOKS**

- 1. Bhatt, N.D. and Panchal, V.M. (2014) Engineering Drawing Charotar Publishing House
- Gopalakrishnan, K.R. (2014) Engineering Drawing (Vol.I& II Combined) Subhas Stores, Bangalore. 2.
- 3. Natrajan K.V., "A Text Book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2018.
- 4. Venugopal K. and Prabhu Raja V., "Engineering Graphics", New Age International (P) Limited, 2008.



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Subject Code:	Sub	jectNan	ne: MAN	UFACT	URING	F PROC	CESSES		Ty/Lb/	L	T/	P/R	C
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		SLI.	supervised	Leann	igr.rioj	CUIN.NO	searche		5				
T/L/ETL:Theor	y/Lab/l	Embedd	edTheory	andLab									
OBJECTIVES:	The stu	udent wi	ill learn:										
 basics an 	d adva	nced ma	nufacturi	ng proce	esses for	metals.							
 Selecting 	g the ap	propriat	e manufa	cturing p	process t	based or	n the app	lication	IS.				
COUDSEOUT). (2 5) 5	tudonta	will be a	ablatar							
COURSEOUT CO1 Fi	nhance	Knowle): (3- 5) 5 edge of ca	sting and	d metal i	ioining	nrocess						
CO^2 U	ndersta	nd the x	various ma	nufactu	ring pro	cess for	metal						
CO3 D	emonst	trate the	operation	of vario	us mani	ufacturi	ng proce	22					
CO4 SI	ibstant	iate the	advanced	method	of manu	ufacturir	ng proce	88 88					
CO5 R	ecomm	end the	suitable n	nanufact	uring pr	ocesses	dependi	ing on t	he requirer	nents			
Mapping of Co	ourse O	outcome	es with Pr	ogram	Outcom	es(Pos)	•		i				
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	12
CO1	3	1	3	2	1	1	2		3	3	1	,	3
CO2	3	1	3	2	1	1	2		3	3	1		3
CO3	3	1	3	2	1	1	2		3	3	1		3
<u>CO4</u>	3	1	3	2	1	1	2		3	3	1		3
CU5	3	1		$\frac{2}{2}$					3	3	1		3
	P5	<u>01</u>	P50	J2	PS	<u>03</u>	P	<u>004</u>					
CO1		י צ	3			5 2		$\frac{2}{2}$					
CO3		, R	3			3		<u>2</u> 2					
CO4		3	3			3		2					
CO5	3	3	3			3		2					
3/2/1 Indicates S	strengt	h Of Co	orrelation	, 3 – Hi	gh, 2- N	Iedium	, 1- Low	7	l	•			
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SubjectCode:	SubjectName:MANUFACTURING PROCESSES	Ty/Lb/	L	T /	P/R	С
EDD 4 22001		ETL		SLr		
EBRA22001	Prerequisite:Nil	Ту	3	0/0	0/0	3

UNIT- I: METAL CASTING PROCESSES

Introduction to Pattern making - Moulding sand - Melting furnaces - Special casting processes - Shell, Investment,

Die casting, Fullmould process - Defects in casting. Computers in casting processes.

UNIT- II: METAL FORMING PROCESSES

Cold and hot working - Forging, Rolling, Extrusion, Drawing. . Introduction to sheet metal forming processes. High energy rate forming - Explosive forming, Electro-hydraulic, Electro magnetic forming, Dynapac machine,

petro forge machines. Super plastic forming

UNIT- III: METAL JOINING PROCESSES

Classification - Arc Welding – Sheet metal arc welding, Gas metal welding- - Submerged Arc, TIG, MIG, -Resistance welding -Electrode types – Specification- Special Types - Laser, Electron beam, Plasma Arc, Ultrasonic, Electro slag, Explosive welding and Friction welding - Thermit welding –inspection of welding-Defects in weld- Brazing and soldering

UNIT- IV: METAL CUTTING PROCESSES

Lathe: Specification - Types - Mechanisms - Operations - Calculations - Capstan and turret lathe – Tooling with examples – Copy turning lathe. Drilling: Specification - Types - Feed Mechanism - Operations – Drill tool nomenclature - Mounting – Reamer and tap tools - Calculations.

UNIT- V: SPECIAL PURPOSE MACHINES

Shaper, Planer, Slotter: Specifications - Types - Mechanism - Calculations

Milling: Specification - Types - Cutter nomenclature - Types of cutter - Milling processes - Indexing -Broaching: Specification - Types - Tool nomenclature - Broaching process.Boring: Specification - Types -Operations - Boring tool - Jig Boring machine.Grinding: Types of grinding machine - Lapping, honing and super finishing.

Total No. of Periods: 45

TEXT BOOKS

- 1. Sharma P.C. (2008), "A Text Book of Production Technology", S.Chand& Company Ltd., New Delhi.
- 2. SeropeKalpakjian (2013), "*Manufacturing Engineering and Technology*", Addison-wesleyPub.Co ,7th edition.

REFERENCES

- 1. Rao P.N. (2007), "Manufacturing Technology Foundry Forging & Welding", Tata McGraw Hill Publishing Co., New Delhi, 2nd edition.
- 2. R.K. Jain, (2001) "Production Technology", Khanna publisher.
- 3. O.P. Khanna, (1993), "Welding Technology", DhanpatRai& sons.
- 4. S. K. HajraChoudry, S. K. Bose, (2010) "Elements of Workshop Technology -Volume I & II". Media promoters.

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EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution)	A A A A A A A A A A A A A A A A A A A
Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.	

Subject (Cod	le S	Subject E NGL	Name : ISH L	COM AB	MUNI	CATI	VE		T E	y/Lb/ TL/IE	L	T/SLr	P/R	C
EBCC22	2102	2 F	Prerequ	isite :N	il					IF	E	1	0/0	1/0	1
C: Cred	its,	L: Le	cture, '	T: Tuto	orial, S	Lr: Su	pervise	d L	earnii	ng, F	P: Proble	n / Prac	ctical		1
R: Rese	arc	h, Ty/	Lb/ET	L/IE: 7	Theory	/Lab/E	mbedd	ed 7	Theor	y an	d Lab/Int	ernal E	valuatio	n	
OBJEC	TIV	/ES			•					<u> </u>					
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I	prof	fession	al readi	ing and	writing	for a su	iccessfi	ıl ca	reer.						
COURS	F (UTC	OMES	(Cos)											
Students		mpleti	ng this	course v	were ab	le to									
CO1	En	Engage in meaningful oral communication in English with writing as a scaffolding activity.													
CO2	Ha	ive an i	n-depth	understa	anding o	f the con	nponent	s of l	Englisl	n lang	guage and i	ts use in	oral com	nunicatio	n.
CO3	Str	engthe	n their v	ocabula	ry and s	yntactic	knowled	lge fo	or use	in aca	ademic and	l technica	al commu	nication	
CO4	Le	arn to r	negotiate	e meanir	ıg in inte	r-person	al and a	cade	mic co	ommu	inication fo	or a succe	essful care	eer.	
CO5	En	gage in	n organiz	ed acad	emic and	l profess	sional w	riting	g for li	fe-lor	ng learning	and rese	arch		
Mappin	g of	Course Outcome with Program Outcome (POs)													
Cos/POs		PO1	PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12												
CO1		1	-	1	1	3	2	1	1		3	3	-	3	
CO2		2	1	1	1	3	3	1	2		3	3	1	2	
CO3		1	1	1	1	2	1	-	2		3	3	1	3	
CO4		1	-	-	2	3	1	2	1		2	2	-	3	
CO5		-	1	1	2	3	1	1	-		3	1	1	2	
COs/PSOs			PSO	1		PSO2			PSC)3		PSO	D4		
CO1			2						1						
CO2			2						1						
CO3			2						1						
CO4			2						1						
CO5			2						1						
3/2/1 Inc	dica	ates St	rength	Of Co	rrelatio	n, 3 – F	High, 2-	Me	dium	, 1- I	Low				
Category		Basic Strength Of Correlation, 3 – High' 5- Wedim Engineering Science Program Core Program Core Program elective Open Elective					Inter Disciplinary		Skill Component		Practical /Project				

EDUCATIONAL AND RESEARCH INSTITUTE											
University with Graded Autonom (An ISO 21001 : 2018 Certified In	ny Status stitution)	ter då e									
Subject Name : COMMUNICATIVE	Ty/Lb/	L	T/SLr	P/R	С						
ENGLISH LAB	ETL/IE										
Prerequisite :Nil	IE	1	0/0	1/0	1						
ING				6							
and videos											
English Pronunciation in use – Mark Hancock,											
ING				6							
Self introduction, Describing, anchoring, welcome	e address, vo	te of th	anks,								
ole play- formal -informal, narrating stories, film i	eview, analy	zing ne	ewspaper h	eadings a	nd						
ng Advertisement pamphlets											
n, mock interviews, formal presentation, power poi	nt presentati	on									
J. C. Richards with J. Hull &S.Proctor, Interchang	e, Cambridg	e Unive	ersity Press	, 2015.							
ING				6							
d reading,											
ective reading - Reading comprehensions – Note m	aking- summ	arizing	g- paraphras	sing, Revi	iew						
g: Short stories, news paper reports, film reviews											
ING				6							
practices - note taking, Cognitive and metacognit	ive strategies	to incu	ulcate a sen	ise of orga	anizing						
nt sentences and paragraphs, Formal letters, Busine	ss letters. Re	sume v	with covering	ng letter							
ERBAL COMMUNICATION/ CHARTS, DIAC	RAMS AN	D TAB	RLE.	6							
				U							
	DEFLORGENENCE DEVENDENCE OF COMMUNICATIVE Deviver EVR. High Road, Maduravoyal, Chemnal Deviver EVR. High Road, Maduravoyal, Chemnal Subject Name : COMMUNICATIVE ENGLISH LAB Prerequisite :Nil ING and videos English Pronunciation in use – Mark Hancock, ING Self introduction, Describing, anchoring, welcome Role play- formal -informal, narrating stories, film r ng Advertisement pamphlets n, mock interviews, formal presentation, power poi J. C. Richards with J. Hull &S.Proctor, Interchang ING d reading, ective reading - Reading comprehensions – Note m g: Short stories, news paper reports, film reviews ING practices – note taking, Cognitive and metacognit nt sentences and paragraphs, Formal letters, Busine	Ing and videos English Pronunciation in use – Mark Hancock, Ing Self introduction, Describing, anchoring, welcome address, vo Role play- formal -informal, narrating stories, film review, analy Ing Advertisement pamphlets n, mock interviews, formal presentation, power point presentati J. C. Richards with J. Hull &S.Proctor, Interchange, Cambridge ING ad reading, ctive reading - Reading comprehensions – Note making- summ g: Short stories, news paper reports, film reviews ING and reading, ctive reading - Reading comprehensions – Note making- summ g: practices – note taking, Cognitive and metacognitive strategies nt sentences and paragraphs, Formal letters, Business letters. Re	Image: Note of the second state of the seco	Image: State of the s	Image: Subject Name : COMMUNICATIVE (An ISO 21001 : 2018 Certified Institution) Ty/Lb/ L T/SLr P/R ENGLISH LAB ETL//IE 10/0 1/0 ING 6 and videos English Pronunciation in use – Mark Hancock, 6 ING 6 exelf introduction, Describing, anchoring, welcome address, vote of thanks, 6 tole play- formal -informal, narrating stories, film review, analyzing newspaper headings a 6 ng Advertisement pamphlets 6 n, mock interviews, formal presentation, power point presentation 6 J. C. Richards with J. Hull &S.Proctor, Interchange, Cambridge University Press, 2015. 6 ING 6 dreading, 6 ective reading - Reading comprehensions – Note making- summarizing- paraphrasing, Rev 6 gractices – note taking, Cognitive and metacognitive strategies to inculcate a sense of org 6 eractices – note taking, Cognitive and metacognitive strategies to inculcate a sense of org 6 eractices – note taking, Cognitive and metacognitive strategies to inculcate a sense of org 6 eractices – note taking, Cognitive and metacognitive strategies to inculcate a sense of org 6 eractices – note taking, Cognitive and metacognitive s						

Total No.of Periods:30

Text Books

1. J. C. Richards with J. Hull &S.Proctor, Interchange, Level 2, Cambridge University Press, 2021.

2. M. ChandrasenaRajeswaran&R.Pushkala, English - Communication Lab Work book

Reference Books

 Hancock, Mark, English Pronunciation in Use; Cambridge Univ. Press, 2013.
 Dutt, K, Rajeevan, G &Prakash, CLN 2008, A Course on Communication Skills, 1st edn, Cambridge University Press, Chennai

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EDC522E12	Prere	quisite	: C Pro	ogramn	ning an	id MS		EIL		I	0/0	2/0			
	office	tools		1 01	<u> </u>					<u> </u>					
C: Credits, L:	Lectur	re, T: 1	l'utoria	I, SLr:	Super	vised	Learni	ng, P: Pi	roble	m / Prac	tical				
R: Research,	Γy/Lb/	ETL/I	E: The	ory /La	ıb/Emb	bedded	Theor	y and La	ab/Int	ternal E	valuatio	on			
OBJECTIVE	:The st	udent s	hould b	e made	to:										
Develo	op a bas	sic unde	erstandi	ng of p	rogram	ming a	nd the <i>l</i>	Python p	rogra	mming la	anguage				
• Write j	progran	ns in Py	thon to	solve 1	real wor	rld prol	olems								
See the	e value	of prog	rammir	<i>ng</i> in a	variety	of diffe	erent di	sciplines	nes, especially as it relates in engineering.						
COURSE OU	TCOM	IES (C	Os) :Af	ter Co	mpletir	ng the o	course,	e, the student can be able to							
COl	Reme	mber th	ie synta	x and s	emantic	cs of py	thon p	rogramm	ing la	inguage					
CO2	Under	Understand how functional and operations are to be utilized													
CO3	Apply	Applythe fundamental programming constructs like variables, conditi									nal logic	, loopin	g, and		
	functi	ons to	build ba	asic pro	grams										
CO4	design	1 object	-oriente	ed prog	rams w	ith Pytł	non clas	sses							
CO5	Apply	the kn	nowledge to solve various real worldproblems												
Mapping of C	ourse (Dutcon	nes with	ı Progi	am Ou	itcome	s (POs))							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8]	PO9	PO10	PO11	PO12		
CO1	3	3	3	2	2	1	1	1		1	0	1	1		
CO2	3	2	2	2	2	1	1	1		1	0	1	1		
CO3	3	2	2	2	2	1	1	1		1	0	1	1		
CO4	3	3	3	2	2	1	2	0		2	0	2	2		
CO5	3	3	3	3	2	1	2	0		2	0	2	2		
COs / PSOs	PSO1			PSO2			PSO3	•			PSO4				
CO1		1			1			2				2			
CO2		1			1			2				2			
CO3		1			1			2				2			
CO4		1			1			2				2			
CO5		1			1			2				2			
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UNIT III: FUNCTIONS

Defining Functions, Calling Functions, Passing Arguments, Keyword Arguments, Default Arguments, Variablelength arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function - Global and Local Variables.

UNIT IV:LISTS, TUPLES, DICTIONARIES

Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing - list

UNIT V: OBJECT ORIENTED PROGRAMMING OOP IN PYTHON

TEXT BOOKS:

- 1. Python Programming: A Modern Approach, VamsiKurama, Pearson.
- Think Python: How to Think Like a Computer Scientist", 2nd editionUpdated for Python 3, Shroff/O'Reilly 2. Publishers, Allen B. Downey
- 3. Learning Python, Mark Lutz, Orielly.

REFERENCE BOOKS:

- 1. Core Python Programming, W.Chun, Pearson.
- Introduction to Python, Kenneth A. Lambert, Cengage. 2.

UNIT I: INTRODUCTION

office tools

Subject

EBCS22ET2

Code:

History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation.

UNIT II: TYPES, OPERATORS AND EXPRESSIONS

PYTHON PROGRAMMING

Prerequisite: C Programming and MS

9 Types - Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while, break, continue, pass.

comprehension; Illustrative programs: selection sort, insertion sort, mergesort, histogram.

Classes, 'self variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding.

Total No. of Hours: 45

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Subject Cod EBCC22I03	e:	Subject Name: ENVIRONMENT							Lb/ L/IE	L	T/SLr	P/ R	С	
		Prereg	uisite:	Nil				I	E	1	0/0	1/0	0	
C: Credits, L	: Lecture,	T: Tuto	rial, SL1	: Sup	pervised	l Learn	ing, l	P: Proble	em / Pr	actical				
R: Research,	Ty/Lb/E1	TL/IE: Th	neory /L	Lab/E1	nbedde	d Theo	ry an	d Lab/Ir	ternal	Evalua	ation			
OBJECTIV	ES:													
• To ac	quire kno	wledge o	of the Er	nviror	iment a	nd Eco	syste	m & Bio	divers	ity				
• To ac	quire kno	wledge of	of the di	fferen	it types	of Env	ironr	nental po	ollution	1				
• To kr	iow more	about Na	atural R	esour	ces	F								
• To ga	in underst	tanding of	of social	l issue	$\frac{1}{2}$ s and the s	ne Env	Ironn	nent						
• To at	tain famili	arity of	human p	popula	ation an	id Envi	ronm	ent						
Students com	pleting th	ES (COS le course	s): (3 – : were al	5) ble to										
CO1	Know ab	out Envi	ronmen	t and	Ecosyst	tem &	Biodi	versity						
CO2	Compreh	mprehend air, water, Soil, Marine, Noise, Thermal and Nuclear Pollutions and Solid												
	Waste ma	ste management and identify the importance of natural resources like forest, water, and												
	food reso	od resources												
CO3	Discover	Discover water conservation and watershed management												
CO4	Identify i depletion	ts proble etc.,	ems and	conc	erns cli	mate c	hang	e, globa	l warm	ing, ac	cid rain, c	zone	layer	
CO5	Explain f and envir	amily we conment	elfare pr	rograr	nmes ai	nd role	of in	formatic	n tech	nology	in humar	n healt	th	
Mapping of	Course O	outcome	s with F	Progr	am Ou	tcomes	(PO	s)						
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO1	2	
CO1						2	3	2				1		
CO2						2	3			2		1		
C03						2	3	2		2		1		
C05						2	3	2		2		1		
3/2/1 Indicate	s Strength	of Cori	relation,	, 3 – H	ligh, 2-	Mediu	n, 1-	Low						
					0 /						s			
Category	Basic Sciences Engg Sciences Humanities & Social Science Program core Program Electives							Open Electives	Practical / Droiact		Internships / Technical Skill	Soft Skills		



Subject Code: EBCC22I03	Subject Name: ENVIRONMENTAL SCIENCE (AUDIT COURSE)	Ty/Lb/ ETL/IE	L	T/SLr	P/ R	С
	Prerequisite: Nil	IE	1	0/0	1/0	0

UNIT I ENVIRONMENT AND ECOSYSTEM

Definition, Scope and Importance of environment – need for public awareness – concept, structure and function of ecosystem- producers, consumers and decomposers – energy flow in the ecosystem. Biodiversity atnational and local levels–India

UNIT II ENVIRONMENT POLLUTION

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution (c) Soil pollution (d)Marine pollution(e)Noise pollution(f)Nuclear hazards (g)E-Wastes and causes, effects and control measures

UNIT III NATURAL RESOURCES

Forest resources: Use and over-exploitation, deforestation. Water resources: Use and over-utilization of surfaceand ground water, floods, drought, conflicts overwater, dams-benefits and problems. Food resources: Worldfood problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticideproblems.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT

From unsustainable to sustainable development – urban problems related to energy – water conservation, rainwater harvesting, watershed management – resettlement and rehabilitation of people; its problems and concernsclimate change, global warming, acid rain, ozone layer depletion, nuclear accidents ,central and state pollutioncontrolboards-Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT

Population growth, variation among nations – population explosion, environment and human health – humanrights-value education-HIV/AIDS-women and child welfare-role of information technology in environment and human health

(A) AWARENESS ACTIVITIES:

i) small group meetings about water management, promotion of recycle use, generation of less waste, avoiding electricity waste

- ii) Slogan making event
- iii) Poster making event
- iv) Cycle rally

v) Lectures from experts

(B) ACTUAL ACTIVITIES:

i) Plantation

ii) Gifting a tree to see its full growth

iii) Cleanliness drive

iv) Drive for segregation of waste

v) To live some big environmentalist for a week or so to understand his work

vi) To work in kitchen garden for mess

vii) To know about the different varieties of plants

viii) Shutting down the fans and ACs of the campus for an hour or so

TextBooks

GilbertM.Masters, 'IntroductiontoEnvironmentalEngineeringandScience',2ndedition,PearsonEducation(2004). BennyJoseph, 'EnvironmentalScienceandEngineering', TataMcGrawHill,NewDelhi,(2006).

References

1. Vairamani, S. and Dr.

K.Sankaran. Elements of Environmental and Health Science. Karaikudi: KPSVPublications, 5th Edition, July, 2013.

2. If this arudeen, Etal, Environmental Studies, Sooraj Publications, 2005.

3. *R.Murugesan*, *EnvironmentalStudies*, *MillenniumPublishers andDistributors*, 2nd Edition, July, 2009.



SEMESTER III



Subject Code:	S	ubject Na	me :Mat	hematio	cs III fo	r Mech	anical		Ty/Lb/	L	T/S	S P/R	C
EBMA22005		anu v	JVII Elig	meers					ETL/IE		Lr		
	P	rerequisi	te:Mathe	matics]	I&II				Ту	3	1/0	0/0) 4
L:LectureT:Tu	ıtorial	SLr:	Supervise	edLearn	ingP:Pro	ojectR:R	lesearch	C:Crea	lits				
T/L/ETL:Theo	ory/La	b/Embedd	ledTheory	yandLab)								
OBJECTIVE	S:The	student v	vill learn										
Basic	mathe	matical to	ools and t	echniqu	es whicl	h empha	size the	devel	opment of 1	rigoro	us logi	ical think	ting and
analyt	ical sk	ills.	C	. 1 1		1	,	1.	· • •				1
• Theor	y and	applicati	ons of p	artial di	ifferentia	al equat	tion, its	appli	cations, Fo	urier	series,	transfor	ms and
		FS(CO c)	11. •(3-5) Th	o studo	nte will	ha ahla	to						
COURSEOUT		Inderstand	the concer	ots of Pai	tial Diffe	erential e	quations						
CO2	I	Determine the Fourier series solutions											
CO3	A	Apply the c	oncepts of	PDE in	Wave an	d Heat pi	roblems						
CO4	A	Apply Lapla	ace transfo	rms									
CO5	A	Apply Four	ier transfor	rms									
		MappingofCourseOutcomes withProgramOutcomes (POs)											
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	10 P	PO11	PO12
CO1	3	2	2	3	3	1	1	2	2	1		1	2
CO2	2	2	1	3	1	2	1	2	3	1		1	2
CO3	3	2	1	3	2	3	2	1	1	2	,	1	3
<u>CO4</u>	3	2	1	2	1	3	2	1	1	1		1	2
CO5	3	3	1 DC	$\frac{2}{2}$	1	$\frac{2}{102}$	2	1	1	2		2	3
COS/PSOS	1	2501	P50	02	PS	503	P	504					
CO1		2	1	1		1		3					
CO2		2	1	1		1		3					
<u>CO3</u>		2]	<u> </u>		1		3					
C04 C05		2	1	<u>l</u>		<u> </u> 1		3					
3/2/1 Indicates	Strer	 oth Of C	orrelatio	<u>.</u> n 3_Н	igh 2.	<u>1</u> Mediun	1 1. Lo	w					
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Subject Code:	Subject Name :Mathematics III for	Ty/Lb/ET	L	T/S	P/R	С
EBMA22005	Mechanical and Civil Engineers	L		Lr		
	Prerequisite:Mathematics I&II	Ту	3	1/0	0/0	4

UNIT- I: PARTIAL DIFFERENTIAL EQUATIONS

DUCATIO

Formation of PDE by eliminating arbitrary constants and eliminating arbitrary functions – Solutions of standardtypes of first order equations – Lagrange's equation – Linear partial differential equations of second and higherorderwithconstantcoefficients.

UNIT- II: FOURIER SERIES

Dirichlet's conditions – General Fourier series – Half range Sine & Cosine series – Complex form of Fourierseries–Parseval'sidentity–HarmonicAnalysis.

UNIT- III: APPLICATIONS OF PARTIAL DIFFERENTIAL EQUATIONS

Classification of second order linear partial differential equations – Solutions of one dimensional wave equation, one-dimensional heat equation – Steady state solution of two dimensional heat equations (Cartesian coordinatesonly) –Fourier series solutions.

UNIT- IV: LAPLACE TRANSFORMS

Transforms of simple functions– Properties of Transforms – Inverse Transforms – Transforms of Derivatives and Integrals – Periodic functions – Initial and final value theorems – Convolution theorem – Applications of Laplace transforms for solving linear ordinary differential equations upto second order with constant coefficients and Linear simultaneous differential equations of firstorder with constant coefficients.

UNIT- V:FOURIER TRANSFORMS

Statement of Fourier integral theorem –Fourier transforms pairs– Fourier Sine and Cosine transforms– Properties–Transforms of simple functions–Convolution theorem–Parseval's theorem.

TEXTBOOKS

- 1. VeerarajanT.(2007), EngineeringMathematics(for firstyear), TataMcGrawHillPublishingCo.,
- 2. VeerarajanT. (2005), EngineeringMathematics(for semesterIII), TataMcGrawHillPublishingCo.,

REFERENCES

- 1. Singaravelu (2009), Transforms and Partial Differential Equations, MeenakshiAgency.
- 2. Kreyszig E.(2011), Advanced Engineering Mathematics(9thed.), JohnWiley&Sons.
- 3. Grewal B.S.(2012), HigherEngineering Mathematics, KhannaPublishers.

Total No.ofPeriods :60

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Subject Code:	:	Subject N	ame: ELI EL	ECTRIC ECTRO	CAL AN NICS C	D IRCUI	ГS		Ty / Lb/ETL	L	T /S.	P/ F	2	C
EBRA22002											Lr			
	P F	Prerequisit Engineerin	te: Basic l g	Electrica	al and E	lectroni	cs		Ту	3	1/0	0/0		4
L: LectureT:Tu	utorial	SLr :	Supervise	d Learni	ngP : Pro	ojectR :	Research	n C:						
CreditsT/L/ET	L:Theo	ory/Lab/Er	nbeddedT	heoryan	d Lab									
OBJECTIVE	:													
To give an und	lerstan	ding of:				1 .1								
I he pr Design	inciple	of AC and develor	d DC Circ	uits usin iers ami	g netwo	rk theore	ems lators as	required						
Design	ing a	ild develop	ing reeth		SEOUT		$\frac{1}{S(CO_S) \cdot (CO_S) \cdot (CO_$	(3-5)						
Studentswillb	e able	to		COUR		COML	5(005).((5 5)						
CO1		Understan	d the fund	lamental	s of Ana	log DC	circuits.							
CO2		Describe t	he signific	cance of	AC circ	uits.								
CO3		Discuss t	he worki	ng of di	odes an	d its app	olication	is						
CO4		Apply the	electronic	devices	to deve	lop an a	mplifier							
CO5		Implemen	t an oscill	ator gene	erating d	lesired fi	requency							
MappingofCo	urseO	utcomeswith ProgramOutcomes(POs)												
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO	011	PC)12
CO1	3	3	3	3	2	3	1	2	3	2	3		3	
CO2	3	3	3	3	3	3	1	3	2	2	3		3	
CO3	3	3	3	3	3	1	1	2	3	3	3		3	
C04	3	3	3	3	3	1	1		3	3	2		3	
	3	5 PSO1	2 PS($\frac{3}{2}$	J PS	03	1 PS	1 SO4	3	2			3	
CO1	3	501	2	52	3	05	3							
	3		1		- 1		3							
CO3	3		1		2		3							
CO4	3		2		2		3							
CO5	3		3		1		3							
3/2/1 Indicates	s Strei	ngth Of Co	orrelation	n, 3 – Hi	gh, 2- M	ledium,	1- Low	-	_					
ory	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills	Interdisciplinarysubject				
Catego				√										

Ty/Lb/ **Subject Code:** SubjectName: ELECTRICAL AND ELECTRONICS L **T**/ **P/ R** CIRCUITS ETL S.Lr **EBRA22002 Prerequisite: Basic Electrical and Electronics** 3 1/0 Ty 0/0 Engineering

UNIT I:DC CIRCUITS

Introduction – V-I relationships of circuit parameters – Voltage source and current source - Kirchhoff's laws –Network reduction techniques – Mesh and Node analysis – Superposition theorem – Thevenin's theorem –Norton's Theorem–Maximumpowertransfer theorem

UNIT II :AC CIRCUITS

RMS and average values of periodic waves– Form factor– phase and phase difference– RL, RC, RLC circuits – Parallel circuits – power and power factor – Introduction to three phase system – Solution ofbalancedthree phasecircuits– Powermeasurementof3-phase system

UNIT III : RECTIFIERS AND REGULATORS

Introduction to Diodes-PN, Zener and Avalanche Diodes - Half Wave Rectifier, Full Wave Rectifier(Centre Tapped and Bridge Type), Filters and its Types - Load and Line Regulation-Zener Diode as Voltage Regulators

UNIT IV: AMPLIFIERS

Transistor biasing - CE, CB and CC – Amplifiers - Current gain - Voltage gain - Frequency response - Power amplifiers - Types of Feedback Amplifiers

UNIT V:OSCILLATORS

Positive Feedback- Barkhausen Criterion for Oscillators - Low Frequency Oscillators (RC Phase shift &Wein Bridge) – High Frequency Oscillators(Hartley &Collpits)

TEXTBOOKS

- 1. Floyd(2005)ElectronicDevice,(7thed.),PearsonEducation
- 2. David, A. Bell (2009) Fundamentals of Electronic Devices and Circuits, (5thed.), Oxford UniversityPress
- Sudhakar, Shyammohan (2010) Circuits & Networks Analysis & Synthesis, Tata McGraw Hill(unit 1&2)

REFERENCES:

- $1. \quad Milman, Halkias (2010) Integrated Electronic, Tata McGrawhill publication$
- 2. BoylestadNashelsky(2009)ElectronicDevices andCircuittheory, (10thed.),PHI



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Total no.of Periods:60

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Control C

Subject Name: ELECTRICAL MACHINES P/R Subject Code: L Т С Tv/Lb/ ETL S.Lr **EBRA22003** 3 0/0 0/0 **Prerequisite:** Basic Electrical and Electronics Ty 3 Engineering SLr :SupervisedLearningP :ProjectR: Research C:Credits L: LectureT:Tutorial T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab **OBJECTIVE:** To familiarize the principles of operations and characteristics of DC machines • To acquire the knowledge of electrical transformers and induction motors To study the operation of synchronous motors. To have exposure to transformers To gain knowledge in stepper and servomotors COURSEOUTCOMES(COs):Studentswillbe able to Understand the fundamentals of DC Machines and their operation. **CO1 CO2** Describe the significance of Transformers in Electrical Applications **CO3** Discuss the construction, types and operations of different categories of Induction motors **CO4** Apply the concept of induction motors to construct synchronous machines for specific electrical application Develop brushless alternators, servomotors, stepper motors and hysteresis motors for dedicated power **CO5** based application MappingofCourseOutcomeswithProgramOutcomes(POs) **COs/POs PO2 PO3 PO9 PO10 PO12 PO1 PO4** PO5 PO6 **PO7 PO8 PO11 CO1** 3 3 3 3 2 2 1 1 1 2 3 2 2 2 CO₂ 3 2 1 1 3 1 2 3 3 3 **CO3** 3 2 1 2 3 2 1 3 3 3 2 2 **CO4** 3 2 1 2 3 2 1 3 3 3 2 2 CO5 3 2 2 3 3 3 3 3 3 3 3 1 COs /PSOs PSO1 PSO₂ PSO3 PSO4 **CO1** 3 2 2 1 **CO2** 3 2 2 1 **CO3** 3 2 2 1 **CO4** 3 2 1 2 **CO5** 3 2 2 1 3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low EngineeringScien ProgramElecti ves andSocialSciences Internships/ Technical Skill Practical/ Project Program Core **DpenElectives** BasicSciences Soft Skills Humanities ces Category $\sqrt{}$

TEXTBOOKS:

1. B L Theraja& A K Theraja, A textbook of Electrical Technology, Schand Publishers, 2014.

2. Murugesh Kumar K.,,, Electric Machines Vol", Vikas Publishing House Pvt Ltd, 2010.

3. MurugeshKumar K.,,,ElectricMachinesVol II",VikasPublishingHousePvtLtd,2010

4. MehtaV.K.andRohitMehta,PrinciplesofPowerSystem",S.Chandand CompanyLtd,2003

REFERENCES:

1. Fitzgerald A.E., Charles Kingsley, Stephen .D. Umans, "Electric Machinery", Tata McGraw Hill publishing Company Ltd, 2003.

2. Gupta J. B.,,, Theory and Performance of ElectricalMachines", S.K.KatariaandSons, 2002

3. Kothari D. P.andNagrath I. J.,,, Electric Machines'', Tata McGraw Hill Publishing Company Ltd, 2002.

4. BhimbhraP.S. "Electrical Machinery", Khanna Publishers, 2003.

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UNIT I: D.C. MACHINES

Engineering

Constructional details – EMF equation –Types-characteristics of series, and shunt generators – principle of operation of D.C. Motor – back emf and torque equation – characteristics of series and shunt motors - starting of D.C. Motors – types of starters - speed control of DC motors.

UNIT II: TRANSFORMERS

Constructional Details – Principle Of Operation – EMF Equation – Transformation Ratio – Transformer on No Load – Parameters Referred To HV/LV Windings – Equivalent Circuit – Transformer on Load – Regulation-Auto Transformer.

UNIT III: INDUCTION MOTORS

Construction – types – principle of operation of three-phase induction motors – equivalent circuit – starting and speed control– single-phase induction motors (only qualitative analysis).

UNIT IV: SPECIAL MACHINES-I

Construction of Synchronous machines-types-induced emf-Equivalent circuit of excited-rotor synchronous motor- Starting- Permanent magnet synchronous motors-Applications of Synchronous motors.

UNIT V: SPECIALMACHINES-II

Brushless alternators–Switched reluctance motor–control differential receiver-stepper motor- servomotor-Hysteresis motors-Synchros and its types.

Total no. of Periods: 45

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Subject Code: EBME22005	Subjec	et Name	: MACI	HINE D	RAWIN	IG		T / L/ ETL]	L T/ S.Lr	· P/ • R	C			
	Prerec	uisite:	Basic Ei	ngineeri	ng Graj	ohics		Ty	2	0/0	2/0	3			
L : Lecture T : Tu	itorial	S Lr : S	upervise	d Learni	ng P: I	Practical	R : Res	search	C: Cred	its					
T/L/ETL : Theory	y/Lab/E1	nbeddec	l Theory	and Lab	0										
OBJECTIVES:	The pur	pose of	study is	to impai	t knowl	edge in f	fundame	entals of	machin	e drawing	g and asse	embly			
drawings.															
COURSE OUTC	COMES	(COs)	: The stu	ident w	ill be ab	le to									
CO1	Unders	stand the	e code of	practice	e and BI	S specifi	ication o	of basic machine elements.							
CO2	Apply manufa	the fund acturing.	lamental	s of mac	hine dra	wing lik	ce fits, limits and tolerance analysis in								
CO3	Assem jack et	ble the v c.	various n	nachine	parts of	onents,	Fail sto	ck, Cotte	r Joint, So	crew					
CO4	Sketch	Sketch the isometric view and orthographic view of various machine parts .													
CO5	Employ	y CAD t	ools to c	convert p	oart draw	ving into	orthogr	aphic vi	ews.						
Mapping of Cou	rse Out	Outcomes with Program Outcomes (POs)													
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
CO1	3	-	-	-	-	2	2	-	3	3	1	2			
CO2	3	-	-	-	-	2	2	-	3	3	1	2			
CO3	3	-	2	-	3	2	2	-	3	3	1	3			
CO4	3	-	2	-	3	2	2	-	3	3	1	3			
CO5	3	-	2	-	3	2	2	-	3	3	1	3			
Cos / PSOs	PS	01	PS	02	PS	03	PS	504							
CO1		3		2		3		2							
CO2	-	3		2		3		2							
CO3	-	3		2		3		2							
CO4	-	3		2		3		2							
CO5	-	3		2		3		2							
3/2/1 Indicates S	trength	Of Cor	relation	, 3 – Hig	gh, 2- M	ledium,	1- Low				•				
		S						cal							
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	es	Sci	and	ė	ctiv	'es	oje	Tec							
gory	enc	ing	les a	Cor	Ele	ctiv	/ Pr	/ sd	S						
ateg	Sci	leer	niti 1 S	am	am	Ele	cal	ishij	skill						
C	asic ngin ocial ogra				1g0	pen	acti	dill	oft S						
	ä	<u>a H K K K</u>					P1	St	Š						
				✓											



SubjectCode:	SubjectName:MACHINE DRAWING	Ty/Lb/	L	Τ/	P/R	С
EDME22005		ETL		SLr		
EDME22005	Prerequisite:Basic Engineering Graphics	Ту	2	0/0	2/0	3

UNIT- I-DRAWING STANDARDS

Code of practice for Engineering Drawing, BIS specifications–Welding symbols, riveted joints, keys, and fasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keysetc.

UNIT- II-INTRODUCTION TO MACHINE DRAWING

Fundamentals of machine drawing: Geometric Dimensioning - Limits, fits, Tolerances – Types – ToleranceAnalysis. Isometric to Orthographic conversion of Part drawings and vice versa, Assembly Drawings –Manual drawing.

UNIT- III-PREPARATION OF ASSEMBLY MODELS

Preparing the assembly views (with minimum four components) of various industrial oriented equipment. (E.g. Piston and connection rod, Coupling and shafts, Plummerblock, Tailstock, Cotter Joint, Knuckle Joint, Universal Joint and Screw Jack)

UNIT-IV –PREPARATION OF PART MODELS USING MODELING SOFTWARE 6

Preparing isometric view of various industrial oriented machine components-Selection of machine components from software library- Conversion of part drawing into orthographic views.(Drafting)

(UNIT-I,II and III should be practiced by drafting equipment-UNIT- IV to be practiced byCAD software)

Total No.of Periods: 45

6

9

24

TEXT BOOK:

1. N.D.BhattandV.M.Panchal, "MachineDrawing", CharotarPublishingHouse, Anand, Gujarat, India. 2004.

REFERENCE:

1. KRGopalakrishnan, "Machinedrawing", SubhasStores, Bangalore. 2007



Subject Code	:	Subject N	ame : ST	RENG	FH OF]	MATE	RIALS	Ty / Lb/E	ГL	L	T /S.	P/ R	C			
EBME22006		Prerequis	ite: Engi	neering	Mecha	nics		Ту		3	1/0	0/0	4			
L: LectureT:T	utorial	SLr :	Supervise	edLearn	ingP:Pro	ject R:	Researc	hC:Crea	lits							
T/L/ETL:Theo	ory/Lal	b/Embedd	edTheory	andLab												
OBJECTIVE	:															
• Ba	asic pr	inciples of	stress, str	ain and o	elastic c	onstants										
• To	o find of	deflection	of beams	unig nic	ment u	agrams										
COURSEOUTCOMES(COs):(3- 5)																
CO1	τ	Jnderstand the concepts of mechanics of solids														
CO2	A	Analyze th	e stresses	involve	d due to	differer	nt types of	pes of loading								
CO3	A	Apply the o	different t	heories	of mecha	anics										
CO4	Ι	Derive the	expressio	n for de	flection	and ben	ding mo	ment								
CO5	Use mathematical approach to analyze the stresses involved															
MappingofCo	ourseC	Outcomes	withProg	ramOut	comes(l	POs)	-		•			-	•			
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9]	PO10	PO11	PO12			
CO1	3	3	3	2	3	2	2	2	3		3	2	2			
CO2	3	3	3	2	3	2	2	2	3		3	2	2			
CO3	3	3	3	2	3	2	2	2	3		3	2	2			
CO4	3	3	3	2	3	2	2	2	3		3	2	2			
CO5	3	3	3	2	3	2	2	2	3		3	2	2			
Cos/PSOs	I	PSO1	PSC	02	PSO3		PS	PSO4								
CO1		3	3			2		2								
CO2		3	3			2		2								
CO3		3	3			2		2								
CO4		3	3			2		2								
CO5		3	3			2		2								
3/2/1 Indicate	s Stre	ngth Of C	Correlatio	n, 3 – H	ligh, 2-]	Mediun	n, 1- Lov	W	1	1		1	1			
							1						1			
Ąŗ	ences	ingSciences	es ISciences	Core	Electives	stives	Project	ps / TechnicalSki	S							
Catego	BasicScie	Engineeri	Humaniti andSocia	Program	Program	OpenElec	Practical/	Internshi	Soft Skill							
				l v												

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Subject Code:	SubjectName:STRENGTH OF MATERIALS	Ty/Lb/ ETL	L	T/ S.Lr	P/ R	С
EBME22006	Prerequisite:Engineering Mechanics	Ту	3	1/0	0/0	4

UNIT-I: STRESS, STRAIN AND DEFORMATION OF SOLIDS

EDUCATIC

Rigid and Deformable bodies – Strength, Stiffness and Stability – Stresses; Tensile, Compressive and Shear –Deformation of simple and compound bars under axial load – Thermal stress – Elastic constants and their relationship –strain energy due to axial load – stress due to suddenly applied load and impact load.

UNIT- II: BEAMS -LOADS AND STRESSES

Types of beams: Supports and Loads– Shear force and Bending Moment in beams– Cantilever, Simplysupported beams and Overhanging beams Stresses in beams– Theory of simple bending – Stress variation along the length and in the beam section – Effect of shape of beam section on stress induced – Shear stress distribution in beams of different sections.

UNIT- III: TORSION OF SHAFTS AND SPRINGS

Theory of pure torsion- Torsion of circular and hollow shafts –Stepped shafts – Composite shaft – Stress due tocombined bending and torsion.Type of springs - Stiffness- Springs in series-Springs in parallel - Stresses and deflections in helical springs and leaf springs–Design of helical springs-design of buffer springs-leaf springs.

UNIT- IV: DEFLECTION OF BEAMS

Double integration method-Macaulay'sMethod-Area Moment Theorems for Computations of slope and deflection in Beams. Columns – End conditions – Equivalent length of a column – Euler equation – Slendernessratio–Rankine formula for columns

UNIT- V: ANALYSISOF STRESSES IN TWO DIMENSIONS

Biaxial state of stresses – Thin cylindrical and spherical shells – Deformation in thin cylindrical and sphericalshells – Biaxial stresses at a point-Stress as Tension. Stresses on inclined plane – Principal planes and Principal stresses –Mohr'scircle for biaxial stresses–Maximum shear stress-Strain energy and Strain Energy Density

Total No.of Periods: 60

TEXTBOOKS

- 1. Rajput R.K. "Strength of Materials (Mechanics of Solids)", S.Chand& company Ltd., New Delhi,2010.
- 2. S.Ramamruthum and R.Narayan, "Strengthof Materials", DhanpatRai&Sons,

REFERENCES:

- 1. BeerF.P.and JohnstonR,(2002) "MechanicsofMaterials", McGraw-Hill BookCo, Third Edition
- 2. EgorP.Popov, "EngineeringMechanicsofSolids", PrenticeHallofIndia, NewDelhi.



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Subject Code:	Subject Code: Subject ELECT					ND DI(GITAL		Ty /Lb/ FTI	L	T/SLr	P/R	С
EDEC221D4	Pr	erequi	site: B	asic El	ectrical	l and	Elect	ronics	Ty	2	0.40	0.0	2
	Er	ngineer	ing						5	3	0/0	0/0	3
L: LectureT :Tut	torial	SLr :	Superv	vised Le	earning	P : Proj	jectR :]	Resear	ch C:				
CreditsT/L/ETL:	Theory	//Lab/E	mbedd	ed Theo	ory and	Lab							
OBJECTIVES:	.	1 (1		C 1'	• ,	. 1	· ·,						
•	To intro	oduce the	ne basic	cs of lin	ear inte	egrated	CITCUITS	S.					
•	To und	ess the orstand	the fur	damen	t operat	1011a1 a	mpinie svetor	rs.	Roolean	algabra			
,	 To design combinational and sequential logic circuits. 												
•	 To illustrate the conceptsof logic families and memory devices 												
COURSEOUTCOMES(COs):(3-5)													
The Students will beable to													
CO1	Recog	Recognize the basics of linearIC's and characteristics of operational amplifier											
CO2	Expre	ess vario	ous app	lication	sof op-	amp.							
CO3	Under	Understand the fundamentals of Number systems and Boolean Algebra											
CO4	Desig	n the co	ombina	tional a	nd Seq	uential	logic c	ircuits.					
CO5	Illustrate the concepts of Logic families and Memory devices.												
MappingofCourseOutcomes withProgramOutcomes(POs)													
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	12
CO1	3	3	3	3	2	3	1	2	3	2	3	3	
CO2	3	3	3	3	3	3	1	3	2	2	3	3	
CO3	3	3	3	3	3	1	1	2	3	3	3	3	
CO4	3	3	3	3	3	1	1	1	3	3	2	3	
CO5	3	3	2	3	3	1	1	1	3	2	1	3	
COs	PS	01	PS	02	PS	03	PSO4						
/PSOs			-		2								
	3		2		3		3						
	3		1		1		3						
CO3	3		1		2		3					-	
C04 C05	3		2		2 1		3						
3/2/1 Indicates S	5 Strengt	th Of C	orrelat	tion, 3	– High	, 2- Me	dium,	1- Low	7				
				,		,	,						
Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project				
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Dr. M.G.R.	NTED WITH
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EDUCATIONAL AND RESEARCH INSTITUTE	NAAC
DEEMED TO BE UNIVERSITY	* * * *
University with Graded Autonomy Status	
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Periyar E.V.R. Salai, Maduravoyal, Chennai – 95	

Subject Code: EBEC22ID4	Subject Name : ANALOG AND DIGITAL ELECTRONICS	Ty/Lb/ ETL	L	T/SLr	P/R	С
	Prerequisite: Basic Electrical and Electronics Engineering	Ту	3	0/0	0/0	3

UNIT I INTRODUCTION TO INTEGRATED CIRCUITS

Integrated circuit and its classification, Introduction to Operational amplifier-General operational amplifier stages-Internal circuit diagram of IC 741, Ideal Op-Amp , DC & ACCharacteristics, Slew rate and methods of improving slew rate, CMRR, PSRR, Frequency Response and Compensation techniques.

UNIT II APPLICATIONS OF OP AMP IC 741

Voltage follower, Inverting and Non-Inverting amplifiers, Summer and Subtractor – MultiplierandDivider – Differentiator and Integrator –Instrumentation Amplifier, Op- Amp Circuits using Diodes, Precision Rectifier – Clipper andClamper –Sample andHoldCircuit–LogandAntilog Amplifiers. RC Active filters-low pass and High pass-Band pass and Band reject, Comparators, Multivibrators

UNIT III NUMBER SYSTEMS AND BOOLEAN ALGEBRA

Review of Number systems, Boolean Algebra–De Morgan's Law-Simplifications of Boolean Expression-Sum of Products and Product of Sums–Karnaugh Map(up to 5 variables)– QuineMcClusky method of Simplification

UNIT IV COMBINATIONAL AND SEQUENTIAL LOGIC CIRCUITS

Logic gates – AND, OR, NOT, NOR, NAND and EX-OR – Combinational Logic- Arithmetic Circuits – Half adder – Full adder, Half Subtractor – Code Converters – Multiplexer – Demultiplexer-Encoder – Decoder – Building Blocks Of Sequential Logic-RS, JK, Master-Slave, D and T Flip-Flops, Design of Asynchronous and Synchronous Counters - Binary and BCD Counters - Shift Registers.

UNIT V LOGIC FAMILIES AND MEMORY DEVICES

Characteristics of RTL, DTL, TTL, Families – Schottky, Clamped TTL, ECL, IIL –Classification of memories-ROM- ROM organization - PROM – EPROM – EPROM – EAPROM, RAM

Total No of Periods:45

Textbooks:

- 1. James. M. Fiore, "Operational Amplifiers and Linear Integrated Circuits", First Edition, ThomsonLearning.
- 2. RoyChoudhuryand ShailJain, "LinearIntegratedCircuits", WileyEasternLtd., 1991.
- 3. Charles H. Roth, "Fundamentals of Logic Design", Thompson Learning, 5th Edition
- 4. Morris Mano, "Digital Electronics and Design", Prentice Hall of India, 2000

Referencebooks:

- 1. MillmanandHalkias, "IntegratedElectronics", McGrawHill, 1992.
- 2. SergioFranco, "DesignwithOperationalAmplifiersandAnalogIntegratedCircuits", ThirdEdition, TMH, 2002.
- 3. John F.Wakerly, "Digital Design", Fourth Edition, Pearson/PHI, 2008
- 4. John.M Yarbrough, "Digital Logic Applications and Design", Thomson Learning, 2006.

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Subject code:		Subjec UNDE	SubjectName:UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY							, ,	L	T/S. Lr	P/ R	C
EBCC22ET1									ET	L		0.10	• 10	
		Prereq	uisite:N	il					ЕТ	L	1	0/0	2/0	2
L:LectureT:Tu	torial	SLr:Sup	ervisedL	earnin	gP:Proj	ectR:Re	searchC	:Credit	S					<u> </u>
T/L/ETL:Theo	ry/Lab/Em	beddedT	heoryan	dLab										
OBJECTIVE														
•	Developn	nent of	a hol	istic	perspe	ctive ł	based of	on se	lf-	explor	ation	about		
	themselve	es (huma	an being	g), far	nily, so	ciety ar	nd natur	e/exist	tenc	e. –				
•	Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence													
	Strengthening of self-reflection.													
	 Strengthening of self-reflection. Development of commitment and courage to act 													
COURSEOU		$\overline{\mathbf{COs}}$	-5)• The	stude	nts will	he able	to							
CO1	Relate sel	If and su	rroundin	gs and	l identify	v respon	sibility i	n life						
CO2	Associate	human	relations	e hip an	d nature	to hand	lle probl	ems an	d pr	ovide si	ustainah	le solutio	ns	
CO3	Develop	critical a	bility and	d enga	oe in ret	flective	and inde	enender	nt Tł	ninking				
CO4	Show cor	nmitmen	t toward	s unde	erstandir	ng of val	ues	pender		iiiikiii 5				
C05	Apply Hu	ıman val	ues in da	to d	ay settir	ng in rea	l life							
MappingofCou	rseOutcon	nes with	Program	nOuto	comes (I	POs)								
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8]	<u>PO9</u>	PO10	PO11	PO	12
CO1			1	1		2	1			1	1			2
CO2			2	2	1	2	3	1			2			2
CO3			1	1	1	2				1	2			3
CO4			2		1	1	1	3		1	1			3
CO5			1			2	1	2		1	1			3
COs /PSOs	PSO1		PS	SO2	PS	03	PSO4 PSO5							
CO1	3		2			3								
CO2	2		2			3								
CO3	3		2		2	2								
CO4	3		1		1	2								
CO5	2		2]	1								
3/2/1 Indicates	s Strength	Of Corr	elation,	3 – H	igh, 2- I	Medium	1, 1- Lov	v			1			
			_											
			ocia		/e		~							
			d sc		ctiv		nar	nent	ject					
ý	snce	50	an	ore	ele	ive	ipli	loq	Pro					
10801	Scie	ring	ties	ı C	ram	lect	lisc	om	al/					
Cate	sic f	inee	nce	ran	rog	υE	er L	IIC	ctic					
	Baí	ingi cie	Hum cie	rog	d.	Deel	Inte	Ski	Pra					
		щΩ	T S	Щ			✓							

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SubjectCode:	SubjectName: UNIVERSALHUMANVALUES: UNDERSTANDING HARMONY	Ty/Lb /ETL	L	T/S. Lr	P/ R	С
EBCC22E11	Prerequisite:Nil	ETL	1	0/0	2/0	2

OBJECTIVE:

- 1. Development of a holistic perspective based on self-exploration about themselves(humanbeing), family, society and nature/existence.
- 2. Understanding(ordeveloping clarity) of the harmony in the human being, family, society and nature/existence
- 3. Strengthening of self-reflection.
- 4. Development of commitment and courage to act.

EDUCATIO

UNIT1:Course Introduction-Need,BasicGuidelines,Conten tand Process for Value Education

- 1. Purpose and motivation for the course, recapitulation from Universal HumanValues-I.
- 2. Self-Exploration–what is it?-Its content and process; 'Natural Acceptance'and Experiential Validation-as the process for self-exploration.
- 3. Continuous Happiness and Prosperity-A look a basic Human Aspirations
- 4. Right understanding, Relationship and Physical Facility-the basic requirements for fulfillment of aspirations of every human being with their correct priority.
- 5. Understanding Happiness and Prosperity correctly-A critical appraisal of the current scenario
- 6. Method to fulfill the above human aspirations: understanding and living in at various levels of harmony

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.

UNIT2:Understanding Harmony in the Human Being-Harmony in Myself!

- 1. Understanding human being as a co-existence of the sentient'I'and the material'Body'.
- 2. Understanding the needs of Self('I') and 'Body'-happiness and physical facility.
- 3. Understanding the Body as an instrument of 'I'(I being the doer, seer and enjoyer).
- 4. Understanding the characteristics and activities of I'and harmony in I'.
- 5. Understanding the harmony of I with the Body:Sanyam and Health;correct appraisal of Physical needs, meaning of Prosperity indetail.
- 6. Programs to ensure Sanyam and Health.

Include practice sessions to discuss the role others have played in makingmaterial goods available to me.Identifyingfrom one's own life.

Differentiate between prosperity and accumulation.Discuss program for ensuring health vs dealing with disease

UNIT3:Understanding Harmonyin the Family and Society-Harmony in Human-Human Relationship

- 1. 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
- 2. Understanding the meaning of Trust; Difference between intention and competence
- 3. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship



- 4.
- 5. family):Resolution,Prosperity,fearlessness(trust)andco-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society-Undivided Society, Universal 6. Order-fromfamily to world family.

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 universal value in relationships. Discuss with scenarios. Elicit examples from students'lives.

UNIT 4: Understanding Harmony in the Nature and Existence-Whole Existence as Coexistence

- 1. Understanding the harmony in the Nature
- 2. Interconnectedness and mutual fulfillment among the four orders of nature- recyclability and self-regulation in nature.
- 3. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space.
- 4. Holistic perception of harmony at all levels of existence.
- 5. Include practice sessions to discuss human being as cause of imbalance innature(film"Home"can be used),pollution,depletion of resources and role of technology etc.

UNIT 5:Implications of the above Holistic Understanding of Harmony on Professional Ethics

- 1. Natural acceptance of human values
- 2. Definitiveness of Ethical Human Conduct
- 3. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- Competence in professional ethics:an Ability to utilize the professional competence for 4 augmenting universal human order b. Ability to identify the scope and characteristics of peoplefriendly and eco-friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
- 5. Case studies of typical holistic technologies, management models and production systems
- 6. Strategy fo rtransition 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
- 7. Sumup.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions e.g.To discuss the conduct as an engineer or scientist etc.

TextBooks

1. HumanValues and ProfessionalEthics byRR Gaur, R Sangal, G PBagaria, ExcelBooks,NewDelhi,2010

REFERENCEBOOKS

- JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999. 1.
- HumanValues, A.N. Tripathi, NewAgeIntl. Publishers, NewDelhi, 2004. 2.
- 3. *TheStoryofStuff(Book).*
- The Story of My Experiments with Truth-by Mohandas Karam chand Gandhi.4.
- 5. SmallisBeautiful-E.FSchumacher.
- 6. SlowisBeautiful-CecileAndrews
- 7. EconomyofPermanence-JCKumarappa
- 8. BharatMeinAngrejiRaj–PanditSunderlal
- 9. RediscoveringIndia-byDharampal

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SubjectCode:	Si C	ubjectNa IRCUITS	me:ELE(S LAB	CTRICA	AL AND) ELEC	TRON	ICS	Ty/Lb/ ETL	L	T/S.Lr	P/ R	С
EBRA22L01	P	rerequisi ngineerir	te:Basic I	Electrica	al And	Electro	nics		Lb	0	0/0	3/0	1
L:LectureT:Tu	torialS	Lr:Superv	visedLear	ningP:Pi	ojectR:	Researc	hC:Crec	lits		1			
T/L/ETL:Theor	ry/Lab	/Embedde	edTheorya	and Lab									
OBJECTIVES	S:The	student w	ill learn										
• To	verify	practical	ly the elec	ctric circ	uits theo	oretically	y analyz	ed by ne	etworkthe	orems			
• 10	venny	experime		electro		115							
COURSEOUT	rCOM	IES(COs)):(3-5)										
CO1	Design electrical circuits based on network theorems and compare the experimental values with												
	th	heoretical calculations.											
CO2	A	nalyse the typical characteristics of PN and Zener diodes by performing experiments in their											
601	d	ifferent m	odes of o	peration	·	C D IT	1 1 1 1 1		· 1 1		· · ·	1	
CO3	U e:	nderstand	I the I/P C ally verify	VP chara	acterstics	s of BJT terstics	and FE	T transi	stors by de	esigning o	circuits ar	ld	
CO4	D	esign osc	illators of	various	categori	ies and v	verify th	eir frequ	ency of o	peration			
<u>CO5</u>	Ĭr	nnlement	the worki	ng pring	vinles of	electror	ic devic	es to de	sign rectif	fiers and y	voltage re	gulator	s
Implement the working principles of electronic devices to design rectifiers and voltage regulators													
MappingofCo Cos/Pos	urseO PO1	utcomesy	vithProgr	amOut	comes(H	Pos) PO6	PO7	PO8	POQ	PO10	PO11	PO1	2
C01	3	3	3	3	2	3	1	2	3	2	3	3	4
CO2	3	3	3	3	3	3	1	3	2	2	3	3	
CO3	3	3	3	3	3	1	1	2	3	3	3	3	
CO4	3	3	3	3	3	1	1	1	3	3	2	3	
CO5	3	3	2	3	3	1	1	1	3	2	1	3	
Cos/PSOs	P	SO1	PSC)2	PSO3		PSO4						
CO1	3		2		3		3						
CO2	3		1		1		3						
CO3	3		1		2		3						
C04 C05	3		2		2 1		3						
	5		5		A		5						
3/2/1 Indicates	Streng	gth Of Co	rrelation	, 3 – Hi	gh, 2- M	ledium,	1- Low				1		
	ences	ingSciences	iesandSocial	Core	Electives	ctives	/Project	nips /Technical	ls				
€gory	BasicSci	Engineer	Humanit Sciences	Program	Program	OpenEle	Practical	Internsł	Soft Skil				
Cate				¥									


SubjectCode: EBRA22L01	Subject Name:ELECTRICAL AND ELECTRONICS CIRCUITS LAB	Ty / Lb/ ETL	L	T/S.Lr	P/ R	С
	Prerequisite: Basic Electrical And Electronics Engineering	Lb	0	0/0	3/0	1

LIST OF EXPERIMENTS:

ELECTRICALCIRCUITS

- 1. Verification of KCLand KVLtheorem.
- 2. Verification of Superpositiontheorem
- 3. Verification of Maximum Power Transfer Theorem
- 4. Verification of Norton Theorem.
- 5. Verification of Thevenin's Theorem.
- 6. Verification of Nodal and MeshAnalysis.

ELECTRONICCIRCUITS

- 7. Characteristics of PNand Zener diode
- 8. I/P and O/P characteristics of BJT
- 9. I/P and O/p characteristics of FET
- 10. Design of Oscillators.
- 11. Rectifiers-FullWave, HalfWave and their characteristics.
- 12. Design of VoltageRegulator

Total No.of Periods:45

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Subject Code:		Subject 1	Name: EL	ECTR	ICAL M	IACHIN	NES I	AB	Ty /Lb/		L	T/S.Lr	P/ R	С
EBRA22L02	Pro	erequisit	te: Electri	ical Ma	chines				<u>EIL</u> Lb		0	0/0	3/0	1
L:LectureT:Tu	torialSL	r:Superv	visedLearr	ningP:Pr	ojectR:	Researcl	h C:Crec	lits						
T/L/ETL: The	ory/Lab/	Embedd	ed Theory	and Lat)									
OBJECTIVE	S:													
 To Students 	y variou gain pr	is types of actical er	of DC maa	chines and in using	nd Trans	formers	which r	nainly (ransfor	covers mers	expe starte	riments rs etc	s with rea	l machir	nes and
•	Various	types of	experime	nts relate	ed to Ele	ectrical r	nachiner	y like I	Load c	harac	teristic	s, Load te	est, Brak	e test,
Parallel	Operati	on, Loss	separatio	n, OC ai	nd SC ch	naracteri	stics are	perform	ned.					
•	l'o study	the char	acteristics	s of sync	chronous	s motors	, inducti	on mot	ors and	d othe	er speci	al machir	nes.	
COURSE OU	TCOM	ES(COs):(3-5)											
The Students v	vill be al	ble to		<u> </u>			11	1						
COI	Design	circuits i	meant for	open cu	cuit cha	ractersti	cs and lo	bad test	s on L	C Sh	ut gene	erators.		
CO2	Analyse	yse the characteristics DC shunt Motors and DC series motors by performing load test experiments on machines												
<u>CO3</u>	these ma	machines existent the significance of speed control characteristics of a DC shunt motor												
CO3	Assess tl	ess the characteristics of single phase transformer by performing O.C, S.C tests and load tests and on												
~~~	Alternate	rnator and single phase induction motor by performing load tests respectively												
CO5	Rememb	per the co	oncepts of	Univers	sal and F	Reluctan	ce motor	rs ram Or	itcom	es(PC	s)			
Cos/Pos	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	9 9	PO10	PO11	PO	12
CO1	3	3	3	3	2	3	2	2		3	3	3		3
CO2	3	3	3	3	2	3	2	2		3	3	3		3
CO3	3	3	3	3	1	3	2	2		3	2	3		3
CO4	3	3	3	3	2	3	2	2	ĺ	3	3	3		3
CO5	3	3	3	3	1	3	2	2	,	3	2	3		3
Cos/PSOs	PS	501	PSC	)2	PSO3	3	PSO-	1						
CO1	2		1		2			2	-					
CO3	2		1		2			2 1						
CO4	2		1		2			2						
CO5	2	th Of C	1	- <u>)</u> II	2 iah 2 N	To dimen	1 Low	2						
3/2/1 Indicate	s Streng	gth Of C	orrelation	n, 3 – H	ign, 2- N	leaium	, 1- LOW	7						
Category	BasicSciences	Engineering Sciences	Humanities and SocialScie	Program Core	Program Electives	OpenElectives	Practical /Project	Internships /Technical	Soft Skills					
				~			$\checkmark$							



Subject Code: EBRA22L02	Subject Name: ELECTRICAL MACHINES	LAB	Ty /Lb/ ETL	L	T/S.Lr	P/ R	С
	Prerequisite: Electrical Machines		Lb	0	0/0	3/0	1

#### LIST OF EXPERIMENTS

- 1. Open Circuit and Load Test on DC Shunt Generator
- 2. Load Test on DC Shunt Motor.
- 3. Load Test on DC Series Motor.
- 4. Speed Control on DC Shunt Motor
- 5. O.C. and S.C. test on 1-phase Transformer
- 6. Load Test on single phase Transformer
- 7. Load Test on Alternator.
- 8. Load Test on 1-phase Induction Motor.
- 9. Study of universal motor
- 10. Study of Reluctance motor.

Total No. of Periods: 45



Subject Code:	Su	bjectNa	me: STRI	ENGTH	OF MA	TERIA	LS LA	B	Ty/	L	T /S I	<b>P/ R</b>	С
EBME22L03									LD/EIL		/S.L r		
	Pre	erequisi	te: Stre	ngth of ]	Materia	ls			Lb	0	0/0	3/0	1
L: LectureT:Tu	ıtorial	SLr:	Supervise	d Learn	ingP : Pr	ojectR :	Researc	ch C:			•		
CreditsT/L/ET	L:Theor	y/Lab/E	mbedded7	Theoryar	nd Lab								
OBJECTIVE	Thestuc	lent will	learn										
<ul> <li>Experi</li> </ul>	mental	methods	of finding	; mechar	nical proj	perties o	of materi	als					
COURSEOU	ГСОМІ	ES(COs)	):(3- 5)										
COl	Un	derstand	l the stress	strain d	iagram o	of steel r	od.						
CO2	De	termine t	he Hardnes	stesting o	of Steel, C	Copperan	dAlumin	ium					
CO3	Est	imate the	Spring con	nstant, un	der Tensi	ion and C	Compress	ion					
CO4	Est	imate the	notch toug	hness of	steel usir	ng Izodin	np attestin	ng machi	ne				
CO5	Stu	dy the m	echanical p	roperties	of Steel a	and Cast	iron spec	imen usi	ng Universa	al testing	machine.		
MappingofCo	urseOu	tcomesv	vithProgr	amOuto	comes(P	os)							
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	<b>PO9</b>	<b>PO10</b>	PO11	PO	12
CO1	3	3	2	2	2	2	2	2	3	3	2		2
CO2	3	3	3 2 2 2 2 2 3 3 2 2										
CO3	3	3	2	2	2	2	2	2	3	3	2		2
CO4	3	3	2	2	2	2	2	2	3	3	2		2
CO5	3	3	2	2	2	2	2	2	3	3	2		2
Cos/PSOs	PS	501	PSC	)2	PS	03	PS	<b>504</b>					
CO1	-	3	3		2	2		2					
CO2	-	3	3		2	2		2					
CO3	-	3	3		2	2		2					
CO4	-	3	3		2	2		2					
CO5		3	3		2	2		2					
3/2/1 Indicates	s Streng	gth Of C	orrelatio	n, 3 – Hi	igh, 2- N	/ledium,	, 1- Low	7					
Category	BasicSciences	EngineeringSciences Humanities andSocialSciences Program Core Program Core Program Core Program Electives Program Core Program Core Pr											



Subject Code: EBME22L03	SubjectName:STRENGTH OF MATERIALS LAB	Ty / Lb/E TL	L	T /S.Lr	P/R	С
	Prerequisite: Strength of Materials	Lb	0	0/0	3/0	1

#### LIST OF EXPERIMENTS

- 1. Evaluation of Engineering Stress/strain diagram on steel rod.
- 2. Compressiontest on Bricks, Concrete blocks
- 3. Deflection test on beams–Verification of Maxwell Theorem
- 4. Hardness testing of Steel ,Copper and Aluminium using Brinell hardness machines
- 5. Hardness testing of Steel ,Copper and Aluminium using Rockwell machine
- 6. Estimation of Spring constant, under Tension and Compression
- 7. Estimation of notch toughness of steel using Charpy impact testing machine

**Total No.of Periods: 45** 



# **SEMESTER IV**

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Subject Coc	le Su	bject Na	ame :STA	TISTIC	CAL AN	DNUN	IERICA	L	Ty/Lb/	L	T/	/ P	/R	С
EBMA220(	)8 M	ETHOI	DS						ETL		S.L	.r		
	F	Prerequis	ite: Math	ematics	-III				Ту	3	1/0	(	)/0	4
L:Lecture7	T:Tutor	ial	SLr:Supe	rvisedLe	earningP	Project	R:Resea	rchC:Credits						
T/L/ETL:7	Theory/	Lab/Em	beddedTh	neoryand	Lab									
OBJECTIV	/ES :													
The studer	nt shou	ld be m	ade to:											
To be able to	apply t	he conce	pts in Stati	stics										
To understan	d the co	ncepts in	Numerica	ly 1 mathod	0									
To be able to	solve A	Algebraic	and Trans	cendental	s equation	ns								
To understan	d the co	ncepts ir	Interpolat	ion.	equation									
COURSEO	UTCO	DMES(C	COs):(3-5	) The st	udents	will be a	ble to							
CO1	Analyz	e Statisti	cal data											
CO2	Unders	tand prob	ability the	ory										
CO3	Unders	tand the	concepts in	Numerio	cal metho	ods								
CO4	Solve a	lgebraic	and Transc	endental	equation	S								
CO5	Apply ]	Interpola	tion concep	ots										
			Mappir	ng of Co	urse Ou	itcomes	with Pr	ogram Outco	omes (POs)					
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO	10	PO11	PC	)12
CO1	3	3	2	2	3	1	1	1	2	2	2	1		3
CO2	3	3	1	3	2	2	1	1	2	1	L	2		2
CO3	2	3	1	2	2	3	3	1	1	2	2	2		3
CO4	2	3	1	1	1	3	3	1	1	2	2	1		2
CO5	3	2	1	3	1	2	3	1	1	2	2	2		2
COs	P	SO1	PSO	02	PS	03	PS	04						
/PSOs						4								
		2		L		1		3						
C02		2	1	L		1 1		3						
		2	1	L		1		3						
C04		2	1	L		1		3					-	
	4 64	4		L 	TT* 1		• 1	<u> </u>						
3/2/1 Indica	ates Sti	rength (	Jf Correl	ation, 3	– High,	2- Med	1um, 1-	Low	1	-				
								al						
		ces						nic						
Ŋ		iene	Icea		ves		sct	ech						
08	ses	Sci	cier	e	ecti	/es	oje	s/T kill						
ate	enc	ing	ies ulSc	Co	Ele	ctiv	/Pı	s S	s					
	Sci	leei	unit oci <i>ɛ</i>	am	am	Ele	cal	msl	kill					
	Isic	ıgir	dSc	ogr	ogr	ben	acti	ntei	ftS					
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Subject Code EBMA22008	Subject Name :STATISTICAL AND NUMERICAL METHODS	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Mathematics -III	Ту	3	1/0	0/0	4

#### **UNIT I: BASICS OF STATISTICS**

Variables–Uni-variateData –FrequencyDistribution–MeasuresofCentralTendency–Mean–Median–Mode– Quartiles –Measures of Dispersion – The Range – Quartile Deviation –Standard Deviation – Relative Measures ofDispersion–Coefficient ofVariation–Quartile CoefficientofVariation.

#### UNIT II: PROBABILITY AND RANDOM VARIABLE

DUCATIO

Axioms of Probability–Conditional probability–Total probability–Baye's Theorem–Random variable– Probability mass function – Probability density function – Properties – Moments (Definition and simple problems).

### UNIT III:BASICS OF NUMERICAL METHODS

Curve fitting-Method of group averages-Principle of least square-Method of moments-Finite differences-Operators(Forward, Backward&Shifting)-Relationship between the operators.

### **UNIT IV: SOLUTION OF EQUATIONS**

Solution of Algebraic and Transcendental equations – Method of false position – Iteration method – Newton-Raphson method – Solution of Linear system of equations – Gauss Elimination method – Gauss-Jordan method –Iterativemethods–Gauss-Jacobimethod –Gauss-Seidel method –MatrixInversionbyGauss-Jordanmethod.

#### **UNIT V: INTERPOLATION**

Newton forward and backward differences – Central differences – Stirling's and Bessel's formulae – Interpolation with Newton's divided differences – Lagrange's method.

#### **Total no.of Periods:60**

#### **ReferenceBooks:**

- 1. VeerarajanT., Probability, Statisticsand, RandomProcesses, TataMcGraw HillPublishingCo., (2008).
- 2. Singaravelu, Probability and Random Processes, Meenakshi Agency, (2017).
- 3. GuptaS.C., KapoorV.K., FundamentalsofMathematicalStatistics, S.Chand&Co., (2007).
- 4. VeerarajanT., Numerical Methods, Tata McGrawHill PublishingCo., (2005).
- 5. SastryS.S., IntroductoryMethodsofNumericalAnalysis, PrenticeHall ofIndia, (2003).
- 6. KandasamyP., Thilagavathy, GunavathyK., Numerical Methods (Vol. IV), S. Chand&Co., (2008).



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EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution)

Charles by with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India. SubjectName: BASICSOF ROBOTICS **Subject Code:** L Т Р С Lb/ET /S.L 1 **EBRA22004** L R r **Prerequisite:Nil** 3 0/0 3 Ty 0/0 L: LectureT:Tutorial SLr : SupervisedLearningP :ProjectR:ResearchC:CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab **OBJECTIVE:** To understand the concept of robot anatomy. To understand the concepts of various drives and endeffectors • To analyze different sensors and significance of robots in various industries. • COURSEOUTCOMES(COs):(3-5) Students will be able to: **CO1** Understand the basic concepts of Robotics and Automation and its future prospects **CO2** Assess the characteristics of Robot anatomy, sensors, actuators and perfomance analysis of Robot systems. Familiarize with various sensors and end effectors of a robot. **CO3 CO4** Recall theapplications of robots in manufacturing, medical, space and agricultural sectors. **CO5** Apply the concepts of UAVs in different domains. MappingofCourseOutcomeswithProgramOutcomes(POs) PO4 COs/POs **PO1** PO3 **PO5 PO6 PO9 PO10 PO11 PO12** PO2 **PO7 PO8 CO1** 3 3 3 3 2 3 2 3 3 2 3 1 **CO2** 3 3 3 3 3 2 2 2 3 1 1 1 **CO3** 3 3 3 3 3 3 2 3 3 1 1 2 **CO4** 3 3 3 3 3 2 3 3 2 2 1 1 **CO5** 3 2 3 3 2 3 3 3 3 1 1 3 COs /PSOs **PSO1** PSO2 PSO3 PSO3 **CO1** 3 3 3 1 **CO2** 3 2 3 1 **CO3** 3 2 2 2 2 2 **CO4** 3 3 **CO5** 3 2 2 2 3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low **EngineeringSciences** undSocialSciences rogramElectives ractical /Project Internships /TechnicalSkill **DpenElectives** BasicSciences Program Core Humanities oft Skills Category

# **UNITI: INTRODUCTION TO ROBOTICS**

**Prerequisite:Nil** 

Automation and Robotics -Robotics in Science Fiction -A Brief History of Robotics- The Robotics Market and the Future Prospects

#### **UNIT II: FUNDAMENTALS OF ROBOTICS**

Definition of Robot - Basic Components -Robot Anatomy-Actuators-Sensors-controllers- Robot Configurations: Polar, Cylindrical, Cartesian coordinate and Jointed - Arm, Robot Motion: Degrees of Freedom, types of movements -Vertical, Radial and Rotational Traverse, Roll, Pitch and Yaw: Joint Notation Scheme: Work Volume.Robot drives Systems, Robot control types and precision of movement.

#### **UNIT III: END EFFECTORS, SENSORS AND ROBOT PROGRAMMING**

Mechanical gripper, vacuum cups, magnetic gripper, Tools as end effectors, Tactile sensors, proximityand range sensors, Machine vision – The sensing and Digitizing Function in Machine Vision-Image Processing Analysis-Training and Vision System-Robot Programing-methods-motion interpolationand WAIT, SIGNAL and DELAY Commands-Branching-Robot Language Structure-motion commandscomputations and Operations-monitor mode commands

#### UNIT IV: APPLICATIONS OF ROBOTS

Applications: Use of Robotics in manufacturing, Materialtransfer, machining loading, unloading, welding&assembly. Medical, Agricultural and space applications.

#### **UNIT V: UNMANNED VEHICLES**

Drones- Types and Applications; Unmanned Vehicles: Ground, Ariel and Underwater - Types and Applications – Biomimictic-Introduction

# Total no. ofPeriods:45

#### **TEXTBOOKS:**

**Subject Code:** 

**EBRA22004** 

1 Mikell P. Grooveret. al., "Industrial Robots - Technology, Programming and Applications", McGraw Hill, Special Indiation Edition, (2012)

2. JohnJ.Craig, "IntroductiontoRobotics", Pearson, 2009.

3. Deb S. R. and Deb S., "Robotics Technology and Flexible Automation", Tata McGraw Hill Education Pvt.Ltd, 2010.

#### **REFERENCES:**

1. Richard D Klafter, Thomas A Chmielewski, Michael Negin, "Robotics Engineering – An

IntegratedApproach", Eastern EconomyEdition, Prentice Hall ofIndiaPvt. Ltd., 2006.

- 2. FuKS, GonzalezRC, LeeC.S.G, "Robotics: Control, Sensing, VisionandIntelligence", McGrawHill, 1987
- 3. https://www.robots.com/applications
- 4. https://www.asme.org/engineering-topics/articles/bioengineering/top-6robotic-applications-inmedicine



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L: LectureT:Tu	torial	SLr	: Superv	visedLe	arningP	Projec	t R: Re	searchC:	Credits				
T/L/ETL:Theor	y/Lab/	Embedd	ledTheo	oryand I	Lab								
<b>OBJECTIVE:</b>													
• To	unders	tand the	basic c	ompone	ents and	layout	of linka	ages in th	e assem	bly of a	system r	nachir	ne.
• 10	unders	stand the	princip	les in a	nalyzing	g the as	sembly	with resp	pect to the pect of the pect to the pect to the pect of the pect o	ne	not of lin	kagaa	
des	sign fey	v linkag	e mecha	nisms a	and cam	mecha	nisms		n or a sp	ecineu s		kages,	
• To	unders	stand the	basic c	oncepts	of toot	hed gea	ring and	d kinema	tics of g	ear train	is		
COURSEOUT	COME	CS(COs)	:(3-5)	•						-			
Students will be	e able t	<b>:</b> 0:											
CO1	1	Understa	derstand the principles and concepts of kinematic pairs, chains.										
CO2		Evaluate	aluate gear tooth geometry and select appropriate gears for the required applications.										
CO3	]	Determin	termine the frictional forces and friction coefficient in machine elements										
CO4		Assess tl	sess the different force calculations on different machine members										
CO5	]	Impleme	plement Balancing and vibration mechanisms in machine elements										
Mapping of Co	ourse (	Outcom	es with	Progra	m Out	comes(l	POs)						
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PC	011	PO12
CO1	3	3	3	3	2	3	2	2	3	2		3	3
CO2	3	3	3	3	3	2	1	1	2	2		1	3
CO3	3	3	3	3	3	2	1	1	2	2		1	3
CO4	3	3	3	3	3	2	1	1	2	2		1	3
CO5	3	3	3	3	3	2	1	1	2	2		1	3
COs /PSOs	PS	501	PS	02	PS	03	PS	504					
CO1		2		2		3		3					
		2		2		3		3					
C03		1		<u> </u>		2		<u>3</u> 2					
CO5		1		<u>3</u>		2		$\frac{2}{2}$					
3/2/1 Indicates	Stren	gth Of (	Correla	tion, 3	– High,	2- Mee	dium, 1	- Low				1	
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#### computerapproachcams-classifications-displacementdiagrams-layoutofplatecamprofilesderivativesoffollowersmotioncirculararcandtangentcams.

**UNIT I: KINEMATICS OF MACHINES** 

**OF MACHINERY** 

# **UNIT II: GEARS AND GEAR TRAINS**

Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interferenceand undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotivetransmissiongear trains.

# UNIT III: FRICTION

SubjectCode:

**EBRA22005** 

Sliding and Rolling Friction angle-friction in threads-Friction Drives -Friction clutches-Belt and rope drives brakes–Tractive resistance.

Subject Name: KINEMATICS AND DYNAMICS

kinematicsanalysisinsimplemechanisms-velocityandaccelerationpolygons-Analyticalmethods-

**Prerequisite: Engineering Mechanics** 

# UNIT IV:FORCE ANALYSIS

Applied and Constrained Forces – Free body diagrams – static Equilibrium conditions – Two, Three and fourmembers – Static Force analysis in simple machine members – Dynamic Force Analysis – Inertia Forces and Inertia Torque - D'Alembert's principle - superposition principle - dynamic Force Analysis in simple machinemembers.

# **UNIT V: BALANCING AND VIBRATION**

Static and Dynamic balancing – Balancing of revolving and reciprocating masses – Balancing machines – freevibrations – Equations of motion – natural Frequency – Damped Vibration - critical speed of simple shaft - Torsional vibration - Forcedvibration - harmonic Forcing - Vibrationisolation.

#### **TEXTBOOKS:**

1. AmbekarA.G., "MechanismandMachineTheory" PrenticeHallofIndia, NewDelhi, 2007

2. Shigley J.E., Pennock G.R and Uicker J.J., "Theory of Machines and Mechanisms", Oxford University Press,2003

#### **REFERENCES:**

- 1. ThomasBevan, "TheoryofMachines", CBSPublishersandDistributors, 1984.
- 2. Ghosh.A, and A.K. Mallick, "Theory and Machine", Affiliated East-West Pvt.Ltd., New Delhi, 1988.
- 3. Rao.J.S.andDukkipattiR.V. "MechanismsandMachines", Wiley-EasternLtd., NewDelhi, 1992.
- 4. JohnHannahandStephensR.C., "MechanicsofMachines", VivaLowPricesStudent Edition, 1999.
- 5. V.Ramamurthi.MechanismsofMachine. NarosaPublishingHouse.2002.
- 6. RobertL.Norton, Designof Machinery, McGraw-Hill, 2004.

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**Total No.of Periods:60** 

#### 12 Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain –

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	SubjectCode:     SubjectName: INSTRUMENTATION AND       Ty     L     T/S.Lr														
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EBRA22	2006								ETL						
		Prere	quisite:]	Basic E	lectrica	l and I	Electror	nics	Ту	3	0/0	0/0	3		
		Engin	eering												
L: Lectu	ireT:T	utorialS	Lr : Supe	ervisedI	Learning	gP:Proj	ect R: I	Research	C:Credits						
T/L/ET	L:Theo	ry/Lab/	Embedd	edTheo	ryand L	ab									
OBJEC	TIVE	:													
•		To int	roduce t	he term	inologie	es assoc	iated w	ith the m	neasuring	system					
•		To im	part kno	wledge	onsense	orsand t	transduc	er for te	mperature	e measu	rements.				
•		To un	derstand	and cal	ibrate th	e meth	od of m	easuring	pressure,	displac	cement and	veloci	ty.		
•		To int	roduce b	asics of	f contro	l systen	n								
•		To ma	themation	cally mo	odel the	physic	al syster	ns							
COURS	SEOU	ГСОМ	COMES(COs):(3-5)												
Student	tswillb	e able t	able to:												
CO1	Id	entify the different factors involved in measuring system													
CO2	U	ndersta	nd const	uction	and wor	·king pr	inciples	of vario	ous types	of trans	ducers for	pressu	e and		
	ter	nperatu	perature measurement												
CO3	C	ompreh	nprehend different equipments for displacement, velocity and flow measurement.												
<u>CO4</u>	R	emembe	member the different classifications of control systems.												
			member the different classifications of control systems.												
05	In	nplement mathematical models of different physical systems.													
Mappir	ngofCo	urseOu	tcomes	withPro	ogramC	Outcom	es(POs)	)							
COs/P	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1	0   PC	011 F	PO12		
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CO1	3	3	3	3	2	2	1	2	3	2	3	3			
CO2	3	3	3	3	3	2	1	3	2	2	3	3			
CO3	3	3	3	3	3	1	1	1	3	3	3	2			
CO4	3	3	3	3	3	1	1	1	3	3	2	3			
CO5	3	3	2	3	3	1	1	1	3	2	1	3			
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Subject	SubjectName: INSTRUMENTATION AND	Ту	L	Т	P/R	С
Code:	CONTROL ENGINEERING	/Lb/		/S.Lr		
		ETL				
EBRA22006	Prerequisite:Basic Electrical and Electronics	Ту	3	0/0	0/0	3
	Engineering					

#### **UNIT I: MEASURINGSYSTEM**

Factors in making the measurements-accuracy, precision, resolution, repeatability, reproducibility, hysteresis, sensitivity, range.International standardsfor measurement.Errors in Measurement – Gross Errors, SystematicErrors, Mounting and deformation Error – Thermally Induced Error – Interpolation Error – Dynamic Error,Calibration techniques.

#### UNIT II: TRANSDUCERS FOR TEMPERATURE AND PRESSURE MEASUREMENT

Terminology, principle of operation, Characteristics and signal conditioning- Bimetallic thermostats, Resistance temperature detectors, Thermistors, Thermocouples, Solid state temperature sensors, Liquid manometers, Capacitance diaphragms, piezoelectric diaphragm.

#### UNIT III:DISPLACEMENT, VELOCITY&FLOW MEASUREMENT

Principle of operation, Characteristics and signal conditioning-, Venturi flow meters, Magnetic flow meter, floatswitch, Linear and angular measurement systems, Potentiometer type- resistive- strain gauge, capacitive and inductive, LVDT, Limit switches, inductive and capacitive proximity switches, ultrasonic and photo-electricsensors- linear scales, Laser Interferometers, tachogenerator, Encoders-absolute and incremental Synchros andresolvers.

#### UNIT IV: INTRODUCTION TO CONTROL SYSTEMS

EDUCATIO

Open-loop and Closed–loop systems-comparison, Transfer function; Block diagram reduction, Signal flowgraphs, PI, PDand PIDcontrolconcepts and explanation.

#### UNIT V :MATHEMATICAL MODELS OF PHYSICAL SYSTEMS

Mechanical systems-Translational and rotational systems, Geartrains, Electrical systems, Components feedback control systems - Potentiometers as error sensing devices, Synchros, Servomotors, Steppermotors.

#### **TEXTBOOKS:**

- 1. PeterElgar, "SensorsforMeasurementandControl", Addison-WesleyLongmanLtd, 1998
- 2. A.K.Sawhney, "Electrical&ElectronicMeasurement &Instruments", DhanpatRai&Co., 2010
- 3. I.J.Nagrath, M.Gopal, "ControlSystemsEngineering", NewAgeInternationalPublications, 2008

#### **REFERENCES:**

- 1. PatranabisD, "SensorsandTransducers", Prentice-HallofIndiaPrivateLimited, NewDelhi, 2003.
- 2. Ernest O Doebelin, "Measurement systems Application and Design", Tata McGraw-Hill Book Company, 2010.



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**TotalNo.of Periods: 45** 

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		F	Prereat	isite:Nil					IEIL/IE	2	0/0	0/0	0
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T/L/ETL:	:Theory/	Lab/E	mbedded	dTheorya	andLab	C 5							
OBJECT	TIVE:												
• To	o provide	an ove	rview of	the histor	ry of the 1	making of	f Indian C	onstitutio	n				
• To	o underst	and the	preambl	e and the	basic stru	ictures of	the Const	itution.					
• To	o Know t	he fund	lamental	rights,du	ties and th	ne directiv	ve princip	les of stat	e policy				
• Te	o underst	and the	function	alityof th	e legislati	ure,the ex	ecutive ar	id the jud	Iciary				
COURS	EOUTC	OME	S (COs)	:(3-5)									
The Stude	ents will	be abl	e to										
CO1 Un	derstand	the his	tory of m	aking of	Indian Co	onstitution	n						
CO2 Un	derstand	the pre	amble ar	d the bas	ic structu	res of the	Constituti	on					
CO3 De	scribe th	e funda	mental ri	ghts,duti	es and the	directive	e principle	s of statep	oolicy				
CO4 De	scribe th	e Emer	gency po	wers of the	he govern	ment							
CO5 Un	derstand	the Sp	ecial Pro	visions fo	or Jammu	and Kash	mir,Nagal	land and (	Other Regi	ons and	Amendme	ents	
Mapping	g of Cou	rse Oı	itcomes	with Pr	ogram (	Outcome	es(POs)						
COs/POs	s PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	12
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CO1						3	1	1	1	1			
CO2						3	1	1	1	1			
C02						3	1	1	2	<u> </u>			
C03						3	1	1	2	1			
CO4 CO5						3	1	1	2	1			
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CO3		1		1		2							
CO4		1		1		2							
CO5		1		1		2							
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Subject Code:	SubjectName:THE IN	DIAN	Ty/Lb/	L	Τ/	P/R	С
	CONSTITUTION (Audit course)		ETL/IE		SLr		
EBCC22104	Prerequisite:Nil		IE	2	0/0	0/0	0

UNIT1	6
TheHistory of the Making of IndianConstitution, Preamble and the Basic Structures	
UNIT2	6
Fundamental Rights and Duties, Directive Principles of State Policy	
UNIT3	6
Legislature, Executive and Judiciary	
UNIT4	6
EmergencyPowers	
UNIT5	6
SpecialProvisionsforJammuandKashmir,Nagaland and Other Regions,Amendments	

#### Total No.of Periods:30

### **TEXTBOOKS:**

1. DDBasu,Introduction to the Constitution of India,20thEdn.,LexisnexisButterworths, 2012.

### **REFERENCEBOOKS:**

- 1. RajeevBhargava(ed), Ethics and Politics of the Indian Constitution, Oxford University Press, NewDelhi, 2008.
- 2. *Granville Austin, The Indian Constitution: Cornerstone of a Nation, Oxford University Press, Oxford, 1966.*

3. ZoyaHassan,E.Sridharan and R.Sudarshan(eds),India's Living Constitution: ideas,Practices,Controversies, Permanent Black,NewDelhi,2002

4. SubhashC.Kashyap, Our Constitution, National Book Trust, NewDelhi, 2011.

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Ind	ia													
COURSEC	DUTCO	OMES (	COs) :(3	-5)										
TheStudent	ts willb	e ableto												
CO1	Understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System													
CO2	Describe	cribe theTraditional Medicine, Traditional Production and Construction Technology												
CO3	Jnderstand the history of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronom													
8	and Astrology													
CO4	Understa	nd the Ori	vin of Mat	hematics	Aviation	n Techno	logy in An	cient In	dia Cra	ofts at	nd Trade	in Ancient	India	
	Understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India													
CO3	Understa	nd the 1 K				$y w or (\mathbf{D})$	$\frac{1}{2}$	union	and H	Re	volution	1		
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COS/POS	POI	PO2	PO3	PO4	P05	PO6	P07	PO8	P09	PC	010	POII	1	
		3	3	1		2				2			1	
<u>CO2</u>		3	3	1		2				2			1	
<u>CO3</u>		3	3	1		2				2			1	
C04 C05		3	3	1		2				2			1	
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COS/ PSOs	ſ	501	<b>F</b> C	502	13	505	1304							
CO1	1		1		2									
$CO^2$	1		1		2									
CO3	1		1		2									
CO4	1		1		2									
CO5	1		1		2									
3/2/1 Indicat	es Strei	ngth Of C	orrelatio	on, 3 – H	ligh, 2- I	Medium	, 1- Low					II		
			-											
			ocia		ve		2		<u>ц</u>					
			d sc		ctiv		nar	lent	ject					
>	nce	50	ano	ore	ele	ve	ipli	por	Pro					
gor.	Scie	ring	ties	C	am	ecti	isci	om	al /					
ateg	ic S	lee	anit	am.	ogr	E	L D	1 C	otici					
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Constant And Chemistry Che

Subject Code: EBCC22I05	Subject Name : THEINDIAN TRADITIONAL KNOWLEDGE(Audit course)	Ty/Lb/ET L/IE	L	T/ SLr	P/R	С
	Prerequisite: Nil	IE	2	0/0	0/0	0

### UNIT I

Historical Background: TKS During the Pre- colonial and Colonial Period, Indian Traditional Knowledge System

### UNIT II

Traditional Medicine, Traditional Production and Construction Technology

# UNIT III

History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology

# **UNIT IV**

Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

# UNIT V

TKS and the Contemporary World, TKS and the Indian Union, TKS and IT Revolution.

# Total No. of Periods: 30

**TEXT BOOKS:** 1. Amit Jha (2009), Traditional knowledge system in india, 1st Edition, Delhi University (North Campus)

2. Dr.A.K.Ghosh (2011), Traditional Knowledge of Household Products

**6** 

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6

EDUCATIONAL INSTITUTE AND RESE ARCH DEEMED TO BE UNIVERSITY Iniversity with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India. Periyar E.V.R. Salai, Maduravoyal, Chennai – 95

Subject Cod	le: Su El	ıbject I LECTI	Name : RONIC	ANAL S LAB	OG Al	ND DIO	GITAL		Ty L T /Lb/			T/SLr P/R		С
EBEC22IL4	,								ETL					
	Pr	erequis	ite: Ele	ctrical a	and Ele	ctronic	Circuit	s Lab	Lb	0	0/0	3	/0	1
L: Lecture T	:Tutori	al S	Lr : Suj	pervise	dLearni	ngP: Pi	roject I	R: Rese	arch					
C:Credits1/L	ELL:	heory/	Lab/En	ibeddeo	1 Theor	yand L	ab							
OBJECTIV	ES:	4:66			. f			~						
• 10 II	leasure	the wor	nt parai	neters (	of operation		ampiiii	er						
• 10 e	xamme	the var	ious ap	Combin	ons of o	p-amp	Cimercia	~						
• 10 d	esign a	na impi	ement		ational	Logic	Circuit	8						
• 10 e	xperim	ent Seq	uential	Logic (	Ircuits									
COURSEOU The Students	UTCO will be	MES(C e able to	<b>COs):(3</b>	- 5)										
CO1	Analy	se the o	lifferen	t chara	cteristic	s of op	eration	al amp	lifier IC7	41				
CO2	Desig	n differ	ent line	ear integ	grated c	ircuits	using I	C741						
CO3	Verify	y the tru	ith table	es of di	fferent	logic ga	ates.							
<u>CO4</u>	Create	e differ	ent com	binatio	nal log	ic circu	its usin	<u>g logic</u>	gates.					
CO5	Imple	ment di	ifferent	sequen	tial log	1c circu	its usin	g flip f	lops.					
Mappingor				Progra		comes(	PUS)				10	<b>DO11</b>		010
COs/POs	PO1	PO2	<b>PO3</b>	PO4	PO5	PO6	<b>PO</b> 7	PO	<u>8 PO9</u>	PO	10	<u>PO11</u>	P	012
	3	3	3	3	2	3	1	2	3	2		3	3	
<u>CO2</u>	3	3	3	3	3	3	1	3	2	2		3	3	
<u>CO3</u>	3	3	3	3	3	1	1	2	3	3		3	3	
CO4	3	3	3	3	3	1	1	1	3	3		2	3	
CO5	3	3	2	3	3	1	1	1	3	2		1	3	
COs	PS	01	PS	02	PS	03	Р	SO4						
/PSO														
S			-		-									
CO1	3		2		3		3							
CO2	3		1		1		3							
CO3	3		1		2		3							
CO4	3		2		2		3							
CO5	3		3		1		3							
3/2/1 Indicat	tes Stre	ength C	Of Corr	elation	, 3 – H	igh, 2-	Mediu	m, 1- I	LOW					
			ces											
			ien					dill						
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x		ces	cia					ica						
or		ien	So		ves		sct	chn		ary				
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ũ	enc	ing	ies	ů	Ele	ctiv	/P1	/sd	ls	cip				
	Sci	eer	mit	am	am	Ele	cal	shi	ikil	dis				
	sic	gin	ma	ngr	gri	enl	licti	ern	ft S	lter				
	Ba.	En	Ηu	Prc	Prc	Op	$\Pr{\epsilon}$	Int	So	Ir				
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Subject Code:	Subject Name : ANALOG AND DIGITAL	Ту	L	T/SLr	P/R	С
	ELECTRONICS LAB	/Lb/				
EBEC22IL4		ETL				
	Prerequisite: Electrical and Electronic Circuits	Lb	0	0/0	3/0	1
	Lab					

# LISTOFEXPERIMENTS

#### **Analog Electronics**

- 1. Measure input bias current; input offset current, input offset voltage of the given op-amp IC741
- 2. Design voltage follower circuit and measure Slew Rate & CMRR
- 3. Design an inverting and noninverting amplifier for required gain using IC741
- 4. Design and realize adder and subtractor using IC741
- 5. Design integrator and differentiator using IC741
- 6. Design Astable multivibrator for required frequency and duty cycle using 555 timer

#### **Digital Electronics**

- 7. Verification of Truth tables of Logic gates
- 8. Design and Implementation of Adder and Subtractor Circuits using Logic gates
- 9. Design and Implementation of Multiplexer and De-multiplexer Circuits
- 10. Experiment Encoder and Decoder Circuits
- 11. Realization of Flip-flops
- 12. Design BCD Counter

Total no. of Periods: 45

EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution)

			Periyar E.	V.R. High Ro	ad, Madu	ravoyal, C	hennai-95.	Tamilnadı	ı, India.				
SubjectCode:	Subj	ectNam	Pe :	DYNA	MICSI	AB	oyai, Chen	nal – 95	Ty / Lb/ ETL	L	T /S.L r	P/ R	C
EDME22104	Prer	equisite	Kinemati	ics and I	Ovnami	cs of M	achiner	v	L	0	0/0	3/0	1
L: LectureT:Tu	itorial	S Lr :	Supervise	ed Learni	ngP : P	roiectR	: Resear	ch C:		-			<u> </u>
CreditsT/L/ETI	L:Theor	y/Lab/E	mbeddedT	heoryan	d Lab	j							
OBJECTIVES	S:	-		-									
• To Uno	derstand	Workin	g of simpl	e mecha	nisms								
To find	l natural	frequen	cy of vibr	ating sys	tem at c	lifferent	models						
COURSEOUT	ГСОМЕ	ES(COs)	:										
CO1	Ga	in know	ledge in ki	inematics	s and D	ynamics	s of Mac	hinery					
CO2	Ch	aracteriz	the dyna	amic proj	perties of	of comp	onent or	equipme	ents				
CO3	An	alyze the	e vibration	h characte	eristics								
CO4	Ap	ply vario	ous princip	ples for d	ynamic	solution	ns						
CO5	Illu	strate th	e method	of static	and dyr	amic ba	alancing	of masse	es				
MappingofCo	urseOut	tcomesw	vithProgr	amOutco	omes(P	Os)							
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO	12
CO1	3	3	3	3	3	2	2	2	3	3	2		2
CO2	3	3	3	3	3	2	2	2	3	3	2		2
CO3	3	3	3	2	3	2	2	2	3	3	2		2
CO4	3	3	3	2	3	2	2	2	3	3	2		2
CO5	3	3	3	2	3	2	2	2	3	3	2		2
Cos/PSOs	PS	01	PSC	)2	P	SO3	PS	<b>504</b>					
CO1		3	3	6		2		3					
CO2	3	3	3	6		2		3					
CO3	3	3	3	;		2		3					
CO4		3	3	;		2		3					
CO5	3	3	3	;		2		3					
3/2/1 Indicates	Strengt	h Of Co	rrelation,	3 – Hig	h, 2- M	edium,	1- Low						
			Se										
			iena										
			Sc										
v		ce	cial		e								
gor		cien	l so		ctiv		lary	ent	ect				
ate	nce	Š	and	re	ele	ve	plir	uoc	Proj				
Ű	cie	ing	ies	Co	am	ecti	isci	luio	al /I				
	ic S	neei	anit	ram	ogr	Ē	I D	1 C	ctic				
	Bas	ngi	um	rog	Pr	per	Inte	Skil	Pra				
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SubjectCode: EBME22L04	SubjectName: DYNAMICSLAB	Ty / Lb /ETL	L	T /S.Lr	P/R	C
	Prerequisite:Kinematics and Dynamics of Machine	ery Lb	0	0/0	3/0	1

#### **KINEMATICS (Demonstration only)**

- 1. Kinematics of fourbar mechanisms-Slider Crank, CrankRocker Mechanism.
- 2. Kinematics of Gears-Spur, Helical, Bevel, Worm.
- 3. Kinematics of Gear trains-Simple, Compound, Epicyclic&differential gear trains.

#### 1. DYNAMICS

- a. Motorized Gyroscope-Verification of Laws.
- b. Connecting Rod and Flywheel-Determination of M.I.by oscillation.
- c. Governors-Watts, Porter, Proell and Hartnell-study of characteristics and determination of Sensitivity, effort etc.
- d. Cam-profile of the cam-study of Jump phenomenon-Determination of Critical Speeds.

#### 2. VIBRATINGSYSTEMS

- a. Helical Spring–Determination of natural frequency
- b. Compound Pendulum-Determination of natural frequencies -moment of inertia.
- c. Torsional vibration-Determination of natural frequencies-Single rotor system-Two rotor system
- d. Flywheel-Determination of torsional natural frequencies-moment of inertia.
- e. Whirling of shaft-Determination of critical speed of shaft.

#### **3. BALANCING**

Static and dynamic balancing of rotating masses

**Total No.of Periods: 45** 



Subject	t Code	2:	Subje	ctName:l	BASIC	S OF I	ROBOT	В	Ty /Lb/	L	T /S.L	<b>P/ R</b>	С	
EBRA2	22L03									ETL	-	r		
		Pro	erequisi	ite:Basics	of Rot	ootics				Lb	0	0/0	3/0	1
L: Lect	ureT:7	Tutorial	SLr	: Supervi	sedLea	rningP	Project	R: Rese	archC:C	redits				
T/L/ET	L:The	ory/Lab	/Embed	dedTheor	yand La	ab	5							
OBJEC	TIVE	:												
	• T	o Study	differer	nt compon	ents of	Robots	s .							
	• T	o analys	se differ	ent homin	g and n	noving	actions	of robot	S.	levin a not	hot own			
	• 1	o write	program	f for perio	ming u	meren	t kinds o	or operat	IONS INVO	orving ro	bot arm.			
COUR	SEOU	TCOM	ES(CO	s):Studen	ts will	able to	)							
CO1	Un	derstand	l differe	nt compo	nents of	f robots	5.							
CO2	An	alyse th	e homin	g and mo	ving ac	tion for	robots.							
CO3	De	monstra	onstrate Pick and Place movements for robots											
CO4	De	velop pi	ograms	employin	g diffe	rentcon	ditional	and unc	ondition	al statem	ents.			
CO5	Per	rform di	form different arithmetic operations using robots											
Mappi	ngofC	ourseO	utcome	swithProg	gramO	utcom	es(POs)							
COs/P	Os	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	<b>PO10</b>	PO11	PO	12
CO1		3	2	3	3	3	1	2	3	3	3	2	2	
CO2		3	3	2	3	3	1	2	3	3	3	2	2	
CO3		3	3	3	3	3	2	1	3	3	3	2	2	
CO4		3	2	3	3	3		2	3	3	3	2	2	
	Oc	J PS	<u> </u>	J PSC	3 12	J D	1 503		3 SO4	3	3	2	2	
C05/1 5	05	3	01	3	14	2	505	3	04					
CO2		3		2		2		3						
CO3		3		3		2		3						
CO4		3		2		3		3						
CO5		3		2		3		3						
3/2/1 Ir	ndicat	es Stren	gth Of	Correlati	on, 3 –	High,	2- Medi	ium, 1-	Low		-			
		S	50	u.	e	ves	S	ect	li					
		ence	iring	es Scie	Col	ecti	tive	roj	ips uISk	ills				
	ory	Scie	nee	nitio	am	JEI	Elec	al/ I	nsh nica	t Sk				
	teg	sic	ngi Sci	mai ISo(	ogr	ran	ent	tic	nter Schi	Sofi				
	Ca	Ba	Щ	Hu and ces	Pr	rog	Op	Prac	Ir /Te					
						✓ □		$\sqrt{1}$						



Subject Code:	SubjectName:BASICS OF ROBOTICS LAB	Ту	L	Т	<b>P/ R</b>	С
		/Lb/		/ <b>S</b> .		
EBRA22L03		ETL		Lr		
	Prerequisite:Basics of Robotics	Lb	0	0/0	3/0	1

# LIST OF EXPERIMENTS

- 1. Study of Robot Component identification.
- 2. Homing and Moving action.
- 3. Programs for Pick and Place.
- 4. Programs for unconditional command.
- 5. Programs for conditional IF command.
- 6. Programs using WAIT command
- 7. Programs for performing various arithmetic operations.

**Total No.of Periods: 45** 

Control C

	Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.																		
Subject Co	ode:	Sub	jectNan	ne:INST1	RUME	<b>VTATI</b>	ON AN	D	nennai — s	ЪЪ	L	Т	<b>P/ R</b>	С					
		COI	NTROL	LAB						/Lb/		/ <b>S.L</b>							
EBRA22L	04									ETL		r							
		Prei	equisit	e:Instrun	nentatio	on and	Contro	l Engine	eering	Lb	0	0/0	3/0	1					
<b>T T C</b>		• 1		<u> </u>	17	·			100	1.									
L: Lecture	l:Tuto	orial Zah	SLr Embody	: Supervi	sedLear	mngP:F	roject	R: Rese	archC:Ci	redits									
I/L/EIL.I				learneor	yanu La	lÜ													
-	UBJE		the stud	anto to Irr	or oho	ut conce	ma and t	ho vonic	and transco	of conce	manaad	for the m	00011#0	mont of					
•	LIIau	ning we pl	he stud	unantitios	low abo	ut sense	ors and t	ne vario	ous types	of sense	ors used	for the fi	easure	nent of					
•		lentif	Tysical C Sy suitab	Je instrur	nents to	meet th	e requi	rements	of indus	trial annl	ication	2							
•	Tok	now	nractica	lly about	the tran	sducer i	ised for	the me	suremer	it temner	ature R	, esistive (	anaciti	ve and					
-	To know practically about the transducer used for the measurement temperature, Resistive, Capacitive and Inductive transducers																		
•	To study the response of the open loop, closed loop, first order and second order systems																		
COURSE	OUTC	OUTCOMES(COs):(3- 5)Students will be able to:																	
C01	Ide	Identify force measurement using Load Cell.																	
		1	1 11	1	52														
CO2	Understand displacement measurement using LVDT																		
CO3	Ren	nemt	per Ther	mocouple	e and Re	esistance	Detectors	, Determ	nine me	asuremen	t of stra	un							
CO4	Study Thermistors, open loop and closed loop systems																		
CO5	Der	nons	trate the	speed co	ntrol of	AC-DO	C servor	motors a	ind const	ruct first	and se	cond orde	r syste	ms using					
	PI/I	PD/P	ID conti	ollers															
Mappingo	fCour	seOu	itcomes	swithProg	gramO	utcome	s(POs)				1								
COs/POs	P	01	PO2	PO3	PO4	PO5	<b>PO6</b>	PO7	PO8	PO9	PO10	) <b>PO11</b>	PO	12					
<u>CO1</u>	3		2	3	3	3	1	2	3	3	3	2	2						
<u>CO2</u>	3		3	2	3	3	1	2	3	3	3	2	2						
<u>CO3</u>	3		3	3	3	3	2	1	3	3	3	2	2						
CO4	3		2	3	3	3	1	2	3	3	3	2	2						
<u>CU5</u>	3	DC	2	<u>3</u>	3	3 DC		2	3	3	3	2	2						
COS/PSUS	2	P59	01	2 PSC	)2	2	03	2	04										
$\frac{CO1}{CO2}$	3			3		2		3											
$\frac{CO2}{CO3}$	3			2		2		3											
$\frac{003}{004}$	3			3		2		3											
<u>CO</u>	3			$\frac{2}{2}$		3		3											
<u> </u>	tes St	reng	th Of C	<u></u> orrelatio	n. 3 – F	-3 Tigh, 2-	Mediu	 m. 1- La	)W										
	tes Strength Of Correlation, 3 – High, 2- Medium, 1- Lo							5 **											
	es		ьa	enc	ore	ive	es	jeci	kill										
	enc		erin ces	es ISci	CC	ect	ctiv	Pro	uips alSI	kills									
	Sci		nee	niti cial	am	nEl	Elec	al/ ]	nsh nica	t Sl									
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SubjectCode:	Subject Name :INSTRUMENTATION AND CONTROL LAB	Ty / Lb/ET	L	T /S.L	P/ R	C
EBRA22L04		Lb		r		
	Prerequisite:Instrumentation and Control Engineering	Lb	0	0/0	3/0	1

#### LIST OF EXPERIMENTS

- 1. Force Measurement using Load Cell
- 2. Displacement Measurement using LVDT
- 3. Thermocouple
- 4. Resistance Temperature Detectors.
- 5. Strain Measurement.
- 6. Study of Thermistors.
- 7. Study of Open Loop and Closed Loop systems.
- 8. Speed Control of AC-DC Servomotor using PI/PD/PID Controllers.
- 9. Modeling and Analysis of first order systems using PI/PD Controller
- 10. Modeling and Analysis of first order systems using PID Controller
- 11. Modeling and Analysis of second order systems using PI Controller
- 12. Modeling and Analysis of second order systems using PID Controller.

**Total No.of Periods:45** 



SubjectCode: EBRA22I01	SubjectName :	TECHNICALSKILL-I	Ty / Lb/ETL /IE	L	T /S.L r	P/ R	C
	Prerequisite: All s	subjects studied upto date	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department

	Subje	ectName	SOFTSK:	ILLS I-I	EMPLO	YABILI	TY SKI	LL	Ty/Lb/	L	T/	P/R	С
SubjectCode:									ETL/IE		SLr		
EBCC22I06	Prere	Prerequisite:Nil							IE	0	0/0	2/0	1
L: LectureT:Tu	ıtorial	SLr :	Supervis	edLearn	ingP:Pro	oject R:	Researc	chC:Cr	edits				
T/L/ETL:Theory	ry/Lab/	Embedd	ed Theory	and La	b								
OBJECTIVES • To leading • To and res	<b>5:</b> create g to devo help st sume.	awaren elop a po udents b	ess in stu ositive fra be aware o	idents, we me of me of various	various iind. us techn	top com iques of	npanies Candida	helping ate recr	g them imp uitment and	prove t d help	heir skills them prep	et mati are CV	rix, 's
To hel	p stude	nts impr	ove their	various verbal re	eading,n	arration	and pre	sentation	on		eiviews.		
Skills I	by perfo	orming v	arious mo	ck sessi	ons.	FCOM		).(2.5)					
CO1	B	e aware	of vario		Compan	ies lead	15(COs ing to i	):(3-5) mprov	ement in s	kills a	mongst th	em	
CO2	B	e aware	$\frac{1}{2}$ of vario	us cand	idate re		ent tech	niques	like group	discu	ssion,inte	erviews	s and
	В	e able t	o prepare	e CV's a	and resu	imes.		1	0 1		,		
CO3	P	repare f	or differe	ent type	s of int	erviews	and be	prepa	red for HR	andtee	chnical in	terviev	vs.
<u>CO4</u>	Ir	nprove	their ver	bal,writ	ten and	other s	kills by	perfo	rming moc	k sessi	ions.		
C04 C05		articipat	tion of gi	oup dis	cussion	and ap	ing to i	ests	omont in a	killa or	monget th	om	
	D	e aware Ma	apping of	us top c 'Course	Onipan Outcor	nes wit	h Progr	am Ou	tcomes(Pos	s)	nongst u	em.	
Cos/Pos	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	PO8	PO9	PO1	0 PO11	PO	12
CO1	1	1	1	1	1	2	2	3	2	3	2		3
CO2	1	1	1	1	1	2	2	3	2	3	2		3
CO3	1	1	1	1	1	2	2	3	2	3	2		3
CO4	1	1	1	1	1	2	2	3	2	3	2		3
	1 DC	1		$ $ $ $		$\frac{2}{03}$	2 D	3	2	3	2		3
C05/F505	10	UI	130	J <u>4</u>	15	05	I v	504					
CO2													
CO3													
CO4													
CO5	Strongt	h Of C	malation	2 U;	ah 2 N	Indium	1 L ou	7					
5/2/1 mulcates	Strengt			l, 3 – Hi	gn, 2- N		, 1- Low	/					
Category	Basic Science	Engineering Science	Humanities and socia Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project	Basic Science			



SubjectCode: EBCC22I06	SubjectName:SOFTSKILLSI-EMPLOYABILITY SKILL	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	С
	Prerequisite:Nil	IE	0	0/0	2/0	1

# UNIT I

Creation of awareness of top companies / improving skill set matrix / Development of positive frame ofmind/Creationofself-awareness.

### UNIT II

Group discussions/Do's and don'ts-handling group discussions/what evaluators look for interpersonal relationships /Preparation of CurriculumVitae /Resume.

### UNIT III

Interview – awareness of facing questions – Do's and don'ts of personal interview / group interview, enabling students to prepare for different procedures such as HR interviews and Technical Interviews /self-introductions.

### UNIT IV

Verbal aptitude, Reading comprehension/narration/presentation/MockInterviews.

### UNIT V

Practical session on Group Discussion and written tests on vocabulary and reading comprehension **PracticalcomponentP: Include case studies/application scenarios** 

# **ResearchcomponentR: Future trends/researchareas/Comparative Analysis**

# TotalNo ofPeriods:30

6

6

6

6

6

#### **TEXTBOOKS:**

- 1. Agarwal, R.S. Chand, S. (1989) *QuantitativeApt.itude*. Publication.
- 2. ShaliniVerma,(2009)SoftSkills.PublicationPearson

#### **REFERENCES:**

- 1. Shaliniverma, (2012) Enhancing employability @SOFTSKILLS.Publication Pearson
- 2. KiranmaiDutt, P.GeethaRajeevan, C.L.Prakash, N. (2010) *ASubjectinCommunicationSkills*. PublicationFoundationBooks.
- 3. Nirakonar,(2011) English Language Laboratories. PHILearning.
- 4. Anandamurugan, S. (2011) *PlacementInterviews*. Publication TataMcGrawHillEducation.



# **SEMESTER V**

CARCELAND RESEARCH INSTITUTE EDUCATIONAL AND RESEARCH INSTITUTE DEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India. Periyar E.V.R. Salai, Maduravoyal, Chennai – 95

SubjectCode:	Su M	bjectNa ACHIN	me:ART E LEAR	IFICIA NING	L INTE	LLIGE	NCE A	ND	Ty / Lb/ETL	L	T /S.Lr	P/ R	С
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Ty/Lb/ETL:Th	neory/La	ab/Embe	ddedTheo	oryandL	ab								
OBJECTIVE • Study ti • Learn ti • Introd	: he conce he meth uce the	epts of A ods of se concepts	Artificial I olving pro	ntelliger blems u t Systen	nce. sing Art ns and m	tificial In achine	ntelligen learning	ce.					
COURSEOUTCOMES(COs):Studentswill:													
CO2	D1         Understand different types of AI agents and know various AI search algorithms           D2         Apply knowledge representation, reasoning, and machine learning techniques to real-world problems in terms of data management												
003	Anarys					laking							
CO4	Describ	be the co	ncepts in	machine	learnin	g							
CO5	Apply I	knowled	ge of AI i	n roboti	cs								
MappingofCo	DurseOi	itcomes	withProg	ramOu	tcomes(	POs)	PO7	DOS	POO	DO1		DO	12
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Category	Basic Science	Engineering Sc	Humanities and Science	Program Core	Program elec	Open Elective	Inter Disciplin	Skill Compone	Practical /Projo				
							V						

# **UNIT I: INTRODUCTION OF AIAND ML**

MACHINE LEARNING

**Prerequisite: MATHEMATICS** 

ARTIFICIAL INTELLIGENCE AND

SubjectName:

Introduction to data science and AI&ML: Data Science AI & ML, Use Cases in Business and Scope, ScientificMethod, Modeling Concepts, CRISP-DM Method, Statistical analysis: Initial Data Analysis, probability, Ressentials: Commands and Syntax, Packages and Libraries, Introduction to Data Types, Data Structures in R -Vectors, Matrices, Arrays, Lists, Factors, Data Frames, Importing and Exporting Data, Control structures and Functions.

# **UNIT II: DATA MANAGEMENT**

Data Acquisition, Data Pre-Processing And Preparation, Data Quality And Transformation, Handling Text Data, Principle Of Big Data, Big Data Framework-Hadoop, Spark, Nosql.

# UNIT III: STATISTICAL DECISION MAKING

DataVisualization, SamplingAndEstimation, InferentialStatistics,Linear Regression,Non Linea rRegression.

# **UNIT IV: MACHINE LEARNING**

#### Foundation for ML, Clustering, Classification: Naïve bayes classifier, K-Nearest neighbors, support vector machine, decision tree, ensembles methods, Association rule mining.

# **UNITY : AI IN ROBOTICS**

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence inrobotics

# **TotalNo.of Periods:45**

# **TEXTBOOKS:**

**Subject Code:** 

EBCS22ID5

1. MichealNegnevitsky, "Artificial Intelligence: A guide to Intelligent Systems", Harlow: Addison-Wesley, 2005.

# **REFERENCES:**

- 1. NilsJ.Nilsson, "IntroductiontoMachineLearning", 2005.
- 2. Pang-NingTan, Michael Steinbach., Introduction to Data Mining, Pearson, 2019.

Periyar E.V.R. Salai, Maduravoyal, Chennai – 95

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	(An ISO 21001 : 2018 Certified Institution)	
	Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.	
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EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status

(An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India. Subject Name : DESIGN OF MACHINE ELEMENTS Subject Code: Ty / Lb/ L Τ/ P/RС ETL S.Lr **EBRA22007 Prerequisite: Engineering Mechanics, Strength of** 3 1/0 0/0 Тy 4 Materials, Kinematics and Dynamics of Machinery L: Lecture T: Tutorial S Lr: Supervised Learning P: Project R: Research C: Credits T/L/ETL : Theory/Lab/Embedded Theory and Lab **OBJECTIVE**: The student will learn Design principles of various gears and bearings • Design of various flexible elements, like shaft, couplings, chain and ropes • Design of friction clutches **COURSE OUTCOMES (COs) : Students will be able to:** CO1 Understand the fundamentals of gear design **CO2** Design the machine elements like Shafts, Keys, and Couplings. Select the appropriate V-belts and Chains for a given power and velocity ratio **CO3 CO4** Demonstrate the working of rolling contact bearings CO5 Develop clutches based on varying friction drives Mapping of Course Outcomes with Program Outcomes (POs) **PO9** Cos/Pos **PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO10** PO11 **PO12 CO1** 3 3 3 3 3 1 2 3 3 3 2 2 **CO2** 3 3 3 3 3 1 2 3 3 3 2 2 **CO3** 3 3 3 3 3 2 L 3 3 3 2 2 3 3 3 3 2 3 3 3 2 2 **CO4** 3 L **CO5** 3 3 3 3 3 3 3 3 3 3 3 3 Cos / PSOs **PSO1** PSO₂ PSO3 PSO4 **CO1** 3 2 3 3 2 **CO2** 3 2 3 **CO3** 3 3 2 3 3 **CO4** 3 2 3 3 **CO5** 3 2 3 3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low Internsips / Technical Skill umanities and Social **Engineering Sciences** rogram Electives ractical / Project **Dpen** Electives **Basic Sciences** Program Core Category Soft Skills Sciences

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Subject Code:	Subject Name : DESIGN OF MACHINE	Ty / Lb/	L	Τ/	<b>P/ R</b>	С
	ELEMENTS	ETL		S.Lr		
EBRA22007						
	Prerequisite: Engineering Mechanics, Strength of	Ту	3	1/0	0/0	4
	Materials, Kinematics and Dynamics of Machinery	-				

### UNIT I : DESIGN OF GEARS

Review of gear fundamentals, interference, gear forces, determining dimensions of a spur gear pair. Design of helical gears-parallel axis helical gear, normal and transverse planes, helix angles, equivalent number of teeth, determining dimension of helical gear pair, nomenclature of straight and bevel gears.

# UNIT II : DESIGN OF SHAFTS AND COUPLINGS

Forces on shafts due to gears, belts and chains, estimation of shaft size based on strength and critical speed. Couplings-types and applications, Design of square keys-use of standards, rigid couplings, flexible flange couplings - selection.

# UNIT III: SELECTION OF V BELTS AND CHAINS

V belts for given power and velocity ratio, selection of micro V-belts, timing belts. Selection of roller chain and power speed ratio, silent chain.

# **UNIT IV : ROLLING CONTACT BEARINGS**

Static and dynamic load capacity, cubic mean load, variable load, probability of survival, selection of deep groove and angular contact ball bearings.

# **UNIT V : FRICTION DRIVES**

Clutches - role of clutches, positive and gradually engaged clutches, toothed claw clutches, design of single plate and multiple plate clutches, variable speed drives, types and selection.

# **TEXT BOOKS:**

1. Robert L Mott, "Machine Elements in Mechanical Design", Macmillan Publishing Co., London, 1992.

2. Shigley and Mische, "Mechanical Engineering Design", McGraw Hill, Inc., New Delhi, 2000.

# **REFERENCES:**

Bandari V B, "Design of Machine Elements ", Tata McGraw Hill Publishers Co. Ltd., New Delhi, 2003.
 Robert L Nortan, "Machine Design-An Integrated Approach", Pearson Publishers, New Delhi, 2003.

3. Maitra G M, "Handbook of Gear Design", Tata McGraw Hill, New Delhi, 1998

4. Faculty of Mechanical Engineering, PSG College of Technology, "Design Data Book", M/s. DPV Printers, Coimbatore, 2000

# Total No. of Periods: 60

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Subject Code:	Su CC	bject N	ame : F	PROCE	ESSORS	S AND	)	T	'y / b/ETI	L	Г/SLr	P/R	C
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CO4 CO5 COs/PSOs CO1 CO2 CO3 CO4 CO5 3/2/1 Indicate	Basic Science	3 2 3 PSO1 3 3 3 gth Of 	Humanities and Science Social Science	3 02 3 2 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 2 2 3 3 2 2 2 3 3 2 2 3 3 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3	Jack Strategy Strateg	3     3     2     D3       Oben Elective	1 2 2 Disciplinary	2 3 04 2 2 2 3 3 , 1- Lov	Z 3 2 Skill Component	Practical 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2			



Subject Code:	Subject Name : PROCESSORS AND	Ty/	L	T/SLr	P/R	С
EBEC22ID6	CONTROLLERS	Lb/ETL				
	Prerequisite: Analog and DigitalElectronics	Ту	3	0/0	0/0	3

# UNIT I- THE 8 and 16 Bit MICROPROCESSOR

8085 Hardware Architecture, pin outs – Functional Building Blocks of Processor - Interrupts. Instruction - format and addressing modes – Instruction format – Data transfer, data manipulation& control instructions – basic assembly language Programming, 8086 architecture- functional diagram, Register organization, Signal descriptions of 8086- minimum mode and maximum mode system design, timing diagrams.

# UNITII - 8086 INSTRUCTION SET AND ASSEMBLY LANGUAGE PROGRAMMING9

Instruction sets and Instruction formats, Addressing modes, Simple programs involving Arithmetic, logical, branch and call instructions- Sorting, evaluating arithmetic expressions, string manipulations

# UNITIII -PERIPHERALS AND INTERFACING

Memory Interfacing – I/O Interfacing – Programmable Peripheral Interface 8255 – USART – DMA controller – Programmable Interval Timer 8253, ADC and DAC Interface.

# UNITIV-MICROCONTROLLER AND INTERFACING

Introduction, Comparison between Microprocessor and Microcontroller, 8051 Architecture – I/O Ports, Memory Organization, Addressing modes, Instruction set, Timers / counters, serial port, Assembly language programming.Stepper Motor interfacing, DC Motor speed Control using PWM, Traffic Light Interface, Interfacing matrix Keyboard, and (16x2) LCD interfacing, Interfacing with ADC- Interfacing with DAC

# UNITV- PROGRAMMABLE LOGIC CONTROLLERS

Basics of PLC,Advantages,Capabilities of PLC,Architecture of PLC,Scan Cycle,Types of PLC,Types of I/O modules,Configuring a PLC,PLC wiring,Programming of PLC-Implementation of Logic Gates using Relay Ladder Logic-Process Control Programs using Ladder Logic-Data transfer-comparision and manipulation instructions-PID instructions-Introduction to SCADA

# TotalNo of Periods:45

# Text books:

- 1. R.S. Gaonkar, "Microprocessor Architecture Programming and Application, with 8085",
- 2. WileyEastern Ltd., New Delhi, 2013.
- 3. Krishna Kant, "Microprocessors and Microcontrollers, Architecture, programming and systemdesign using 8085, 8086, 8051 and 8096", PHI2007.
- 4. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay "*The 8051Microcontroller* and *EmbeddedSystems*", Second Edition, Pearson Education 2008.
- 5. Frank D Petruzella "Programmable Logic Controllers", Mcgraw HillInc. 2005

# References:

- 1. DouglasVHall, "MicroprocessorandInterfacing, Programmingandhardware", TMH, 2006.
- 2. Kenneth J. Ayala, "The 8086 Microprocessor: Programming & Interfacing the PC", DelmarPublishers, 2007.
- 3. AKRay, KM Bhurchandi, AdvancedMicroprocessorsand Peripherals, TMH, 2007.
- 4. Steve furber "ARM Systems on chip Architecture", Second Edition Addison Wesley trade computerpublication, 2000.

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Subject Code: Subject Name: POWER ELECTRONICS AND P/R С Tv/ L Т DRIVES Lb/ETL /S.L EBRA22ET1 r **Prerequisite: Electrical and Electronics circuits** ETL 2 0/0 2/0 3 L: Lecture T:Tutorial SLr: Supervised Learning P :Project R: Research C:Credits T/L/ETL: Theory/Lab/Embedded Theory and Lab **OBJECTIVE:** Familiarity to Power Electronic Devices and its characteristics and convertors. Familiarization to inverters and choppers • To study about DC drives and AC drives To have knowledge in doing the experiment using the theoretical knowledge. To have knowledge in doing application oriented to power electronics drives **COURSEOUTCOMES(COs):** Students will able to: C01 Understand the basic concepts of power semiconductor devices and converters CO2 Design inverters and choppers CO3 Demonstrate the working of DC and AC drives CO4 Describe experimentally the concepts of voltage controllers CO5 Implement the concepts learnt to develop inverters and choppers Mapping of Course Outcomes with Program Outcomes(POs) COs/POs **PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 CO1** 3 2 3 2 3 3 2 3 3 3 3 3 **CO2** 3 3 2 3 2 3 3 3 3 2 3 3 **CO3** 3 3 1 3 3 3 3 3 3 3 1 1 3 3 3 **CO4** 3 3 3 3 3 3 2 3 3 CO5 3 3 3 3 3 3 2 3 3 3 3 3 PSO₂ PSO4 COs PSO1 PSO3 /PSOs **CO1** 3 2 2 1 **CO2** 3 1 2 1 3 2 2 2 **CO3 CO4** 3 1 2 2 CO5 3 2 2 2 3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low andSocialSciences TechnicalSkill EngineeringSciences ProgramElectives Practical/ Project Program Core OpenElectives BasicSciences Soft Skills nternships / Humanities Category  $\sqrt{}$ 

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### TEXTBOOKS:

1. Bimbhra, Power Electronics-khanna Publishers, 2018

- 2. Rashid M.H ,"Power Electronics-circuits ,Devices and Applications, PHI, New Delhi.,2004
- 3. Dubey, G. K "Power Semiconductors and Drives", Prentice Hall, 1989

#### **REFERENCES:**

Bimal K Bose, "ModernPowerElectronicsandACDrives", PearsonEducation, 2002.
 JosephVithyathil, "PowerElectronics", McgrawHill, USA, 1995.
 Mohan, Udeland and Robbins, "PowerElectronics", John Wiley and sons, New York, 2003.4. VedamSubramaniam, "ThyristorcontrolofElectricalDrives", TataMcGrawhill, NewDelhi, 1998



Subject Code:	Subject Name:	POWER ELECTRONICS AND	ЪТу /	L	Т	<b>P/ R</b>	С	
		DRIVES	Lb/ETL		/S.L			
EBRA22ET1					r			
	Prerequisite: Elec	trical and Electronics circuits	ETL	2	0/0	2/0	3	I

#### THEORY COMPONENT:

#### UNIT I: REVIEW OF POWER SEMICONDUCTOR DEVICES AND CONVERTERS 12

Characteristics of SCR, TRIAC, Power MOSFET, IGBT-Thyristor protection circuits-thyristor triggering circuits-Single Phase-three Phases-Half controlled –full controlled rectifiers-Dual converters- AC regulators (no derivations).

#### UNIT II: INVERTERS AND CHOPPER

Voltage Source Inverters-Current Source inverters-Voltage and waveform control of inverters-Dc choppers-Step up and step down –uninterrupted power supplies.

#### UNIT III: DC DRIVES AND AC DRIVES

Introduction to drives-basic elements of drive-load characteristics-selection of drive-Basic characteristic of DC motor-Operating modes-quadrant operation of chopper-Closed loop control of DC drives-applications- Induction motor-Performance characteristics-Stator and rotor voltage control, frequency and voltage control-Current Control-applications.

#### LAB COMPONENT:

- 1. AC to DC half and full controlled converter
- 2. AC Voltage Controller
- 3. IGBT based single phase PWM inverter With filter and without filter
- 4. Step up and step down chopper

#### Total no. of Periods: 60

111

12

24



Subject Code: EBOL22I01	Subject Name: ONLINE COURSE NPTEL/SWAYAM/Any MOOC APPROVED BY AICTE/UGC	Ty/Lb/ ETL	L	T/ SLr	P/R	С
	Pre requisite: Nil	IE	1	0/0	1/0	1

Students should register for the online course with minimum course duration of 4 weeks through the online portals such as NPTEL/SWAYAM/Any MOOC in the beginning of the semester. A mentor will be assigned by the department for monitoring the students.

Students are expected to attend the online classes regularly and submit the weekly assignments before the due Dates.Students should appear for the online examination and submit the certificate at the end of the semester. Internal Examination will be conducted by the examiners duly appointed by the head of the department

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SubjectCode: Subject Name : PROCESSORS AND T/SLr P/R Τv L С EBEC22IL5 **CONTROLLERS LAB** /Lb/ ETL **Prerequisite:**Processors and Controllers Lb 0 0/0 3/0 1 L: Lecture T :Tutorial SLr : SupervisedLearningP: Project R: Research C:CreditsT/L/ETL:Theory/Lab/Embedded Theory and Lab **OBJECTIVE:** To write Assembly Language Program for arithmetic and logical operations in 8085 and 8086. To write Assembly Language Program for arithmetic and logical operations in 8051. To understand the interfacing concepts of the peripheral devices with processors and controller. To understand the mechanism of Programmable logic Controllers and write Ladder logic programming. **COURSEOUTCOMES(COs):** TheStudentswill beableto Ability to understand the Programming of 8085 and 8086 microprocessor. **CO1 CO2** Interfaceperipherals with 8086 microprocessor **CO3** Develop programs using 8051 Microcontroller. **CO4** Interface peripherals with 8051 Microcontroller **CO5** Understand, Analyse the working of Programmable Logic Controllers and gain mastery over developing Ladder logic programs for automation processes MappingofCourseOutcomeswithProgramOutcomes(POs) **COs/POs PO1 PO2 PO3 PO4 PO5 PO6 PO7 PO8** PO9 **PO10 PO11 PO12 CO1** 2 2 3 3 3 3 3 2 2 3 3 3 2 2 2 **CO2** 3 3 3 3 3 2 3 3 3 3 3 2 2 3 3 3 2 2 3 2 **CO3** 3 **CO4** 3 3 3 3 3 2 2 2 2 3 3 2 **CO5** 3 3 3 3 3 2 2 2 2 3 3 3 COs **PSO1** PSO₂ PSO₃ PSO4 /PSOs **CO1** 3 3 3 3 **CO2** 3 3 2 3 3 3 3 3 **CO3 CO4** 3 3 2 3 **CO5** 3 3 2 3 3/2/1 Indicates Strength Of Correlation, 3 - High, 2- Medium, 1- Low Internships/Technical EngineeringSciences undSocialSciences ProgramElectives Practical/ Project OpenElectives BasicSciences Program Core Category Humanities Soft Skills Skill



SubjectCode:	Subject Name :PROCESSORS AND	Т	L	T/SLr	P/R	С
EBEC22IL5	CONTROLLERS LAB	/L/				
		ETL				
	Prerequisite: Processors and Controllers	Lb	0	0/0	3/0	1

#### LIST OF EXERCISES USING 8085 Kits:

- 1. Basic Arithmetic, Logical operations
- 2. Sorting.

#### LIST OF EXERCISES USING 8086 kits / MASM

- 3. Arithmetic and Logical operation.
- 4. Code conversion and Square of Given No.
- 5. String manipulations.
- 6. Searching

#### LIST OF EXERCISES USING 8051 kits

- 7. Basic Arithmetic, Logical operations.
- 8. Find 2s complement of a number
- 9. Conversion of packed BCD to unpacked BCD
- 10. Square and Cube of Given no. PERIPHERALS AND INTERFACING EXPERIMENTS USING 8086/8051
- 11. Wave form Generation.
- 12. Traffic light control
- 13. Stepper motor control
- 14. Serial interface
- 15. Parallel interface
- 16. A/D interface

#### PLC BASED EXPERIMENTS

17.Ladder Logic Program for control of bottling mechanism for soft drinks.

- 18.Ladder Logic Program for car parking.
- 19.Ladder Logic Program for liquid level control.

Total No. of Hrs: 45



Subject Code	: S	ubject Na IACHIN	ame : AR E LEARN	TIFICI	AL INT	<b>FELLIO</b>	GENCE	AND	Ty / Lb/ ETL	L	T/ S.Lr	P/ R	C	
EDCS2211 A	P	rerequisi	te: ART	<b>IFICIA</b>	L INT	ELLIG	ENCE	AND	Ty	0	0/0	3/0	1	
L · Lecture T	N Tutor	ial SLr	<u>E LEAR</u> Supervis	ed Lean	ning P·	Project	R · Res	earch (	[•] Credits					
Ty/Lb/ETL : T	Theory	/Lab/Emb	edded Th	eory and	l Lab	110,000	10.1005	curen c						
OBJECTIVE	:													
• Study	the co	ncepts of	Artificial	Intellige	ence.									
• Learn	the m	ethods of a	solving pr	oblems	using Aı	rtificial	Intellige	nce.						
<ul> <li>Introd</li> </ul>	uce th	e concepts	s of Exper	t Systen	ns and m	achine l	earning							
COURSE OI	TCO	MES (CO	$\overline{(s): Stud}$	ents will	able to	:	0							
CO1		Write a F	R program	n to me	rge two	given l	ists into	one li	st, given i	natrix i	nto one	list.		
CO2		Demonst	rate the v	vorking	of the	decision	n tree ba	ased IE	03 algorith	ım				
CO3		Write a p	orogram t	o imple	ment th	e naïve	Bayesi	an clas	sifier for	a sampl	e trainir	g data	a set	
		stored as	a .CSV	file.	1 /		1 4 4	1.	COV C1					
C04		Apply El	VI algorit	hm to c	luster a	set of c	lata stoi	$\frac{1}{1}$	$\frac{1}{1}$ .CSV file	e 1	· C 1	• •		
005		Write a j	program	to impl	ement I	k-Neare	est Neig	hbor a	lgorithm	to class	ify the	iris da	ata set	
Manning of (	ourse		es with P	ngram	Outcom	nes (POs	3)							
COs/POs	PO1	PO2	O2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12											
CO1	3	3	3	3	2	3	2	2	3	3	3		3	
CO2	3	3	3	3	2	3	2	2	3	3	3		3	
CO3	3	3	3	3	1	3	2	2	3	2	3		3	
CO4	3	3	3	3	1	3	2	2	3	2	3		3	
CO5	3	3	3	3	1	3	2	2	3	2	3		3	
COs / PSOs	PSO	1	PSO2		PSO3		PSO4					•		
CO1								3						
CO2								3						
CO3								3						
CO4								3						
CO5								3						
3/2/1 Indicate	es Stre	ngth Of (	Correlatio	on, 3 – E	<b>ligh, 2-</b>	Mediun	n, 1- Lo	W		T				
ĸ	e		nd social		ective		inary	nent	oject					
tegoi	sienc	ing	es ar	Core	un el	ctive	scipl	oduu	1 /Pr					
Cai	c Sc	een. Se	initi ce	am	)gra	Ele	Di	Co	tica					
	asi	gin	ima ien(	ngr.	Prc	en	nter	kill	rac					
	В	En	Hu Sc	Pr		OF	II ,	S	Ъ Р					
							✓		$\checkmark$					



SubjectCode: EBCS22IL4	SubjectName:ARTIFICIAL MACHINE LEARNING LAB	INTELLIGENCE	AND	Ty/Lb/ ETL	L	T/ SLr	P/R	С
	Prerequisite:ARTIFICIAL MACHINE LEARNING	INTELLIGENCI	E AND	Lb	0	0/0	3/0	1

- 1. Write a R program to list containing a vector, a matrix and a list and give names to the elements in the list.
- 2. Write a R program to merge two given lists into one list.
- 3. Write a R program to convert a given matrix to a list.
- 4. Write a program to demonstrate the working of the decision tree based ID3 algorithm.

5. Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file.

6. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm.

7. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set. Print both correct and wrong predictions.

**Total No.of Periods: 45** 



SubjectCode:	SubjectName: TECHNICALSKILL II	T/L/ ETL/IE	L	T/ S.Lr	<b>P/ R</b>	С
EBRA22I02	Prerequisite: All Subjects Studied Up to Date	IE	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department



## **SEMESTER VI**



Subject	Su	bjectNa	me: CAD	,CAM	&CIM				Ty/Lb/	L	Τ/	P/R	С
Code	_								ETL		SLr		
couc.	Pr	erequisi	te:Design	of Mac	chine El	ements,			Ty	3	0/0	0/0	3
EBME22011													
L: LectureT:T	utorial	SLr :	: Supervis	edLearn	ingP:Pro	oject R:	Researc	chC:Cre	dits				
T/L/ETL:Theo	ory/Lab/	Embedd	ed Theory	yand Lał	b								
OBJE	CTIVE	2											
To pro	ovide an	overvie	ew of how	/ compu	ters are	being u	sed in d	esign,de	evelopment	t of Ma	nufacturi	ng plan	s and
manuf	facture					~	1 00 1						
• To une	derstand	I the nee	d for integ	gration c	of CAD,	CAM an	nd CIM						
				COUR	SEOUT	COME	CS(COs)	:(3-5)					
CO1	Un	derstand	d the conc	epts and	l uses of	various	CAD de	evices					
CO2	Ap	ply vari	ous CAD	modelin	ng techni	iques							
CO3	Un	derstand	the CNC	² machin	nes and i	ntegerat	ion of <b>(</b>	CAD/CA	AM				
CO4	An	alyze an	nd write de	own part	t prograr	nming f	or lathe	and mil	ling operat	ions			
CO5	Ар	ply grou	ıp technol	ogy and	comput	er aided	process	plannir	ng and und	erstand	the FMS	concep	t and
	fur	nctions											
<u> </u>	<b>D</b> 04		Map	pingofC	Coursew	ithProg	ramOu	tcomes(	(Pos)	2010			
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	) PO11	PO	12
	3	3	2		3								
	3	3	2		3								
CO3	3	3	2		3								
C04	3	3	2		3							_	
	J DS	5				03	D	504					
C05/F 505	15		13	<u>52</u>	13	2	I C	<del>יטק</del>					
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CO2			•	, 2		<u>3</u>		2					
CO4				ہ ۲		3		2					
CO5				<u>,</u> २		3		2					
3/2/1 Indicate	s Stren	gth Of (	Correlatio	on, 3 – E	ligh, 2-	Mediun	n, 1- Lo	w					
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r E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnac Periyar E.V.R. Salai, Maduravoyal, Chennai – 95 Tamilnadu, India. DCAMOCI

SubjectCode:	SubjectName: CAD,CAM &CIM	Ty/Lb/	L	1/	P/ K	C
		ETL		S.Lr		
EBME22011	Prerequisite:Design of Machine Elements,	Ту	3	0/0	0/0	3

#### **UNIT- I INTRODUCTION**

A typical product cycle, CAD tools for the design process of product cycle, CAD / CAM system evaluation criteria,Input/Outputdevices;Graphics Displays: Refresh display, DVST, Raster display, pixel value and lookup table, estimation of graphical memory,LCD,LED fundamentals.Concept of Coordinate Systems:Working Coordinate System, ModelCoordinateSystem, ScreenCoordinate System. Graphics exchange standards.

#### **UNIT- II GEOMETRIC TRANSFORMATIONS AND MODELING**

Homogeneous representation; Translation, Scaling, Reflection, Rotation, Shearing in 2D and 3D: Window to View-port transformation. Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations.Schemes:Brep,CSG,Sweep representation,ASM,Primitive instancing,Cell Decomposition and Octree encoding

#### **UNIT- III COMPUTER AIDED MANUFACTURING**

Concepts, Objectives&scope, Nature&Typeofmanufacturingsystem, Evolution, BenefitsofCAM, Role CAM of management in CAM, Concepts of Computer Integrated Manufacturing, Impact of CIM on personnel, Roleof manufacturingengineers, CIM Wheelto understand basic functions.

NC and CNC Technology: Types, Classification, Specification and components, Construction Details-Axisdesignation, NC/CNC tooling. Fundamentals of Part programming, Types of format, Part Programming for drilling, lathe and milling machine operations.

#### **UNIT- IV GROUP TECHNOLOGY AND CAPP**

Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank orderclustering, composite part concepts, Benefits of group technology. Approaches to Process Planning, Different CAPP system, application and benefits

#### **UNIT- V FLEXIBLE MANUFACTURING SYSTEM**

Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS,FMS layout and advantages.Automated material handling system:Types and Application,Automated Storage and Retrieval System, Automated Guided Vehicles, Cellular manufacturing, Tool Management, Tool supplysystem, Tool Monitoring System, Flexible Fixturing, Flexible Assembly Systems.

#### **TEXTBOOKS**

- 1) ChrisMcMohanandJimmieBrowne, "CAD/CAM", AddisonWesleyPublications, 2ndEd.
- 2) HMT,(2000) "Mechatronics", TataMcGraw-Hill Ed.
- 3) Mikkel.P.Groover, (2007) "Automation, Production and Computer Integrated Manufacturing", PHI., PvtLtd.

#### REFERENCEBOOKS

- 1. MikellPGroover, "Automation, ProductionSystems and ComputerIntegratedManufacturing", PearsonEducation
- 2. Rao, Tewari, Kundra, "Computer Aided Manufacturing", McGraw Hill
- 3. P.Radhakrishnan, "ComputerNumericalControl", NewCentralBookAgency

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## **Total No.of Periods:45**

120



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Subject		Subject	Name:IN	DUSTR	IAL AU	JTOMA	TION		Ty/Lb/	L	T/	P/R	C		
Code:EBME2	22013								ETL		SLr				
		Pre re	quisite: Iı	nstrume	ntation	and			Τv	3	0/0	0/0	3		
		Contro	ol Engine	ering		Data in a (D	D	al C	<b>1</b> J						
L: Lecture I: I CreditsT/I /FT	utoriai T •Theor	SLI: v/Lab/F	: Supervis mbedded7	ed Learr	ungP : P nd I ab	rojectk	: Resear	ch C:							
	C.T.	y/ Lao/ L	mocuucu	i neor yai	lu Luo										
OBJECTIVE	5:10 gai nowledg	in e in hydi	raulic nne	umatic	and mec	hatronic	s system	in Auto	omation						
OURSEOUT	COMES	$\overline{\mathbf{S}(\mathbf{COs})}$ :	iaune, pik	unatio			s system	111111111	Jination.						
CO1		Underst	and Pneur	natic an	d hvdrau	lic princ	ciples, co	mponer	nts and fun	ctions					
CO2		Analyze	and Desi	gn the P	neumati	c and hy	draulic o	circuits	for automa	tion					
CO3		Recogni	se the var	the various components of mechatronics system e various actuation systems and System models in automation Mechatronic system for the required automation vith Program Outcomes(POs) PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12											
CO4		Discuss	the variou	the various components of mechatronics system e various actuation systems and System models in automation Mechatronic system for the required automation with Program Outcomes(POs) PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12 2 2 3 3 2 3 3 2 3 3 2											
CO5		Design	the Mecha	e Mechatronic system for the required automation with Program Outcomes(POs) PO3 PO4 PO5 PO6 PO7 PO8 PO9 PO10 PO11 PO12											
Mapping of C	Course C	Jutcome	s with Pro	Mechatronic systems and systems induction           Mechatronic system for the required automation           vith Program Outcomes(POs)           PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12           2         2         3         3         2         3         3         3         2           3         3         3         2         3         3         3         2											
Cos/Pos	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	<b>PO10</b>	PO11	PO	12		
CO1	3	3	2	2	3	3	2	3	3	3	3		2		
CO2	3	3	3	3	3	3	2	3	3	3	3		2		
CO3	3	3	2	2	3	3	2	3	3	3	3		2		
CO4	3	3	2	2	3	3	2	3	3	3	3		2		
CO5	3	3	3	3	3	3	2	3	3	3	3		2		
Cos/PSOs	PS	501	PSO	02	PS	03	PS	504							
CO1		3	3			2		3							
CO2		3	3		,	2		3							
CO3		3	3		2	2		3							
CO4		3	3		,	2		3							
CO5		3	3		,	2		3							
3/2/1 Indicates	Strengt	h Of Co	rrelation	, 3 – Hig	gh, 2- M	edium,	1- Low			1					
Category	BasicSciences	EngineeringSciences	3       3       3       3       2       3       3       3       3       3         2       2       3       3       2       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3       3												



Subject Code:	SubjectName:INDUSTRIAL AUTOMATION	Ty/Lb/	L	Τ/	P/R	С
EBME22013		ETL		SLr		
	Pre requisite: Instrumentation and Control Engineering	Ту	3	0/0	0/0	3

#### **UNIT- I BASIC PRINCIPLES OF HYDRAULICS AND PNEUMATICS**

Hydraulic principles – Hydraulic pumps – pumping circuits - Hydraulic actuators – Characteristics – Hydraulic valves types and Applications – Hydraulic Fluids. Fundamentals of pneumatics – Control elements – logiccircuits – position – pressure sensing – switching – Electro-pneumatic – Electro-hydraulic circuits.Symbols of hydraulic and pneumatic circuits.

#### UNIT- II DESIGN OF HYDRAULIC AND PNEUMATIC CIRCUITS

Hydraulic circuits – Reciprocating – Quick-return – sequencing – synchronizing –Accumulators circuits – Safety circuits –Industrial circuits.Pneumatic circuits –classic–cascade –step counter–combination methods.Design of Hydraulic and pneumatic circuits-Selection of components–Installation and Maintenance of Hydraulic and Pneumati cpowerpacks.

#### UNIT-III MECHATRONICS, SENSORS AND TRANSDUCERS

Introduction to Mechatronics Systems – Measurement Systems – Transducers – Performance Terminology – Sensors for Displacement, Position and Proximity; Velocity, Motion, Force, Fluid Pressure, Liquid Flow, LiquidLevel, Temperature, LightSensors– Selection of Sensors.

#### UNIT-IV ACTUATION SYSTEM AND SYSTEM MODELS

Hydraulic,Pneumatic and electrical actuation Systems–MechanicalSwitches–SolidStateSwitches–Solenoids – D.C Motors – A.C Motors – Stepper Motors.Building blocks of Mechanical, Electrical, Fluid andThermal Systems, Rotational – Translational Systems, Electromechanical Systems – Hydraulic – MechanicalSystems.

#### UNIT-VCONTROLLERS AND DESIGN OF MECHATRONIC SYSTEMS

Continuous and discrete process Controllers –PID Controllers – Digital Controllers, Digital Logic Control – Micro Processors Control. Programmable Logic Controllers – Basic Structure – Input / Output Processing – Programming – Mnemonics – Timers, Internal relays and counters – Shift Registers – Master and Jump Controls.Stages in designing Mechatronics Systems -Case Studies of Mechatronics Systems, Pick and place robot –Automatic Car Park Systems– Engine Management Systems.

#### TEXTBOOKS

- 1. S.Ilango and V.Soundarrajan, (2011)"Introduction to Hydraulics and Pneumatics", Prenticehallindia, 2ndEdition.
- 2. K.Shanmugasundaram(2006)"*Hydraulic and Pneumatic control*"S.Chand&Co.
- 3. W.Bolton, "Mechatronics", Pearson Education, Second Edition, 1999.

#### REFERENCES

- 1. Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems", McGraw-Hill InternationalEditions, 2000.
- $2. \quad Bradley D.A., Daws on D., Buru N.C. and. Loader A.J, ``Mechatronics'', Chapman and Hall, 1993.$
- 3. Lawrence J. Kamm, "Understanding Electro Mechanical Engineering", An Introduction to Mechatronics, Prentice– HallofIndia Pvt., Ltd., 2000.
- $4. \ Nitaigour Premchand Mahadik, ``Mechatronics'', TataMcGraw-HillpublishingCompanyLtd, 2003$

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#### TotalNo.of Periods: 45



SubjectCode:	S	ubjectNa	me:EMB	EDDEI	O SYSTI	EMS DI	ESIGN		Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Р	rerequisi	te: Analo	g and D	igital E	lectroni	cs		Ту	3	1/0	0/0	4
L: LectureT:Tu	ıtorial	SLr :	Supervis	edLearn	ingP:Pro	ject R:	Researc	hC:Cre	dits				
T/L/ETL:Theor	ry/Lal	b/Embedd	edTheory	and Lab									
<b>OBJECTIVE:</b>	:												
• To	give	an unders	tanding of	workin	g of emł	bedded s	system a	nd its ap	pplications				
COURSEOUT	<u>rcon</u>	AES(COs	):			1							
COI		Understar	id the basi	c conce	pts of a	n embed	Ided syst	tem					
CO2		Analyze t	he archite	cture of	a typica	l embed	ded syst	em.					
CO3		Recognise	e the diffe	rent ope	rating sy	stems f	or embe	dded sy	stem				
CO4		Evaluate	the differ	ent perfo	ormance	issues of	of embed	ldedsys	tem				
CO5		Implemen	t real time	e embed	ded syst	ems bas	ed on th	e conce	pts studied				
MappingofCo	urseC	Outcomes	withProg	ramOut	tcomes(l	POs)							
COs/POs	<u>PO1</u>	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO	1
	3	3	3	3	3	3	3	1	3	3	3	3	
CO2	3	3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								2	2	
	3	3	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$								3	5	
CO4	3	3	3	3	3	3	3	1	3	3	3	3	
CO5	3	3	3	2	3	3	3	3	2	3	2	2	
COs /PSOs	ľ	2		)2	PS	03	PS	<u>504</u> 2					
CO1		3	3	1	1	<b>)</b> I		3					
		2		1		2							
CO4		4	3			,		3					
C05		3	5			3		5					
3/2/1 Indicates	s Stre	ngth Of C	Correlatio	n. 3 – H		Mediun	1. 1- Lo	w					
		8					, -						
Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	Interdisciplinary	OpenElectives	Practical/ Project	Internships/TechnicalSkil	Soft Skills				
					$\checkmark$								

SubjectName: EMBEDDED SYSTEMS DESIGN P/R SubjectCode: Ty/ L Т С Lb/ETL /S.L EBEC22ID7 r Prerequisite: Analog and Digital Electronics Тy 3 1/0 0/0 4

#### **UNIT I: INTRODUCTION TO EMBEDDED SYSTEM**

Embeddedsystem, Functional building blockofembeddedsystem, Characteristics of embedded system applications, Challenges in embedded system design, Embedded system design processes.

#### **UNIT II: ARCHITECTURE OF EMBEDDED SYSTEM**

Computer architecture taxonomy, CPUsProgramming input and output, Supervisor mode, Exceptions& Traps, Coprocessors, Memory system mechanisms - CPU bus - Memory devices - I/O devices - Componentinterfacing-Assemblyand linking-Basic compilationtechniques-Program optimization.

#### **UNIT III: OS FOR EMBEDDED SYSTEMS**

Introduction to RTOS, Multiple tasks and multiple processes, Context switching, Operating system, Scheduling policies, Inter process communication mechanisms. Introduction to µC/ OS II.

#### **UNIT IV: PERFORMANCE ISSUES OF EMBEDDED SYSTEMS**

CPU Performance, CPU power consumption, Program level performance analysis, Analysis and optimization ofprogramsize, energy and power, Evaluating operating system performance, Powermanagement and optimization strategies for processes, Multiprocessors – CPUs and accelerators, Multiprocessor performanceanalysis.

#### **UNIT V:DESIGN& IMPLEMENTATION**

Development and debugging, Manufacturing Testing, Program validation and Testing, Distributed embedded architecture, Networks for Embedded Systems- I 2 C Bus, CAN Bus, Design examples: Cell phones, DigitalStill Cameras, Elevator Controller.

## Total No.of Periods: 60

124

#### **TEXTBOOKS:**

1. WayneWolf, "Computers as Components: Principles of Embedded Computer Systems Design", TheMorgan Kaufmann Seriesin Computer Architectureand Design, Elsevier Publications, 2008.

2. Rajkamal, "EmbeddedSystems-Architecture, Programming and Design", TataMcGraw-HillPublishingCompanyLtd., NewDelhi,2010.

#### **REFERENCES:**

1. DavidESimon, "AnEmbeddedsoftwareprimer", PearsoneducationIndia, New Delhi, 2004.

2. SriramVIyer, PankajGupta, "EmbeddedReal-timeSystemsProgramming", TataMcGrawHillPublishingCompany Ltd, New Delhi,2008



## 12

## 12

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#### 12



SubjectCode:	SubjectNa	meINDU	STRIA	L AUTO	OMATI	ON LA	В	Ty/	L	T /S I	<b>P/ R</b>	C
EBME22L09										/5.L r		
	Prerequisi	te:Indust	rial Au	tomatio	n			Lb	0	0/0	3/0	1
L: LectureT:Tutor	ial SLr	:Supervise	edLearni	ngP : Pr	ojectR:	Research	nC:Crec	lits	J			J
T/L/ETL:Theory/l	Lab/Embedd	ledTheory	and Lab									
<b>OBJECTIVES:</b>												
• To pr	actice simp	ole progra	ms on i	micropr	ocessor	s and n	nicroco	ntrollers.				
• To design	n and imple	ment pne	eumatic	and hy	draulic	circuits	with a	utomation	studio	software	e and w	/ith
KITS		.).(2 5)St	donta	rill he el	hla tat							
COURSECUTO	Pacogniza	the variou		onents o	f Hydra	ulice and	Duqun	natic circui	te			
	Design and	l impleme	nt hvdra	ulic circ	nits wit	h autom	ation st	udio softwa	are and ]	kit		
02	Design and	impienie	int iny die	tune ene	uns wit	ii aatoiii	unon st	uulo soltwa	are und	AIL .		
CO3	Design and	l impleme	nt pneui	natic cir	cuits wi	th auton	nation s	tudio softw	are and	kit		
CO4	Understand	d the conc	epts and	applica	tions of	robots						
CO5	Write prog	ramming	for cont	rollers ir	n automa	ation						
Mapping of Cour	rse Outcom	es with Pr	ogram	Outcom	es(Pos)				2010			
Cos/Pos PO	D1 PO2	D2         PO3         PO4         PO5         PO6         PO7         PO8         PO9         PO10         PO11         PO12           D2         D3         D4         D5         PO6         PO7         PO8         PO9         PO10         PO11         PO12										12
COI	3 3	2	2	3	3	2	3	3	3	3		2
CO2 :	3 3	3     3     3     2     3     3     3     2									2	
<u>CO3</u>	3 3	3	3	3	3	2	3	3	3	3		2
CO4	$\frac{3}{2}$ 3	2	2	3	3	2	3	3	3	3		2
	<u>3 3</u> DSO1		3	J DS	3		$\frac{3}{504}$	3	3	3		2
C05/1 505	3		J4	15	<u>03</u>	10	3					
CO2	3	3		4	2		<u> </u>					
CO3	3	3			2		3					
CO4	3	3		2	2		3					
CO5	3	3		2	2		3					
3/2/1 Indicates St	rength Of (	Correlatio	n, 3 – F	ligh, 2-	Mediun	n, 1- Lo	W		_			
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							Ski					
	ses						cal					
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ory es	Sci	ien	ſe	ctiv	es	oje	<b>Γec</b>					
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C	ginee	uman dSoc	ograi	ogra	enE	actic	ems	ft Sl				
C BasicSc	Enginee	Human andSoc	Progra	Progra	OpenE	Practic	Interns	Soft Sl				



SubjectCode:	SubjectName:INDUSTRIAL AUTOMATION LAB	Ty/	L	Т	<b>P/ R</b>	С
		Lb/ETL		/S.L		
EBME22L09				r		
	Prerequisite:Industrial Automation	Lb	0	0/0	3/0	1

#### LIST OFEXPERIMENTS:

- a. Exercises in PLC Trainer Kit.
- b. Exercises in Pneumatic/Hydraulic Trainer Kit.
- c. Exercises in Electro Pneumatic kit.
- d. Exercises in Industrial Robot.
- e. Exercises in microprocessors and microcontrollers.
- f. Design of pneumatic and hydraulic circuits using Automation Studio software.

**Total No.of Periods:45** 

C EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) R. High Road, Maduravoyal, Chennai-95. Tamiln

du, India

Subject Code: EBME22L07	Sub	ject Nar	ne: CAD	/CAM 1	LAB				Ty/Lb/ ETL	L	T/ SLr	P/R	С	
	Pr	e requis	ite: CAD,	CAM&	CIM, M	lachine	Drawin	g	Lb	0	0/0	3/0	1	
L: LectureT:T	utorial	SLr :	Supervise	edLearn	ingP								1	
:ProjectR:Rese	earchC:	CreditsT/	/L/ETL:Tł	neory/La	ab/Embe	ddedTh	eoryand	Lab						
OBJECTIVE	:													
• Get pr	actical k	nowledg	ge through	practic	e on CN	C Mach	ines and	related s	oftware .					
				COU	OSEOU	FCOM		.(2.5)						
<u>CO1</u>	Ur	derstand	the conce	ents of n	netal cut	ting and	25(COS related	):(3-5) informati	ion					
CO2	Ac	auire sk	ill in speci	ial purpo	ose mach	nines	Terated	morman						
CO3	Se	lect appr	opriate m	ethod of	manufa	cturing	based or	n the reau	uirement					
<b>CO4</b>	Un	Understand the concepts and applications of powder metallurgy												
	enderstand the concepts and appreations of powder metanoity													
CO5	CO5 Expose to various advanced manufacturing processes of precision components													
	MappingofCoursewithProgramOutcomes(Pos)													
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	<b>PO10</b>	PO11	PO	12	
CO1	3	3	2	-	2	3	3	2	3	2	2		2	
CO2	3	3	3	-	2	3	3	2	3	2	2		2	
CO3	3	3	3	-	2	3	3	2	3	2	2	2 2		
CO4	3	3	2	-	3	3	3	2	3	2	2	2		
CO5	3	3	2	-	3	3	3	2	3	2	2		2	
Cos/PSOs	PS	<u>501</u>	PSC	)2	PS	03	PS	<u>504</u>			_			
		3	3			2		3						
	•	3	3		-	2		<u>3</u>						
		3	3		-	2		3						
C04	•	3	3		-	<u> </u>		<u>3</u>						
2/2/1 Indicato	c Strong	5 	J Correlatio	n 3 U	ligh 2 M	5 Modium		<u> </u>						
3/2/1 mulcate	s Streng			n, 5 – 11	ligii, 2- 1		l, 1- LUV	• 						
			al											
			soci		ive		ıry	nt	ct					
	ce		pu	e	elect	e	lina	one	roje					
ory	ien	ng	es a	Cor	me	ctiv	scip	mpe	I/P1					
Iteg	c Sc	eeri Se	niti Se	m	gra	Ele	Dis	Co	ica					
C	asi	ienc	ima ienc	ngc	Prc	en	nter	kill	ract					
	щ	En Sc	Ht Sc	Pr		Of	П	S	<u>д</u>					
				✓										



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Subject Code: EBME22L07	SubjectName:CAD/CAM LAB	Ty /Lb/ ETL	L	T /S.L r	P/ R	С
	Prerequisite: CAD,CAM&CIM, Machine Drawing	Lb	0	0/0	3/0	1

#### List of Experiments

#### 1. CAD LAB

Introduction to computer Aided Design and Drafting Packages.

2D - Drawing using Auto CAD/ Solid works or CATIA Software

2D sectional views, part drawing, assembly drawing, detailed drawing.

Dimensioning, annotations, symbols - Welding, Surface finish, threads, Text, Bill of Materials, Title Block.

Exercises - Knuckle joint, Gib & Cotter joint, Screw Jack, Foot step bearing.

Orthographic views, Isometric views.

Solid modeling features-Boolean operations.

#### CAM LAB

NC part programme with G and M codes should be generated, tool path simulation and execution to be done for the following machines.

- 1. Exercises in CNC lathe.
- 1. Step Turning
- 2. Taper Turning
- 3. Thread Cutting
- 4. Eccentric Turning
- 2. Exercises in CNC milling machines.
  - 1. Contour Milling
  - 2. Hexagonal Milling

**Total No. of Periods: 45** 

EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status	TH GRADE
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SubjectCode:	Su	ibjectNa	ame:SOF	T SKI	LLS II		I		Ty/ Ib/FT	L	T /S I	<b>P/ R</b>	С
EBCC22107		UALIIA KILLS	AIIVEA	ND QU	ANIII		1		LUEL		/5.L r		
	Pre	erequisi	te:Nil						IE	0	0/0	2/0	1
L: LectureT:Tu	utorial	SLr :	Supervis	edLearn	ingP:Pr	oject R	Resear	chC:Cre	dits	I I	1		1
T/L/ETL:Theo	ry/Lab/	Embedd	edTheory	and Lab	1								
OBJECTIVE	S:												
<ul> <li>To bri</li> </ul>	ng beh	avioura	l patterns	s of stuc	lents.								
• To tra	in then	n for con	porate c	ulture.									
• To cre	eate sel	f aware	ness.										
• To bu	ild con	fidence.											
• To tra	in the s	students	for facin	g the ir	nterview	vs and o	levelop	interpe	ersonal rel	lationsl	nip		
COURSE OU	TCOM	ES(COs	s):( <b>3- 5</b> )										
CO1	R	ecogniz	e and ap	ply arit	hmetic	knowle	dge in a	avariety	of conte	xts.			
CO2	A	bility to	o identify	and cr	itically	evaluat	e philos	sophica	l argumer	nts and	defend tl	nem fr	om
<u>CO3</u>		riticism.	in the skill in solving H C E & L C M_Problem and Profit&Loss problems										
$\frac{C03}{C04}$	0 G	Frain the skill in solving the problems in Permutations & Combinations											
<u>CO</u> 5		ani ule s	rpretatio	n using	differen	t granhs	ciniuta		Comona	10115			
Mapping of C	ourse (	Jutcome	s with P	ogram	Outcon	ies(POs	 ;)						
Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	<b>PO9</b>	<b>PO10</b>	PO11	PO	12
CO1	3	3	3	3	3	3	1	1	3	2	3	3	
CO2	2	2	2	3	1	3	1	3	3	3	3	1	
CO3	3	3	3	3	3	3	2	2	3	3	3	3	
CO4	3	3	3	3	3	3	1	1	3	2	3	3	
CO5	2	2	2	3	1 PC	3	1	3	3	3	3	1	
Cos/PSOs	PS	01	PS0	)2	PS	03	PS	604					
<u>CO2</u>													
CO3													
CO4													
CO5				-									
3/2/1 Indicates	s Streng	gth Of C	Correlatio	on, 3 – F	ligh, 2-	Mediur	n, 1- Lo	W		1		1	
			social		ive		ry	at	ct				
	ence	ac	s and s	ore	ı elect	ive	iplina	iponei	/Proje	ence			
	Sci	erin e	nitie. e	m C	gran	Elect	Disc	Con	ical	Sci			
ory	<b>3</b> asic	ngine xienc	umaı ienc	ogra	Pro	pen ]	nter	Skill	Tract	3asic			
ateg	I	Er Sc	H Sc	Pr		O		✓ ✓	-4	н			
C													

EDUCATIONAL AND RESEARCH INSTITUTE	NAAC * * * *
University with Graded Autonomy Status	
(An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.	

SubjectCode:	SubjectName: SOFT SKILLS II	Ty/	L	Т	<b>P/ R</b>	С
	QUALITATIVE AND QUANTITATIVE SKILLS	Lb/ETL		/S.L		
EBCC22I07		/IE		r		
	Prerequisite:Nil	IE	0	0/0	2/0	1

#### **UNIT I LogicalReasoningI**

Logical Statements – Arguments – Assumptions – CoursesofAction.

#### **UNIT II LogicalReasoningII**

Logical conclusions–Deriving conclusions from passages–Themedetection.

#### **UNIT III ArithmeticalReasoningI**

Number system –H.C.F&L.C.M–Problem on ages–Percentage–Profit&Loss–Ratio& Proportion–Partnership.

#### UNIT IVArithmeticalReasoningII

Time&Work–Time&Distance–Clocks–Permutations&Combinations–Heights&Distances–Odd manout and Series.

#### **UNIT V DataInterpretation**

Tabulation-Bar graphs-Piegraphs-Linegraphs.

#### **Total No of Periods:30**

6

6

6

6

6

#### **REFERENCEBOOK:**

- 1. R.S.Agarwal, AmodernapproachtoLogicalReasoning, S.Chand&Co., (2017).
- 2. R.S.Agarwal, AmodernapproachtoVerbalandNonverbalReasoning, S.Chand&Co., (2017).
- $\label{eq:second} 3.\ R.S. A garwal, Quantitative Aptitude for Competitive Examinations, S. Chand \& Co., (2017).$
- 4. A.K.Gupta, Logical and Analytical Reasoning, Ramesh Publishing House, (2014).
- 5. B.S.Sijwali, Indusijwali, AnewapproachtoReasoning(VerbalandNonverbal), ArihantPublishers, (2014).



SubjectCode:	SubjectName: TECHNICAL SKILL-III	Ту	L	Т	<b>P/ R</b>	С
		/Lb/		/S.L		
EBRA22I03		ETL		r		
	Prerequisite: All Subjects Studied Upto Date	Lb	0	0/0	2/0	1

Students should acquire skill in the domain/inter disciplinary area from government/private training centers/industries /University for a minimum period of 15 calendar days. The training can be through off line, online or mixed mode. Students are supposed to prepare Technical skill report at the end of the training and submit the report along with the certificate in proof of the training, during the viva voce examination conducted by the examiners duly appointed by the head of the department.



Subject Code:	Subject Name : MINI-PROJECT /INTERNSHIP	Ty / Lb/ETL	L	T /S.L	<b>P/ R</b>	С
EBRA22I04				r		
	Prerequisite: Knowledge of Interdisciplinary Subjects and Skills.	Lb	0	0/0	3/0	1

#### MINI PROJECT:

Students will have an opportunity to expose their knowledge and talent to make an innovative project. Students are supposed to do innovative projects useful to industries/society in the area of relevant Engineering, inter and multi-disciplinary areas, under the guidance of a staff member. They have to prepare a project report and submit to the department.

At the end of the semester Viva-Voce examination will be conducted by the internal Examiner duly appointed by the Head of the department and the students will be evaluated.

#### **INTERNSHIP**

Students are supposed to undergo internship in related Industries for a minimum period of 30 days cumulatively during the semester. They have to prepare a report on the Internship with a certificate in proof from competent authority in the industry. At the end of the semester Viva-Voce examination will be conducted by the Examiners duly appointed by the Head of the department and the students will be evaluated.



## **SEMESTER VII**

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SubjectCode:	S	ubject N	Name: K	KINEM	ATICS	AND D	YNAM	ICS	Ty	L	T	<b>P/ R</b>	С
				0	F ROB	OTS			/Lb		/S.L		
EBRA22008									/ <b>F</b> TI		r		
	Pre	requisit	e:Kinen	natics a	nd Dvn	amics of	f Machi	nerv		3	1/0	0/0	4
L: LectureT:T	utorial	SLr	: Super	visedLe	arningP	Project	R: Res	earchC:Cr	redits	U	1/0	0/0	-
T/L/ETL:Theo	ory/Lat	o/Embed	dedTheo	oryand l	Lab								
<b>OBJECTIVE</b>	:			č									
• To	ounder	stand the	specifi	cations	and kine	etics of r	obotics						
• To	o under	rstand th	e works	pace and	alysis of	Four ax	is,Five	axis and S	ix axis ro	obots	3		
• To	o under	rstand th	edynam	ic analy	sis and t	forces of	robots						
• To	o under	rstand th	e differe	ent moti	on of ro	bots							
COURSEOU	ГСОМ	IES(CO	s):										
Students will	be abl	e to:											
CO1	J	Jndersta	lerstand the different specifications of robots										
CO2	F	Analyse v	lyse work space analysis of different categories of robots										
CO3	S	Solve dif	ferential	motior	and sta	tics for t	hree and	d four axis	s robots				
CO4	ŀ	Apply La	ly Langrangian mechanics ,determine moment of inertia, and derive dynamic equation for tw										
	а	ixia plan	ar articu	lated ro	bot								
CO5	CO5 Generate trajectory for path planning for robots												
MappingofCo	ourseO	utcome	swithPr	ogram	Outcom	es(POs)							
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PC	<b>)10</b>	PO11	PO12
CO1	3	3	3	3	2	3	2	2	3		2	3	3
CO2	3	3	3	3	3	2	1	1	2		2	1	3
CO3	3	3	3	3	3	2	1	1	2		2	1	3
CO4	3	3	3	3	3	2	1	1	2		2	1	3
CO5	3	3	3	3	3	2	1		2		2	1	3
COs /PSOs	P	<b>SO1</b>	PS	02	PS	503	P	<u>'SO4</u>					
COI		2	2	2		3		3					
CO2		2	2	2		3		3					
CO3		1		5		2		3					
<u>CO4</u>		1	2	2		2		2					
CU5 2/2/1 Indicate	a Stma	l nath Of	Correla	5 tion 2	Iliah	2 2 Mod	;,,,,,,, 1	2					
5/2/1 Indicate	s Stre	ngth Of	Correla	uion, 5	– Hign,	2- Mea	<u>1um, 1-</u>						
Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	DpenElectives	Practical/ Project	Internships/Technica Skill	Soft Skills				
				~									

	Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu	, India.				
SubjectCode:	Subject Name: KINEMATICS AND DYNAMICS OF	Ту	L	Т	<b>P/ R</b>	С
	ROBOTS	/Lb/		/S.L		
EBRA22008		ETL		r		
	Prerequisite:Kinematics and Dynamics of Machinery	Ту	3	1/0	0/0	4

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#### **UNIT-I: INTRODUCTION**

Specifications of Robots- – Work envelope - Flexible automation versus Robotic technology –Dot and crossproducts,Co-ordinateframes,Rotations,Homogeneous coordinates,Linkcoordinates,D-HRepresentation,Arm equation -Two axis, three axis, four axis, five axis and six axis robots. Inverse Kinematic problem, Generalproperties of solutions, Tool configuration, Inverse Kinematics of Two axis Three axis, Four axis and Five axisrobots.

#### **UNIT-II: WORKSPACE ANALYSIS**

Workspace analysis of Four axis, Five axis and Sixaxis robots, Perspective transformation, structured illumination, Camera calibration, Work envelope of Four and Five axis robots, Workspace fixtures.

#### UNIT-III DIFFERENTIAL MOTIONANDSTATICS

EDUCATIO

The tool Configuration Jacobian matrix for three axis and, four axis robots, joint space singularities, resolved motion rate control, manipulator Jacobian for three and four axis joint space singularities, induced joint torques and forces.

#### UNIT-IV DYNAMIC ANALYSIS AND FORCES

Introduction, Langrangian mechanics, Effects of moments of Inertia, Dynamic equation for two axis planar articulated robot.

#### UNIT-V TRAJECTORYPLANNING

Trajectory planning Pick and place operations, Continuous path motion, Interpolated motion, Straight linemotion.

#### **TEXTBOOKS:**

- 1. RobertJ.Schilling,—FundamentalsofRoboticsAnalysisandControll,PHILearning,2009.
- 2. NikuSB,—IntroductiontoRobotics,Analysis,Systems,Applicationsl,PrenticeHall,2001.

#### **REFERENCES:**

- 1. JohnJCraig,—Introduction toRobotics, Pearson, 2009.
- 2. DebSRandDebS,—RoboticsTechnologyandFlexibleAutomationI,TataMcGrawHillEducationPvt.Ltd, 2010.
- 3. RichardDKlafter,ThomasAChmielewski,MichaelNegin,"RoboticsEngineering– AnIntegratedApproach",Eastern Economy Edition, PrenticeHallofIndiaP Ltd., 2006.
- 4. SahaSK,—IntroductiontoRobotics, TataMcGrawHillEducationPvt.Ltd, 2010.

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**Total No.of Periods: 60** 

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Subject	Sub	oject Na	ame: IN	DUST	RIAL	voyu, ene			Ту	L	Т	I	<b>P</b> /	С
	AP	PLICA	TIONS	OF R	OBOTS	5			/Lb		/S.I		R	
Code:									/ FTL		r			
EBRA22009	Pre	requisi	te:Basi	cs of R	obotics				Ty	3	0/0	(	)/0	3
L: LectureT:Tut	torial	SLr	: Super	visedLe	earning	P:Proje	ct R: R	esearch	C:Credits	5				
T/L/ETL:Theor	v/Lab/	Embed	dedTheo	orvand	Lab									
<b>OBJECTIVE:</b>	J			J										
Togivea	aconce	ptualun	derstand	dingofu	sageofr	obotsin	manufa	cturingi	industries	5				
Toanaly	yserobo	otsforpr	ocessing	goperat	ions									
Toanaly	ysether	obotsfo	rassemb	oly,insp	ection,	selection	nandsel	ectrobo	tsbasedoi	nvariou	isdesig	gnconsi		
deration	15													
COURSEOUT	COM	ES(CO	s):(3- 5)	)										
Studentswillbe	able t	e to												
COI	Unders	erstand the significance of robots in material transfer and machine loading and unloading												g
CO2	process Pocell	esses												
	Domor	call the applications of robots for processing operations												
CO3		istrate a		y and n	ispectio	on techn	iques io		S nta					
C04	Apprec	ppreciate the role of robots in safe and unsafe environments												
CO5 Mannin asfCar	Exami	ne the I	actors 11	nvolved	i in sele	ction ar	$\frac{10}{2}$ desig	gn consi	deration	of rode	ots			
COs/POs	PO1	PO2	PO3		PO5	PO6	S) PO7	PO8	POQ	PO1	0	PO11	P	012
CO1	3	3	3	3	2	3	2	2	3	101	)	3	3	012
	3	3	3	3	3	2	1	<u>2</u> 1	2	2	<u>.</u>	<u> </u>	3	
CO2	3	3	3	3	3	2	1	1	2	2	2	1	3	
CO4	3	3	3	3	3	2	1	1	2	2	2	1	3	
CO5	3	3	3	3	3	2	1	1	2	2	2	1	3	
COs /PSOs	PS	01	PS	02	PS	03	PS	<b>604</b>						
CO1		2	2	2		3		3						
CO2		2	2	2		3		3						
<u>CO3</u>	-	1		3		2		3						
CO4		1		5	1	2	-	2						
CO5	1	1		3		2		2						
3/2/1 Indicates	Streng	gth Of	Correla	tion, 3	– High	, 2- Me	dium,	1- Low						
		es						al						
		suc	ses		SS		t.	nic						
	S	Scie	enc	e	tiv	SS	)jeć	ech						
	nce	ng	es Sci	Cor	llec	tive	Pro	ips Te	s					
	cie	eri	niti cial	m (	mE	llec	cal/	nsh	kill					
ory	icS	gine	mai So	gra	gra	enE	ctic	iter	t SI					
teg(	Bas: Eng Hur Pros				Pro	Op	Pra	Ir	Sof					
Cat														
Approval														

**Subject Code:** Subject Name: INDUSTRIAL L Т **P**/ Ty APPLICATIONSOF ROBOTS /Lb/ /S.L R **EBRA22009** ETL r 3 0/0 **Prerequisite:Basics of Robotics** Tv 0/0

#### UNIT I: MATERIAL TRANSFER AND MACHINE LOADING/UNLOADING

General considerations in Robot material handling-material transfer application-machine loading and unloading-robotcelldesign and control.

#### **UNIT II: ROBOT FOR PROCESSING OPERATIONS**

Applications of Robots in Spot Welding-Continuous Arc welding-Spray coating-Other processing operations using robots-examples and case studies.

#### UNIT III: ASSEMBLY AND INSPECTION

Assembly and Robotic Assembly Automation-part presentation Methods-Assembly Operations-Compliance and the Remote Center Compliance (RCC) Device-AssemblySystemConfigurations-Adaptable-programmableAssemblysystem-Designingfor Robotic Assembly-Inspection Automation.

#### UNIT IV: ROBOTS FOR UNSAFE AND SAFE ENVIRONMENTS

Robot in hazardous and inaccessible non manufacture environments-construction-underground coal mining-firefightingoperations-underseaoperations-Spaceoperationsetc.RobotsinServiceindustries-Teaching, security and household robots-casestudies

#### UNIT V: SELECTION AND DESIGN CONSIDERATION OF ROBOTS

Factors influencing the choice of a robot, robot performance testing-Path/point accuracy and repeatability-maximum working envelop-kinematic and state values-robot safety-considerations-Factors affecting robot safety measures-safety features built into industrial robot-safetybarriers and other devices

### Total no. of Periods: 45

#### **TEXTBOOKS:**

1. MikellP.Groover,"IndustrialRoboticsTechnology,ProgrammingandApplications",2ndEdition,JohnMcgraw HillBookCompany, 2013

2. Bernard Hodges, ``Industrial Robotics'', Second Editon, Jaico Publishing House, 1993

#### **REFERENCES:**

- $1. \ DebSR and DebS, -Robotics Technology and Flexible Automation |, TataMcGrawHillEducation Pvt. Ltd, 2010.$
- 2. SahaSK,—IntroductiontoRobotics,TataMcGrawHill EducationPvt.Ltd,2010



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Subject Code	: !	SubjectNa	me:MAC	HINE	VISION	SYSTE	EM		Ty /I b/	L	T /S I	<b>P/ R</b>	C					
EBRA22010									ETL		r							
	]	Prerequisi	te:Progra	mming	and Ma	athemat	tical		Ту	3	0/0	0/0	3					
	]	knowledge	e,Basics of	f Robot	tics													
L: LectureT:T	utoria	l SLr	: Supervis	edLearn	ingP:Pro	oject R:	Researc	hC:Crea	lits									
T/L/ETL:Theo	ory/La	ıb/Embedd	edTheory	andLab														
OBJECTIVE	:																	
I ostudyandanalyzevisionsystem, algorithmsandroboticvision.																		
COURSEOU'	COURSEOUTCOMES(COs):Students will be able to:																	
CO1		Understa	nd the basi	ic conce	pts of vi	sion sys	tem in r	obotics.										
CO2		Discuss v	arious vis	ion algo	rithms in	n image	processi	ing.										
CO3		Implemen	nt recognit	ion of o	bjects by	y variou	s metho	dologies										
CO4		Appreciat	e the vari	ous appl	ications	of imag	e proces	sing in r	obotics									
CO5		Get expos	sed to Rob	otic Op	erating s	ystem, l	nardware	e and sof	tware cor	nponent	s of robot	s.						
MappingofCourseOutcomeswithProgramOutcomes(POs)																		
Cos/Ps	PO	1 PO2	PO3	PO4	PO5	<b>PO6</b>	PO7	PO8	PO9	PO10	PO11	PO	12					
CO1	3	3	3	2	3	1	3	2	3	2	3	3						
CO2	3	3	2	2	3	3	2	2	3	2	3	1						
CO3	3	2	3	2	2	3	2	2	2	3	3	3						
CO4	2	3	3	3	3	2	2	1	2	1	2	3						
CO5	1	2	3	3	3	2	2	1	2	2	3	3						
Cos/PSOs		PSO1	PSC	)2	PS	03	PS	504										
C01	3		3		2													
<u>CO2</u>	2		3		1													
<u>CO3</u>	2		3		3													
C04	2		3		3													
2/2/1 Indicate	J a Stre	angth Of (	) Correlatio	n 2 L	Ligh 2	Madium												
5/2/1 mulcate	8 511			п, <u>э</u> – г	ngn, 2	lvieuiun	I, I- LO	w		T								
Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	<ul> <li>▲ Program Core</li> </ul>	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkil	Soft Skills									

Subject Code:	SubjectName:MACHINE VISION SYSTEM	Ту	L	Т	<b>P/ R</b>	С							
		/Lb/		/S.L									
EBRA22010		ETL		r									
	Prerequisite:Programming and Mathematical	Ту	3	0/0	0/0	3							
	knowledge,Basics of Robotics												

#### UNIT I :VISION SYSTEM

Basic Components – Elements of visual perception, Lenses: Pinhole cameras, Gaussian Optics – Cameras–Camera-Computer interfaces.

#### **UNIT II : VISION ALGORITHMS**

Fundamental Data Structures: Images, Regions, Sub-pixel Precise Contours – Image Enhancement: Gray valuetransformations, image smoothing, Fourier Transform – Geometric Transformation - Image segmentation –Segmentation of contours, lines, circles and ellipses–Camera calibration – Stereo Reconstruction.

#### **UNIT III:OBJECT RECOGNITION**

Object recognition, Approaches to Object Recognition, Recognition by combination of views- objects withsharpedges, usingtwo views only, using single view, use ofdept values.

#### UNIT IV: APPLICATIONS

Transforming sensor reading, Mapping Sonar Data, Aligning laser scan measurements - Vision and Tracking: Followingtheroad, Iconicimageprocessing, Multiscaleimageprocessing, VideoTracking-Learninglandmarks: Landmarkspatiograms, K-means Clustering, EM Clustering.

#### **UNIT V: ROBOT VISION**

Basic introduction to Robotic operating System (ROS) - Real and Simulated Robots - Introduction to Open CV,OpenNI and PCL, installing and testing ROS camera Drivers,ROS to Open CV-The cv_bridge Package.

#### **Total No.of Periods: 45**

#### **TEXTBOOKS**:

 Carsten Steger, Markus Ulrich, Christian Wiedemann, "Machine Vision Algorithms and Applications", WILEY-VCH, Weinheim, 2008.
 Damiann vons "Cluster Computingfor Pohotiosand Computer Vision" World Scientific Singapore 2

 $\label{eq:linear} 2. \ DamianmLyons, ``Cluster \ Computing for Robotics and Computer Vision'', World Scientific, Singapore, 2011.$ 

#### **REFERENCES:**

1. Rafael C. Gonzalez and Richard E.woods, "Digital Image Processing", Addition - Wesley PublishingCompany, NewDelhi, 2007.

2. Shimon Ullman, "High-Level Vision: Object recognition and Visual Cognition", A Bradford Book, USA, 2000.

3. R.Patrick Goebel, "ROS by Example: A Do-It-Yourself Guide to Robot Operating System – Volume I", A PiRobotProduction, 2012.

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Subject Code:	Su RC	bject Na )BOTS	me: AU	JTONO	MOUS	MOBII	LE		Ty /Lb/	L	T /S.Lr	P/ R	C
EBRA22011	Dm	moguigi	topDosio	a of Dol	notion				ETL	3	0/0	0/0	2
	Pr	erequisi	le:Basic	S 01 K0	Dotics				Тy	3	0/0	0/0	3
L: LectureT:Tut	orial	SLr :	Supervis	sedLearn	ningP:Pi	oject R	: Resea	rchC:Cre	dits				1
T/L/ETL:Theory	y/Lab/E	Embedde	dTheory	and Lat	)								
<b>OBJECTIVE:</b>													
• To get to	o know	about di	ifferent	configur	ations o	of mobile	e robots						
To analy	yse and	understa	and mob	ile robo	t kinem	atics							
To unde	• To understand and analyse perception concepts ,mobile robot locoalization and planning and navigation concepts												
COURSEOUTCOMES(COs):(3-5) Studentswillba abla ta:													
Studentswillde able to:													
01	1	Understa	and the d	lifferent	configu	rations (	of mobi	le robots					
CO2		Solve kii	nematics	equation	ons invo	lved in 1	nobile r	obots de	sign	_			
<u>CO3</u>		Understa	ind the v	vorking	of differ	rent type	es of ser	isors in r	nobile ro	bots			
<u>CO4</u>		Design d	ifferent	techniqu	ues for r	nobile re	obot loc	alization	for molt	1			
MappingofCourseOutcomeswithProgramOutcomes(POs)													
COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO1		11 P	<b>PO12</b>
CO1	3	3	3	2	2	2	2	2	3	2	3	3	012
CO2	3	3	3	2	2	2	2 1	2	2	2	1	3	
CO3	3	3	3	2	2	2	1	2		2	1	3	1
CO4	3	3	3	2	2	2	1	2	2	2	1	3	
CO5	3	3	3	2	2	2	1	2	2	2	1	3	
COs /PSOs	PS	501	PS	$\frac{2}{02}$	2 PS	$\frac{2}{03}$	PS	504	4				
CO1		1		1	3			3					
CO2		1		2	3			2					
CO3		1		2	3			2					
CO4		1		2	3			2					
CO5		1		2	3			2					
3/2/1 Indicates	Streng	th Of Co	orrelatio	on, 3 – I	High, 2-	Mediu	m, 1- L	ow			<b>I</b>		
		ences	ces		les g		ct	nical					
sgory	asicSciences	ıgineeringSci	umanities idSocialScien	ogram Core	ogramElectiv	penElectives	actical/ Proje	nternships / Tech	oft Skills				
Cate	Â	<u>й</u>	H H	↓ Pi	-4		I.I.		Sc				
Approval													

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Subject Code:	Subject Name: AUTONOMOUS MOBILE	Ту	L	Т	<b>P</b> /	С
	ROBOTS	/Lb/		/S.L	R	
EBRA22011		ETL		r		
	Prerequisite:Basics of Robotics	Ту	3	0/0	0/0	3

#### **UNIT I: INTRODUCTION**

Locomotion, Legged Mobile Robots-Leg configurations and stability-Examples of legged robot locomotion, Wheeled Mobile Robots-Wheeled locomotion: the design space-Wheeled locomotion: case studies

#### **UNIT II: MOBILE ROBOT KINEMATICS**

EDUCATIO

Mobile Robot Kinematics, Kinematic Models and Constraints, Mobile Robot Maneuverability, Mobile Robot Workspace, Motion Control

#### **UNIT III: PERCEPTION**

Sensors for Mobile Robots, Sensorclassification, characterizing sensor performance, Wheel/motor sensors, Heading sensors, Ground-based beacons, Active ranging, Motion/speed sensors, Vision-based sensors, Representing Uncertainty, Feature Extraction

#### UNIT IV: MOBILE ROBOT LOCALIZATION

The Challenge of Localization: Noise and Aliasing, To localize or not to localize: Localization-Based Navigation versus Programmed Solutions, Belief Representation, Single-hypothesis belief Multiple-hypothesis belief Map Representation, continuous representations, decomposition strategies, State of the art: current challenges in map representation, Probabilistic Map-Based Localization, Other Examples of Localization Systems. Autonomous Map Building

#### **UNIT V: PLANNING AND NAVIGATION**

Introduction, Competences for Navigation: Planning and Reacting: Path planningObstacle avoidanceNavigation Architectures:Modularity for code reuse and sharing,Control localizationTechniques for decompositionCase studies: tiered robot architectures.

#### **TEXTBOOKS:**

1. Roland Siegwart and Illah R.Nourbaksh ,"Introduction to Autonomous Mobile Robots, The MIT Press, London 2004.

2. Farbod Fahimi, "Autonomous Robots Modelling ,Path Planning and Control", Springer-Verlag New York,2008.

#### **REFERENCES:**

1. Shuzi Sam Ge, Frank L Lewis "Autonomous Mobile Robots Sensing, Control, Decision Making and Applications", Taylor & Francis, 2006.

2. Gregor Klancar, Andrej Zdesar, Saso Blazic, Igor Skrjanc, "Wheeled Mobile Robots From Fundamentals Towards Autonomous Systems", Elseiver Press, 2017.

#### **Total No.of Periods:45**

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# CONTROL OF CONTROL OF

SubjectCode: EBRA22L05	: Su	ıbjectNa	bjectName: ROBOT PROGRAMMIN AND SIMULATION LAB					Ty /Lb /	L	T/S.Lr	P/ R	C
								ETL				
	Pı	rerequisi	te:Indus	trial Ap	plicatio	ns of R	obots	Lb	0	0/0	3/0	1
L: LectureT:T	'utoria	al S.L	r : Supe	rvisedLe	arningP	: Project	R: Rese	arch C:C	credits			
T/L/ETL:Theo	ory/La	ab/Embed	ldedTheo	oryand L	ab							
OBJECTIVE	2:			•								
•	To	program i	robot for	differen	t kinds o	of real t	ime appl	lications				
COURSEOU	TCO	MES(CC	<b>Ds</b> ):(3-5)	)			• •					
Students will	Students will be able to											
CO1		Program	and sim	ilate rob	ot for lin	ne follov	ver appli	ication				
CO2		Design and develop robotic metal detector vehicle									-	
<u>CO3</u>		Develop	and simi	ilate sma	rt bot,su	irveillar	ice bot a	and sixth	sense a	nd gestur	e based	robot
<u>CO4</u>		Learn and	d develo	p haptic	based ro	bots,rot	bot navig	gation sys	stem em	ploying l	RFID an	d sensors
ManningofCourseOutcomeswithProgramOutcomes(POs)												
COs/POs	PO1				PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	<u>105</u>	2	2	2	2	2	2	3
CO2	3	3	3	3	2	2	<u> </u>	<u> </u>	3 2	2	<u> </u>	3
CO3	3	<u> </u>	3	3	3	<u>2</u> 1	2	1	2	2	1	3
CO4	3	2	3	3	3	1	2	1	3	3	3	3
CO5	3	2	3	3	3	1	2	1	3	3	3	3
COs /PSOs	-	PSO1	P	SO2	<u> </u>	1 603	2 PS	504	5	5	5	-
CO1	3	1001		2	$\begin{array}{c c} 1 \\ \hline 1 \\ 3 \\ \hline 3 \\ \hline 3 \\ \hline \end{array}$							
CO2	3			2	•	, २	3					
CO3	3			3		<u>,</u>	3					
CO4	3			3		2	3					+
CO5	3			3		2	3					
3/2/1 Indicates	Stre	ngth Of (	Correlat	ion, 3 – 1	High, 2	- Mediu	m, 1- L	ow				-1
	Jce			ec	iv		_					
Category	BasicScier	s Engin eerinσ	Humaniti es Program	Core	uves OpenElect es	Practical/ Project	Interns hips	Soft Skills				
				✓		<b>√</b>						
Approval												

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SubjectCode: EBRA22L05	SubjectName:	ROBOT PROGRAMMING AND SIMULATION LAB	Ty /Lb	L	T/S.Lr	<b>P/ R</b>	С
			/ ETL				
	Prerequisite:In	dustrial Applications of Robots	Lb	0	0/0	3/0	1

#### LIST OF EXPERIMENTS:

- 1. Line follower Robot
- 2. Metal Detector Robotic Vehicle
- 3. Arduino Based Smart Bot with Obstacle Detection
- 4. Sixth Sense Robot
- 5. Surveillance Robot
- 6. Gesture Based Robotics
- 7. RF Based Controlled Haptic Forefinger Robotic Aid
- 8. Mobile Robot Navigation System with RFID and Ultrasonic Sensors
- 9. War Field Spying Robot with Wireless Camera.
- 10. Surface Cleaning Robot

Total No. of Periods: 45

a sea transmission	EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status	AT NAAC
	(A = 100, 04004, 0040, 0 = stiff = stift = stift = st)	

(An ISO 21001 : 2018 Certified Institution) Perivar E.V.B. High Road, Madurayoval, Chennai-95, Tamilnadu, India

Subject Code:	S	ubject	tName	e: PR(	DUC	T DES	IGN LA	AB	Ty /Lb/ ETL	L	T /S.L r	P/ R	С
EBRA22L06	Pre	requis	site:In	dustri	al Aut	tomatic	n		Lb	0	0/0	3/0	1
L: LectureT:T	utorial	S	$Ir \cdot Si$	inervi	sedLe:	arninoP	· Projec	tR· Rese	arch C·C	'redits			
T/I /FTI ·Theo	ww/Lab	/Embe	dded7	beory	and L	ah	. 110,000			icans			
			Juucu	neory		10							
OBJECTIVE	: illusti	rate th	e desi	on an	1 cimi	lation	of vario	us mod	ules not	limited	to nneum	natic ele	ectro-
pr	pneumatic and PLCs, and enable the students to integrate various modules to form a final												
robotic product													
COURSEOU	TCOM	IES(C	Os):(3	<b>3- 5</b> )									
Students will	be able	e to	41		<b>I</b>	<u>al 4a al a</u>		for a					
	CO2 Analyze the various technical tools necessary for product development												
C02	O3 Design and develop a working prototype based on the mathematical model												
CO4	CO4 Trouble shoot and debug any issues while fine tuning the product												
CO5	CO5 Demonstrate the spirit of team work												
MappingofCourseOutcomeswithProgramOutcomes(POs)													
COs/POs	PO1	PO2	PO	)3 I	PO4	PO5	<b>PO6</b>	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	2	3	2	2	3	2	3	3
CO2	3	3	3		;	3	2	1	1	2	2	1	3
CO3	3	2	3	3	\$	3	1	2	1	3	3	3	3
CO4	3	3	3	3	\$	2	3	2	2	3	2	3	3
CO5	3	2	3	3	;	3	1	2	1	3	3	3	3
COs /PSOs	PS	501		PSO	2	PS	03	PS	SO4				
CO1	3			2 3 3									
CO2	3			2			3	3					
CO3	3			3			2	3					
CO4	3			2			3	3					
	3	4 0		3			2	3					
3/2/1 Indicates	Streng	gth Of	Corr	elatior	1, 3 – I	High, 2	- Medii	ım, 1- L	ow	1			
Category	BasicSciences	EngineeringSciences	HumanitiesandSocial	ProgramCore	ProgramElectives	OpenElectives	Practical /Project	Internships /Technical	Soft Skills				
Approval													



Subject Code: EBRA22L06	SubjectName: PRODUCT DESIGN LAB	Ty /Lb/ ETL	L	T /S.L r	P/ R	С
	Prerequisite:Industrial Automation	Lb	0	0/0	3/0	1

Students have to do design a Robotic based product based on any related concept. It includes modeling, simulation, and a final design of a particular product

Total No. of Periods: 45


Subject Code: EBRA22I05	SubjectName:PROJECT PHASE-I	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite: Knowledge of Robotics &Inter	Lb	0	0/0	3/3	2
	aisciplinary concepts					

Students should identify the topic of the Project and should collect the literatures and datas, at the end of the semester the students should submit their Project Phase- I report to the Department and Viva-Voce examination will be conducted with external examiners and this carries 6 credits.

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SubjectCode:	SubjectN	ame: FC	DREIGN	LANGU	AGE		Τ	y/Lb/	<b>.</b>	Τ/	D/D	C		
EDEL MINN								ETL/IE	L	SLr	P/R	C		
EBFL22IAA	Pre Requ	isite:Nil						IE	1	0/0	1/0	1		
L : Lecture T :	TutorialS.	Lr : Superv	vised Lea	arning F	': Proj	ectR : I	Researc	h C:	11					
CreditsT/L/ETL:The	eory/Lab/E	mbeddedTh	eoryandL	ab										
<b>OBJECTIVE:</b> The	main obje	ctive of this	course is	to equip	the stud	lents wit	h one f	oreign langu	age whi	ch will en	able the	m for		
higherstudies/profes	higherstudies/professional career abroad													
COURSEOUTCOMES(COs):(3-5)														
CO1	Student	s will gain th	e knowle	edge of ic	lentifyin	g phoneti	cs of al	l the letters i	n one for	reign lang	lage			
CO2	Student	s will gain th	e knowle	edge of re	eading sr	nall word	ls and in	n one foreigi	ı languag	ge				
CO3	Students will gain the knowledge of writing skill in one foreign language.													
CO4	Students will gain the knowledge of reading skill in one foreign language													
CO5	Students will gain the knowledge of spoken skill in one foreign language													
		Mapping	ofCours	eOutcon	neswithF	rogram	Outcon	nes(POs)						
COs/POs PO	D1 PO2	PO3	PO4	PO5	PO6	PO7	PO8	<b>PO9</b>	PO10	PO11	PO1	2		
CO1 2	1	1	1	1	3	3	3	3	3	3	3			
CO2 3	2	3	3	2	3	3	3	3	3	3	2			
CO3 3	3	3	3	2	3	3	3	3	3	3	2			
CO4 3	2	3	3	2	3	3	3	3	3	3	2			
CO5 3	3	3	3	2	3	3	3	3	3	3	2			
COs/PSOs	PSO1	PSO2	-	PS	i03	P	504		-	-				
CO1														
CO2														
CO3														
CO4														
CO5														
3/2/1 Indicates Str	ength Of	Correlatio	on, 3 – H	ligh, 2-	Mediun	n, 1- Lo	W	I	I					
Category Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project						



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SubjectCode:	SubjectName: FOREIGNLANGUAGE	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	С
	Pre Requisite:Nil	IE	1	0/0	1/0	1

Foreign language is introduced in the curriculum to make the students globally employable.Students should select and register for any one of the foreign languages from the given list.At the end of the course students should be able to read, write and converse the language in the basic level.At the end of the semester the assessment will be done through internal examination by the examiner duly appointed by the head of the department.

S.NO	COURSE CODE	COURSE NAME
1	EBFL22I01/HBFL22I01	FRENCH
2	EBFL22I02/ HBFL22I02	GERMAN
3	EBFL22I03/ HBFL22I03	JAPANESH
4	EBFL22I04/ HBFL22I04	ARABIC
5	EBFL22105/ HBFL22105	CHINESE
6	EBFL22I06/HBFL22I06	RUSSIAN
7	EBFL22I07/HBFL22I07	SPANISH



# **SEMESTER VIII**

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Subject Code: EBCC22ID1	Subje AND	ect Nan INDUS	(/ riyar E.VR ne :ENG STRIAL	An ISO 2 High Ros INEE MAN	1001 : 20 ad. Madura RING E AGEM	18 Certif woyal, Ch CONC ENT	ied Institu ennai-95. DMICS	ution) Tamilnadu, Ind Ty/Lb/ ETL	L	T/S Lr	P/R	C			
	Prere	equisite	:Nil					Ту	3	0/0	0/0	3			
L:LectureT:Tutorial	SLr:	Superv	isedLear	ningP:	ProjectR	:Resea	rchC:Cr	edits							
T/L/ETL:Theory/Lab./	Embed	dedThe	oryandL	ab.											
OBJECTIVE: Thestuc	lentwill	learn:													
• Conce	ptsofine	dustrial	manager	nentan	deconom	nics									
COURSEOUTCOME	S(COs)	: The s	tudent v	vill be	able to										
CO1	Unders	stand th	e variou	s conce	pts of or	ganiza	tions and	d economics	s related to	o it					
CO2	Expose	e to the	behavior	r of the	human i	in the c	rganizat	tion							
CO3	Analyz	the de	emand a	nd supp	oly patte	rns and	costs re	elated to it							
CO4	Illustra	te the v	arious n	nethods	of prod	uction	with cos	t effectiven	ess						
CO5	Identif	y the ef	fect of c	ost on 1	nacro ec	conomi	cs								
MappingofCourseOu	tcomes	(COs)v	vithProg	gramO	utcomes	s(POs)	&Progr	amSpecific	Outcome	s(PSOs)					
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12			
CO1	2	2	2	-	3	2	-	3	3	3	3	2			
CO2	2	2	2	-	3	2	-	3	3	3	-	2			
CO3	2	2	2	-	3	2	-	2	3	3	3	2			
CO4	2	2	2	-	3	2	-	2	3	3	3	2			
CO5	2	2	2	-	3	2	-	2	3	3	3	2			
COs /PSOs	PS	501	PS	02	2 PSO3 PSO 4				·						
C01		2	3		3	6	3								
CO2		2	3		3	6	3								
CO3		2	3		3	6	3								
CO4		2	3		3	6	3								
CO5		2	3		3	•	3								
3/2/1 Indicates Strengt	h Of C	orrelat	ion, 3 –	High, 2	2- Mediu	um, 1-	Low	1	1	1		•			
Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project						
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Subject Code:	Subject Name :ENGINEERING ECONOMICS AND	Ty/Lb	L	T/S.Lr	<b>P/ R</b>	С
	INDUSTRIAL MANAGEMENT	1				
EBCC22ID1		ETL				
	Prerequisite:Nil	Ту	3	0/0	0/0	3

#### **UNIT I:Introduction to Management**

The Nature of Management–Management:Science or Art–Difference between administration and management -Evolution of management thought-Roles of managers–F.W.Taylor and Henri Fayol contribution to the management- Organization and the environmental factors.

#### **UNIT II: Managing Organizational Behavior**

EDUCATIO

Definition- need and Importance of Organizational Behavior – Nature and Scope of Organizational Behavior -Role of managers – Contributing disciplines to Organizational Behavior - Frame work of OrganizationalBehavior.

#### UNIT III: Demand& SupplyAnalysis

Meaning of demand, the demandcurve, Elasticity of demand, types of elasticity of demand. Supply–Meaning, the supply curve, equilibrium with supply and demand curves.

#### **UNIT IV: Theory of Production**

Meaning of Production, Basic concepts- total, average, and marginal product, short run and long run production Function, Law of Variable Proportion. Production function with two variable inputs – Isoquants – Meaning, Properties, ISO cost Lines, All variable inputs – Returns to Scale, Cost Analysis: Determinants of Costs, types of Cost.

#### **UNIT V: MacroEconomic Concepts**

National income concepts, Inflation, Balance of Payment, Circular flow of income Monetary and Fiscal Policy, Demonetization, Exchange Rates

#### TotalNo.ofPeriods:45

#### **REFERENCE BOOKS:**

- 1. Meenakshi Gupta-PrinciplesofManagement-PHILearningPvt.Ltd.-2009.
- 2. L.M.Prasad- PrinciplesandPracticeofManagement-SultanChand&Sons- 7thEdition- 2007.
- 3. HaroldKoontz-Principles ofManagement-Tata McGrawHill-2004.
- 4. Mithani, D.M, ManagerialEconomics-Theory&applications, Himalayapub.
- 5. Mehta, P, L, Managerial Economics. Analysis, problem & cases, Sultan Chand

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SubjectCode: EBRA22L07	SubjectName:PROJECT PHASE-II	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite:ProjectPhase-I	Lb	0	0/0	12/12	8

To make the students to make use of the knowledge and skill developed during their four years of study and to apply them for making an innovative product/process for the development of society and industries.

Students are expected to do a Project work either in an Industry or at the University in the field of relevant Engineering /inter-disciplinary /multi-disciplinary area in a group of 3 or 4 students. The work to be carried out in Phase II should be continuation of Phase I. Each group will be allotted a guide based on the area of Project work. In case of industrial Project external guide has to be allotted from Industry. Inter disciplinary/multi-disciplinary project can be done with students of different disciplines as a group. Monthly reviews will be conducted during the semester to monitor the progress of the project by the project review committee. Students have to submit the Project thesis at the end of the semester and appear for the Project Viva-Voce examination conducted by the examinersduly appointed by the Controller of Examination.In case of industrial project certificate in proof has to be included in the report along with the bonofide certificate.



# **ELECTIVE SUBJECTS**



# **PROGRAM ELECTIVE: I**

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Subject Cod EBRA22E0	e: Su 1 E	ubject N NGINE	Name: I ERINO	MAINT G	ENAN	ICE AN	ND SAF	TETY	Ty/l ETL	Lb/	L	T / S.Lr	P/ R	C	
	P M	rerequi Ianufac	site: W	orking Equipr	Princij nents	ples of			Ту		3	0/0	0/0	3	
L : Lecture T	: Tuto	orial S	Lr : Sup	pervised	l Learni	ing P:	Project	R : Res	search	C: C	redit	s			
T/L/ETL : Tł	neory/I	Lab/Em	bedded	Theory	and La	ıb									
OBJECTIV	E :														
• To in	• To impart knowledge on maintenance, fundamentals and Safety Engineering practices														
COURSE O	COURSE OUTCOMES (COs) : (3-5)														
Students wil	Students will be able to														
CO1	Understand the basic concepts of maintenance														
CO2	Describe the total predictive maintenance														
CO3	Ι	Define safety system analysis Categorize different types of hazards													
<u>CO4</u>	(	Categorize different types of hazards Implement safety systems in machine operations													
CO5 Monning of	f Course Outcomes with Program Outcomes (POs)														
COg/DOg			DO2	IIII Pro	gram (		DO7	S)	DO				11	DO12	
COS/POS	PU 1	PO2	P03	PU4	P05	PU0	P0/	PUð	PUS	,	PUI	U P	)]]	POIZ	
CO1	3	3	3	2	2	2	2	2	3		2	3		3	
CO2	3	3	3	2	2	2	1	2	2		2	1		3	
CO3	3	3	3	2	2	2	1	2	2		2	1		3	
CO4	3	3	3	2	2	2	1	2	2		2	1		3	
CO5	3	3	3	2	2	2	1	2	2		2	1		3	
COs / PSOs	PS	501	PS	02	PS	03	PS	<b>SO4</b>							
CO1		1	1	l		3		3							
CO2		1	2	2		3		2							
CO3		1	2	2		3		2							
CO4		1	2	2	с.	3		2							
CO5		1	2	2	~~ <b>,</b>	3		2							
3/2/1 indicat	es Str	ength o	f Corre	1ation	<b>3-</b> hig	gh, 2- n	nedium	, 1-1ow			1				
Category	Basic Sciences	Engineering Sciences	numanities and Socia1	Program Core	Program El ectives	Open Electives	Practica1 / Project	Internships / Technica1	Skill Soft Skills						
Approva1					✓										

Subject Code:	Subject Name: MAINTENANCE AND SAFETY	Ty / Lb/	L	Т/	P/ R	C
<b>EBRA22E01</b>	ENGINEERING	ETL		S.Lr		
	Prerequisite: Working Principles of Manufacturing	Ту	3	0/0	0/0	3
	Equipments					

#### **UNIT I : MAINTENANCE:**

Types of breakdown, preventive, predictive, TPM; elements of preventive maintenance – checklist, schedule, procedure.

#### **UNIT II: TOTAL PRODUCTIVE MAINTENANCE:**

EDUCATIO

Principles; preparatory stages of implementation – TPM organisation structure, creation; basic TPM policies and aids, master plan. TPM IMPLEMENTATION: Small group activities, autonomous maintenance, establishing planned maintenance, training, developing equipment management program.

#### **UNIT III: SAFETY SYSTEMS ANALYSIS:**

Definitions, safety systems; safety information system: basic concept, safety cost / benefit analysis; industrial safety engineering, OSHA regulations.

#### **UNIT IV: HAZARD ANALYSIS:**

General hazard analysis: electrical, physical and chemical hazard, detailed hazard analysis. Cost effectiveness in hazard elimination. Logical analysis: map method, tabular method, fault tree analysis and hazop studies. FIRE PROTECTION SYSTEM: Chemistry of fire, water sprinkler, fire hydrant, alarm and detection system. Suppression system: CO2 system, foam system, Dry Chemical Powder (DCP) system, halon system, portable extinguisher.

#### **UNIT V: SAFETY IN MACHINE OPERATION:**

Design for safety, lock out system, work permit system, safety in use of power press, cranes. Safety in foundry, forging, welding, hot working and cold working, electroplating and boiler operation. SAFETY AND LAW: Provisions in factory act for safety, explosive act, workmen compensation act, compensation calculation. Boiler act and pollution control act.

#### **TEXT BOOKS:**

1. John Ridley, "Safety at Work", Butter Worth Publisher, Oxford, 1997.

2. Robinson C J and Ginder A P, "Implementing TPM", Productivity Press, USA, 1995.

#### **REFERENCES:**

1. Dhillon B S, "Maintainability, Maintenance and Reliability for Engineers", CRC Press, 2006.

2. Heinrich H W, "Industrial Accident Prevention", National Safety Council, Chicago, 1998.

3. National Safety Council, "Personal Protective Equipment", Bombay, 1998.

4. National Safety Council, "Accident Prevention Manual for Industrial Operations", Chicago, 1995.

5. Patrick A Michaud, "Accident Prevention and OSHA Compliance", CRC Press, 1995.

6. Derek James, "Fire Prevention Handbook", Butter Worth & Co., Oxford, 1991.

7. Dan Peterson, "Techniques of Safety Management", 1990.

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## **Total No. of Periods: 45**



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Subject Code EBRA22E0	e: Si 2	ubject N	Name: M	ICRO E MECHAN	LECTR NICAL S	0	Ty / ETI	Lb/	L		Г / S.Lr	P/ R	C	
	P	reregui	site: Fun	damentals	s of sens	ors	Tv		3		0/0	0/0	3	
L : Lecture T	: Tuto	rial S	Lr : Supe	rvised Le	arning I	P: Project	R : Res	search C	: Cre	dits	6		-	
T/L/ETL : Th	T/L/ETL : Theory/Lab/Embedded Theory and Lab7													
<ul> <li>OBJECTIVES:</li> <li>To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.</li> <li>To educate on the rudiments of Micro fabrication techniques</li> <li>To introduce various sensors and actuators</li> <li>To introduce different materials used for MEMS</li> <li>To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.</li> </ul>														
COURSE OU	OUTCOMES (COs) : (3-5) will be able to													
CO1	will be able to           Understand the basic concepts of MEMS and their processes													
CO2	Analyse the working of electrostatic sensors and magnetic actuators													
CO3	Analyse the working of piezoresistive and piezeelectric sensors													
CO4 Remember about micromachining techniques														
CO5	]	mpleme	ent the co	oncept of I	MEMS i	n polymer	and opt	ical app	licati	ons				
Mapping of	Cours	e Outco	omes wit	h Prograi	m Outco	omes (POs	5)							
COs/POs	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO	9	PO10	PO11	PO12	
CO1	3	3	3	2	2	2	2	2	3		2	3	3	
CO2	3	3	3	2	2	2	2	2	3		2	3	3	
CO3	3	3	3	2	2	2	2	2	3		2	3	3	
CO4	3	3	3	2	2	2	2	2	3		2	3	3	
CO5	3	3	3	2	2	2	2	2	3		2	3	3	
COs /	P	SO1	P	<b>SO2</b>	PS	503	PS	04						
PSOs			_	_		_		_						
CO1		1		1		3		3						
CO2		1		1		3		3						
CO3		1		1		3		<u>s</u>	-					
CO4		1		1		3		<u>s</u>	-					
2/2/1 indicate	og Stm	1 math at	f Cannal	1 otion 3	high 2	3 modium	1 1 0 1	,						
5/2/1 Indicate	es Sire		l Correl	ation 3-	• mgn, 2	- meaium	, 1-10w	~						
Category	Category Basic Basic Sciences humanities and Social Sciences Program Electives Project Internships Technical / Skill Skill													
Approva1					•									

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Subject Code: EBRA22E02	Subject Name: MICRO ELECTRO MECHANICAL SYSTEMS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Fundamentals of sensors	Ту	3	0/0	0/0	3

#### **UNIT I INTRODUCTION**

Intrinsic Characteristics of MEMS - Energy Domains and Transducers- Sensors and Actuators - Introduction to Micro fabrication - Silicon based MEMS processes - New Materials - Review of Electrical and Mechanical concepts in MEMS - Semiconductor devices - Stress and strain analysis - Flexural beam bending- Torsional deflection.

#### UNIT II SENSORS AND ACTUATORS-I

EDUCATIO

Electrostatic sensors – Parallel plate capacitors – Applications – Interdigitated Finger capacitor – Comb drive devices – Micro Grippers - Micro Motors - Thermal Sensing and Actuation - Thermal expansion - Thermal couples - Thermal resistors - Thermal Bimorph - Applications - Magnetic Actuators - Micromagnetic components - Case studies of MEMS in magnetic actuators- Actuation using Shape Memory Alloys

#### **UNIT III SENSORS AND ACTUATORS-II**

Piezoresistive sensors - Piezoresistive sensor materials - Stress analysis of mechanical elements - Applications to Inertia, Pressure, Tactile and Flow sensors – Piezoelectric sensors and actuators – piezoelectric effects – piezoelectric materials – Applications to Inertia, Acoustic, Tactile and Flow sensors.

#### UNIT IV MICROMACHINING

Silicon Anisotropic Etching – Anisotrophic Wet Etching – Dry Etching of Silicon – Plasma Etching – Deep Reaction Ion Etching (DRIE) - Isotropic Wet Etching - Gas Phase Etchants - Case studies - Basic surface micro machining processes - Structural and Sacrificial Materials - Acceleration of sacrificial Etch - Striction and Antistriction methods - LIGA Process - Assembly of 3D MEMS - Foundry process.

#### UNIT V POLYMER AND OPTICAL MEMS

Polymers in MEMS-Polimide - SU-8 - Liquid Crystal Polymer (LCP) - PDMS - PMMA - Parylene - Fluorocarbon -Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS - Lenses and Mirrors - Actuators for Active Optical MEMS.

#### **TEXT BOOKS:**

1. Chang Liu, "Foundations of MEMS", Pearson Education Inc., 2012.

2. Stephen D Senturia, "Microsystem Design", Springer Publication, 2000.

3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, New Delhi, 2002.

#### **REFERENCES:**

1. Nadim Maluf, "An Introduction to Micro Electro Mechanical System Design", Artech House, 2000. 2. Mohamed Gad-el-Hak, editor, "The MEMS Handbook", CRC press Baco Raton, 2001.

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Subject Code EBRA22E03	: S 3	Subject Na	ame:ADV MA	ANCE	D STRE ALS	NGTH	OF		Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	I	Prerequisi	te: Str	ength of	f Materi	ials			Ту	3	0/0	0/0	3
L · Lecture T	· Tuto	rial SLr	· Supervis	ed Lear	ning P	Project	R · Re	search C	· Credits				<u> </u>
T/L/ETL : The	eory/L	.ab/Embed	lded Theo	ry and I	Lab	110jee			· creatts				
OBJECTIVE	2:												
• Ba	asic p	rinciples a	analysis of	f stress,	strain in	plates a	and rotat	ing discs	5				
• To	o anal	yze the str	esses and	deforma	ations th	rough a	dvanced	mathem	atical mo	dels.			
• To	o estir	nate the de	esign stren	igth of v	various in	ndustria	l equipn	nents.					
COURSE OU	JTCO	MES (CC	<b>)</b> s) : Stud	ent will	be able	to:							
CO1		Understar	nd the mat	hematic	al mode	ling of p	plates of	varying	loads				
CO2		Solve the	equibriun	n, comp	atability	, bound	ary cond	itions an	d stress c	alculati	ons.		
CO3		Describe	the variou	s stresse	es and ot	her bou	ndary co	onditions	on rotati	ng discs	5		
CO4		Compare	the perfor	mance	of infinit	e beam	on elasti	ic founda	ation subj	jected to	o varying	loads	
CO5		Analyse s	tresses in	beams of	of differe	ent curv	ature and	d derive	hertz equa	ation fo	r contact s	stresses	
Mapping of C	Course	e Outcom	es with P	rogram	Outcon	nes (PO	s)	<b>D</b> 00	DOG	<b>D</b> 010	Dodd		
Cos/Pos	POI	l PO2	PO3	PO4	PO5	PO6	<b>PO</b> 7	PO8	PO9	PO10	PO11	PO	12
<u>CO1</u>	3	3	3	2	2	2	2	2	3	2	3	3	
CO2	3	3	3	2	2	2	1	2	2	2		3	
CO3	3	3	3	2	2	2	1	2	2	2	1	3	
CO4	3	3	3	2	2	2	1	2	2	2	1	3	
CO5	3	3	3	2	2	2	1	2	2	2	1	3	
Cos / PSOs	J	2	PSC	J2	PS	03	PS	504 1					
		2	3			<u>l</u>		1					
		3	1			2		2					
<u>CO3</u>		2	3			2		1					
C04		2	3		-	2		1					
$\frac{C05}{2/2/1}$ in diasta	a Star	2 math of C	3	- 2 k		<u>/</u>	1 1	1					
5/2/1 Indicate	s Sire			on 3-n	ugn, 2- 1	neatun	l, 1-10w						
Category	Basic Sciences	Engineering Sciences	3u2anities and Social Sciences	Program Core	Program Electives	Open E1ectives	Practica1 / Project	Interns3ips / Tec3nica Ski11	Soft Ski11s				
Approva1													

**Subject Code:** Subject Name: ADVANCED STRENGTH OF Ty / Lb/ L Τ/ P/R С **EBRA22E03 MATERIALS** ETL S.Lr **Strength of Materials Prerequisite:** Ty 3 0/0 0/03

#### **UNIT I: ANALYSIS OF PLATES**

Mathematical modeling of plates with normal loads – Point and Distributed Loads – Support conditions – Rectangular plates - Stresses along coordinate axes - Plate deformations - Axisymmetric plates - Radial and tangential stresses plate deflections.

## **UNIT II: THICK CYLINDERS AND SPHERES**

EDUCATIO

Equilibrium and compatibility conditions - Lame's Theorem - Boundary conditions - distribution of radial and tangential stresses – compound cylinders – Interference fits - Stresses due to temperature distributions.

## **UNIT III: ROTATING DISCS**

Lame-Clayperon Theorem - radial and tangential stresses in discs due to centrifugal effects - boundary conditions - solid and hollow discs - Interference fit on shafts -Strengthening of the hub - residual stresses - Auto frettege - Discs of variable thickness – Disc profile for uniform strength.

## **UNIT IV: BEAMS ON ELASTIC FOUNDATION**

Infinite beam subjected to concentrated load - Boundary Conditions - Infinite beam subjected to a distributed load segment - Triangular load - Semi infinite beam subjected to loads at the ends and concentrated load near the ends - Short beams.

## UNIT V:CURVED BEAMS AND CONTACT STRESSES

Analysis of stresses in beams with large curvature – Stress distribution in curved beams – Stresses in crane hooks and C clamps - Contact Stresses - Hertz equation for contact stresses - applications to rolling contact elements.

#### **TEXT BOOKS:**

1. Boresi A.P., Schmidt R.J., "Advanced Mechanics of Materials", John Wiley and Sons, Sixth edition, 2003. 2. Dally J.W. and Riley W.F, "Experimental Stress Analysis", John Wiley and Sons 2003

## **REFERENCES:**

1. Burr A. H., Cheatham J.B., "Mechanical Analysis and Design", Prentice Hall of India, Second Edition, 2001. 2. Den-Hartog J.P., "Strength of Materials", John Wiley and Sons.

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#### Total No. of Periods : 45



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Subject Code	: Sub	ject Nan	ne: C	OMPU MAN	FER IN	TEGEI	RATED	Ty	/ /FTI	L	T/ SIr	<b>P/ R</b>	С
EBRA22E04	Pre	equisite	: CAI	),CAM	& CIM		9			3	0/0	0/0	3
L. · Lecture T. ·	Tutorial	SLr	Supervi	sed Lear	ning P	· Projec	t R·Re	esearch C.	Credits				
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	S. Studer	nte will h	eu mee	i y ana i	200								
	To und	erstand t	he appl	ication of	of comp	uters in	various	aspects of	Manufa	acturing	viz., Des	ign,	
	Process	s plannin	g, Man	ufacturi	ng cost,	Layout	& Mate	rial Handli	ng syst	em			
•	To und	erstand t	he Mod	ern mar	ufacturi	ing syste	ems						
COURSE OU	TO UND	erstand t	ne conc ) : Stud	epts and ents wi	i applica	ations of le to:	TIEXIDI	e manufact	uring s	ystems			
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COI									, mausi	ſy			
CO2	De	fine proc	luction	planning	g and pr	ocess pl	anning i	n manufac	turing s	sector			
CO3	An	alyse cel	lular m	anufactu	uring tec	chniques	•						
CO4	De	velop Fle	exiblke	manufa	cturing a	and auto	mated g	guided vehi	cle sys	tems			
CO5	Im	plement	robotics	s in indu	strial se	ctor							
Mapping of C	Course O	utcomes	with P	rogram	Outcor	nes (Po	s)						
Cos/Pos	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	PO8	<b>PO9</b>	PO10	PO11	PO	12
CO1	2	2	3	2	3	2	3	3	2	3	3	2	
CO2	2	2	2	2	3	2	3	3	2	2	3	2	
CO3	2	2	2	2	3	2	3	3	2	2	3	2	
CO4	2	2	2	2	3	2	3	3	2	2	3	2	
		$\frac{2}{501}$		$\frac{2}{102}$	J DC	$\frac{2}{03}$	J D	3 504	Z	<u></u>	3	2	
C01		$\frac{1}{2}$	10	3	3	05	3	504					
CO2		2		3	3		3						
CO3		3		3	3		3						
CO4		3		3	3		3						
CO5		3		3	3		3						
3/2/1 indicate	s Strengt	h of Co	rrelatio	n 3-h	igh, 2-1	medium	ı, L-Lov	V					
Category	Basic Sciences	Engineering Sciences	humanities and Social	Program Core	Program < Electives	Open Electives	Practical / Project	Internships / Tec3nical Skill	Soft Skills				
Approval					· · ·								

Subject Code:	Subject Name : COMPUTER INTEGERATED	Ty/	L	Τ/	<b>P/ R</b>	C
	MANUFACTURING	Lb/ETL		S.Lr		
<b>EBRA22E04</b>	Prerequisite: CAD,CAM & CIM	Ту	3	0/0	0/0	3

Perivar E.V.R. High Road, Maduravoval, Chennai-95, Tamilnadu, India.

#### UNIT I INTRODUCTION

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control- Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerised elements of CIM system –Types of production - Manufacturing models and Metrics – Mathematical models of Production Performance – Simple problems – Manufacturing Control – Simple Problems – Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

#### UNIT II PRODUCTION PLANNING AND CONTROL AND COMPUTERISED PROCESS PLANNING 10

Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.

#### UNIT III CELLULAR MANUFACTURING

Group Technology(GT), Part Families – Parts Classification and coding – Simple Problems in Opitz Part Coding system – Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method – Simple Problems.

#### UNIT IV FMS AND AGVS

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Quantitative analysis in FMS – Simple Problems. Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.

#### UNIT V INDUSTRIAL ROBOTICS

Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems – End Effectors – Sensors in Robotics – Robot Accuracy and Repeatability - Industrial Robot Applications – Robot Part Programming – Robot Accuracy and Repeatability – Simple Problems.

#### **TEXT BOOKS:**

1. Mikell.P.Groover "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall of India, 2008.

2. Radhakrishnan P, Subramanyan S.and Raju V., "CAD/CAM/CIM", 2nd Edition, New Age International (P) Ltd, New Delhi, 2000.

#### **REFERENCES:**

1. Kant Vajpayee S, "Principles of Computer Integrated Manufacturing", Prentice Hall India, 2003. 105 2. Gideon Halevi and Roland Weill, "Principles of Process Planning – A Logical Approach" Chapman & Hall, London, 1995.

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## Total No. of Periods : 45





#### .G EDUCATIONAL AND RESEARC **H INSTITUTE DEEMED TO BE UNIVERSITY** University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

Subject Code	: Si	ubject Na	ame : I	FINITE	ELEM	ENT A	NALYS	SIS 1 F	Ty / Lb/ ETL	L	T / S.Lr	<b>P/ R</b>	С
EBRA22E05	5 Pi	rerequisi Iachine H	ite: Stre Elements	ngth of	Materi	als, Des	ign of	]	Г <b>у</b>	3	0/0	0/0	3
L : Lecture T	: Tutor	ial SLr	: Supervi	sed Lear	rning P	: Projec	t R:R	esearch	C: Credit	s	1		
T/L/ETL : The	eory/La	ab/Embeo	ided Theo	ory and l	Lab								
OBJECTIVE	S: To Euro	learn	of Finito	Flomor	ot Analy	voic and	thair an	alication	20				
COURSE OL	JTCO	MES (CO	$(\mathbf{J}\mathbf{s}) : \mathbf{Stud}$	lents wi	ll be ab	le to:	ulen apj	pilcation	15				
CO1	U	Inderstan	d the mat	nematic	al mode	ls and b	asic con	cepts of	finite ele	ement me	ethods.		
CO2		Analyse o	one dimer	sional p	oroblem	s in finit	e eleme	nt analy	vsis				
CO3		Solve sec	ond order	two dir	nension	al equat	ions inv	olving	scalar vari	iable fun	ctions		
CO4	]	Define tw	vo dimens	ional ve	ector var	iable pr	oblems,	stress a	nd strain c	calculation	ons		
CO5	]	Implemen	nt isopara	metric e	lements	and ren	nember	advance	ed numeri	cal techi	niques		
Mapping of C	Course	Outcom	es with P	rogram	Outco	mes (Po	os)						
Cos/Pos	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	PO9	<b>PO10</b>	<b>PO11</b>	PO	12
CO1	2	2	3	2	3	2	3	3	2	3	3	2	
CO2	2	2	2	2	3	2	3	3	2	2	3	2	
CO3	2	2	2	2	3	2	3	3	2	2	3	2	
CO4	2	2	2	2	3	2	3	3	2	2	3	2	
CO5	2	2	2	2	3	2	3	3	2	2	3	2	
Cos / PSOs	P	SO1	PSC	02	PS	03	PS	604					
CO1		2	3		3		3						
CO2		2	3		3		3						
CO3		3	3		3		3						
CO4		3	3		3		3						
CO5		3	3		3		3						
3/2/1 indicate	s Strei	ngth of C	Correlatio	on 3-h	nigh, 2-	mediun	n, L-Lo	W					
Category	Basic Sciences	Engineering Sciences	hu2anities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills				
Approval													

Subject Code:	Subject Name : FINITE ELEMENT ANALYSIS	Ty / Lb/ ETL	L	T / S.Lr	<b>P/ R</b>	С
EBRA22E05	<b>Prerequisite:</b> Strength of Materials, Design of Machine Elements	Ту	3	0/0	0/0	3

#### UNIT I INTRODUCTION

Historical background-mathematical modeling of field problems in engineering-governing equations-discrete and continuous models-boundary-initial and Eigen value problems-weighed Residual methods-variational formulation of boundary value problems-Ritz technique-basic concepts of finite element method.

#### UNIT II ONE DIMENSIONAL PROBLEMS

One Dimensional Second Order Equations-Discretization-Element types-Linear and Higher order Elements-Derivation of shape functions and stiffness matrices and force vectors-Assembly of matrices-Solutions of problems from solid mechanics including thermal stresses-heat transfer ,Natural frequencies of longitudinal vibration and mode shapes –fourth order beam equation-Transverse deflections and Transverse Natural frequencies of beams

#### UNIT III TWO DIMENSIONAL SCALAR VARIABLE PROBLEMS

DUCATIO

Second Order 2D Equations involving Scalar Variable Functions-Variable formulation-finite element formulation-Triangular Elements and Quadrilateral Elements-Shape functions and element matrices and vectors. Application to field problems-Thermal problems-Torsion of non circular shafts

#### UNIT IV TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS

Equations of Elasticity-Plane Stress, plane strain and axisymmetric problems-Constitutive matrices and Strain displacement matrices-Stiffness matrix-Stress calculations-Plate and Shell elements.

#### UNIT V ISOPARAMETRIC FORMULATION AND ADVANCED TOPICS

Natural co-ordinate systems-Isoparametric elements-shape functions for isoparametric elements-One and two dimensions-Serendipity elements-Numerical integration-Matrix solution techniques-Solutions Techniques to Dynamic problems-Introduction to Analysis Software-Introduction to Non-Linearity.

#### **TEXT BOOKS:**

J.N Reddy "An Introduction to the Finite element Method",3rd Edition ,Tata McGraw Hill, 2005.
 Seshu P., "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt.Ltd, New Delhi, 2007.

#### **REFERENCES:**

 Logan ,D.L, "A first Subject in Finite Element Method", Thomson Asia Pvt.Ltd., 2002.
 Robert D.Cook,David S.Malkus et.al, "Concepts and Applications of Finite Element Analysis" 4th Edition,Wiley Student Edition,2002
 Rao, S.S., "The Finite Elelent Method in Engineering", 3rd Edition, 3rd Edition, Butter worth Heinemann,2004

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Total No. of Periods: 45

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# **PROGRAM ELECTIVE: II**



SubjectCode	: Su	ıbjectNa	me:INI	DUSTRI	IAL NE	TWO	RKIN	١G	Ty/ Lb/	L	T /S	I.	P/ R	С
EBRA22E0	6								ETL		r	•₽		
_	Pı	rerequisi	te: Inst	rumenta	ation an	d Co	ntrol		Ту	3	0/	0	0	3
	E	ngineerii	ıg											
L: LectureT:7	Tutorial	SLr	: Super	visedLea	arningP:	Proje	ct R: l	Rese	archC:C	redit	S			
T/L/ETL:The	ory/Lal	o/Embed	dedTheo	oryand L	ab									
OBJECTIVE	E:													
• T	o unde	rstand the	e evoluti	ion of co	omputer	netwo	orks us	singt	helayere	dnet	worka	archited	cture.	
• 0	Indersta	and the co	oncepts	of modb	ous.									
• B	etamili	ar with d	lifferent	Etherne	t system	S	•••••	1	•					
		Tar with	wireless $(2, 5)$	commu	nication	s and	itsapp	ncat	ions.					
Students will	be abl	e to	8):(3- 5)	,										
CO1	U	nderstand	the bas	ic conce	epts of ir	strun	nentati	on a	nd netw	orkin	g apr	olicable	in indust	ries.
CO2	Di	iscuss the	concep	ots of mo	dbus an	d pro	fibus i	n inc	lustrial r	netwo	orking	<u>z</u> .		
CO3	A	pply Ethe	ernet and	d CAN p	rotocols	in in	dustria	al sy	stems		Ľ			
CO4	Re	emember	wireles	s comm	unicatio	ns cor	ncepts	in n	etworkin	ıg				
CO5	In	plement	commui	nication	technolo	ogies i	in indu	ıstria	al applic	ation	s			
MappingofC	ourseC	Outcomes	swithPr	ogramC	Outcome	es(PO	s)							
COs/POs	<b>PO1</b>	PO2	PO3	<b>PO4</b>	PO5	PO	6 PC	<b>)7</b>	PO8	PC	9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2		2	3		2	3	3
CO2	3	3	3	2	2	2	1		2	2		2	1	3
CO3	3	3	3	2	2	3	1		2	2		2	3	3
CO4	3	3	3	2	2	3	1		2	2		2	3	3
CO5	3	3	3	2	2	3	1		2	2		2	3	3
COs/PSOs	P	SO1	PS	<b>SO2</b>	PS	03		PS	504					
CO1	3		2		3		3							
CO2	3		2		3		3							
CO3	3		2		3		2							
CO4	3		2		3		3			_				
CO5	3		2		3		3							
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Approval					-									
II														

SubjectCode:	SubjectName:INDUSTRIAL NETWORKING	Ty/	L	Т	<b>P/ R</b>	С
		Lb/		/S.L		
<b>EBRA22E06</b>		ETL		r		
	Prerequisite: Instrumentation and Control	Ту	3	0/0	0	3
	Engineering					

#### UNIT I INTRODUCTION

Modern instrumentation and control systems – OSI model – Protocols – Standards – Common problems and solutions – Grounding/shielding and noise - EIA-232 interface standard – EIA-485 interface standard – Currentloop and EIA-485 converters. FIBRE OPTICS: Introduction – Fibre optic cable components and parameters –Basiccabletypes– Connectionfibres–troubleshooting.

#### UNIT II MODBUS CONCEPTS

Overview – Protocol structure – Function codes – Modbus plus protocol –Data Highway – AS interface (AS-i)–DeviceNet: Physicallayer–Topology–Devicetaps–ProfibusPA/DP/FMS: Protocolstack–Systemoperation.

#### UNIT III ETHERNET SYSTEMS

IEEE/ISO standards – Medium access control – frames – Reducing collisions – Auto negotiation – LAN systemcomponents – Structured cabling – Industrial Ethernet – Troubleshooting Ethernet. 99 CAN BUS: Concepts ofbus access and arbitration – CAN: Protocol-Errors: Properties – detection – processing – Introduction to CAN2.0B

#### UNIT IV WIRELESS COMMUNICATIONS

Radio spectrum – Frequency allocation – Radio modem – Intermodulation – Implementing a radio link – RFID: Basicprinciples of radiofrequencyidentification–Transponders -Interrogators

#### UNIT V APPLICATIONS

Automotive communication technologies – Design of automotive X-by-Wire systems, - The LIN standard – The IEC/IEEE Train communication network: Applying train communication network for data communications inelectrical substations.

#### **TEXTBOOKS:**

 Steve Mackay,Edwin Wright,Deon Reynders and JohnPark, "Practical Industrial Data Networks:Design,Installation andTroubleshooting", Newnes (Elsevier),2004
 "PracticalFilebus,Device NetandEthernetforIndustry",IDCTechnology,2006

#### **REFERENCES:**

 $\label{eq:linear} 1.\ Richard Zurawski, ``The Industrial Communication Technology Handbook'', Taylor and Francis, 2005$ 

2. DominiqueParet, "MultiplexedNetworksforEmbeddedSystems", JohnWiley&Sons, 2007

 $\label{eq:alpha} 3. \ Albert Lozano-Nieto, ``RFIDDesignFundamentals and Applications'', CRCPress, 2011$ 

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## **Total No.of Periods: 45**

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EDUCATIONAL AND RESEARCH INSTITUTE DEEMED TO BE UNIVERSITY University with Graded Autonomy Status	AC +
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SubjectCode:	Su	bjectNa	me:T(	TAL I	INTEG	ERAT	ED		Ту	L	T	P/	C
				AUTO	MATI	UN			/Lb		/S.L	K	
EDKA22EU/									/ ETL		ľ		
	Pre	erequis	ite: An	alog an	d Digi	tal			Ty	3	0/0	0/0	3
	Ele	ectronic	s,Proc	essors a	and Co	ntrolle	rs		U				
L : LectureT:T	utorial	SL	r: Super	rvised I	earnin	gP: Pro	jectR:R	lesearch	C:Credits	3			
T/L/ETL:Theo	ry/Lab	/Embed	dedThe	eoryand	l Lab								
OBJECTIVE	:												
• To	o gain a	awarene	ess on c	omplet	e auton	nation in	n indust	tries					
COURSEOU	ГСОМ	IES(CC	<b>S</b> ):(3-	5)									
Students will	be able	e to:	, , ,										
CO1	U	ndersta	nd the c	oncept	of TIA	system	ns ,PAC	s and V	ertical Int	tegratio	on Str	ucture	
CO2	A	rticulate	e the rol	le of HI	MI syst	ems in	Industri	ial Autor	mation.				
CO3	A	nalyse S	SCADA	s signi	ficance	in auto	mation						
CO4	A	ssess di	fferent	commu	nicatio	n proto	cols inv	volved in	n SCADA	1			
CO5	D	emonsti	ate the	usage o	of DCS	in indu	strial a	utomatio	on				
MappingofCo	urseO	utcome	swithP	rogran	nOutco	omes(P	Os)						
COs/POs	<u>PO1</u>	PO2	PO3	PO4	PO5	<b>PO6</b>	PO7	PO8	PO9	PO1	0 I	<u>2011</u>	PO12
CO1	3	3	3	2	2	2	2	2	3	2	3	3	3
CO2	3	3	3	2	2	2	2	2	3	2	3	3	3
CO3	3	3	3	2	2	2	2	2	3	2	3	3	3
CO4	3	3	3	2	2	2	2	2	3	2	3	3	3
CO5	3	3	3	2	2	2	2	2	3	2	3	3	3
COs /PSOs	PS	501	PS	02	PS	603	PS	<b>SO4</b>					
CO1		1	1	l	3		3						
CO2		1	1	l	3		3						
CO3		1	1	l	3		3						
CO4		1	1	l	3		3						
CO5		1	1	l	3		3						
3/2/1 indicates	Stren	gthofCo	orrelati	on	3-Hi	gh,2-M	edium	, 1-Low					
					es		it						
Category	BasicSciences	Engineeri ngScience	Humanities andSocialScie	Program Core	ProgramElective	OpenElectives	Practical/ Projec	Internships /TechnicalSk	Soft Skills				
Approval					•								

#### Perivar E.V.R. High Road, Maduravoval, Chennai-95, Tamilnadu, India. SubjectName:TOTAL INTEGERATED SubjectCode: Tv L Т P/R/S I /L.h/ AUTOMATION

(An ISO 21001 : 2018 Certified Institution)

				10.1		
<b>EBRA22E07</b>		ETL		r		
	Prerequisite : Analog and Digital	Ту	3	0/0	0/0	3
	Electronics, Processors and Controllers					

#### **UNIT I: TOTALLYINTEGRATEDAUTOMATION**

DUCAT

Need, components of TIA systems, advantages, Programmable Automation Controllers (PAC), Vertical Integration structure.

#### **UNIT II: HMI SYSTEMS**

Necessity and Role in Industrial Automation, Need for HMI systems. Types of HMI- Text display operatorpanels - Touch panels-Panel PCs-Integrated displays (PLC&HMI).

#### UNIT III: SUPERVISORY CONTROL AND DATA ACQUISITION(SCADA)

Overview – Developer and runtime packages – architecture – Tools – Tag – Internal & External graphics, Alarmlogging – Tag logging – structured tags– Trends – history– Report generation, VB & C Scripts for SCADAapplication.

#### UNIT IV: COMMUNICATION PROTOCOLS OF SCADA

Proprietary and open Protocols - OLE/OPC - DDE - Server/Client Configuration - Messaging -Recipe - Useradministration- InterfacingofSCADA with PLC, drive, and other fielddevice

#### **UNIT V: DISTRIBUTED CONTROL SYSTEMS (DCS)**

DCS – architecture – local control unit- programming language – communication facilities – operator interface-engineering interfaces. APPLICATIONS OF PLC&DCS: Case studies of Machine automation, Process automation, Introduction to SCADAComparison between SCADA and DCS.

#### **Total No.ofPeriods: 45**

#### **TEXTBOOKS:**

- John.W.Webb&RonaldA.Reis,"Programmablelogiccontrollers:PrinciplesandApplications", PrenticeHall 1. India, 2003.
- 2. MichaelP.Lukas, "DistributedControlsystems", "VanNostrandReinfoldCompany" 1995

#### **REFERENCES:**

- 1. WinCCSoftwareManual, Siemens, 2003
- 2. RSVIEW32 SoftwareManual, Allen Bradly, 2005
- 3. CIMPLICITYSCADAPackagesManual, FanucIndiaLtd, 2004



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SubjectCode EBRA22E08	e: SubjectName:MICRO ROBOTICS								Ty / Lb/	/ ET	L ]	Г S.L	P/ F	C C
									L		I	•		
	Pre	erequis	ite:Bas	ics of I	Robotio	cs			Ту		3 (	)/0	0/0	3
L: LectureT:T	utorial	SL	r:Super	rvisedL	earning	gP :Pro	jectR: I	Resea	rchC	C:Credit	ts			
T/L/ETL:The	ory/Lat	/Embe	ddedTh	eoryan	d Lab									
OBJECTIVE	2:													
• T	o gain	knowle	dge in	microro	bot wo	orking p	orincipl	e and	its a	pplicat	ions			
COURSEOU Students will	TCOM be able	IES(CO e to:	Os):(3-	5)										
CO1	Unders	stand th	e micro	machi	ning te	chnolo	gy cond	epts						
CO2	Discus	s differ	ent scal	ing law	vs and 1	materia	ls for N	IEM.	S					
CO3	Analys	e flexu	res,actu	ators a	nd sens	sors for	micro	robots						
CO4	Assess	the usa	ge of N	<b>IEMS</b>	in desig	gning n	nicrorol	bots						
CO5	Implen	nent mi	crorobo	ots usin	g MEN	1S								
Mapping of C	Course	Outco	nes wit	th Prog	gram ()	<b>)</b> utcom	es(POs	5)						
COs/POs	<b>PO1</b>	PO2	<b>PO3</b>	<b>PO4</b>	PO5	<b>PO6</b>	<b>PO7</b>	PO	8	PO9	PO10	PO	)11	PO12
CO1	3	3	3	2	2	2	2	2		3	2	3		3
CO2	3	3	3	2	2	2	2	2		3	2	3		3
CO3	3	3	3	2	2	2	2	2		3	2	3		3
CO4	3	3	3	2	2	2	2	2		3	2	3		3
CO5	3	3	3	2	2	2	2	2		3	2	3		3
COs/PSOs	PS	501	PS	02	PS	03	PS	504						
CO1		1	1	l	3		3							
CO2		1	1	l	3		3							
CO3		1	1	l	3		3							
CO4		1	1	L	3		3							
CO5		1	1	1	3		3							
3/2/1 indicate	s Strer	ngth of	Correl	ation	<b>3-H</b>	igh,2-N	Mediun	n, 1-I	JOW					
Category	BasicSciences	EngineeringSciences	Humanities	Program Core	<ul> <li>Program Elective</li> </ul>	OpenElectives	Practical/ Project	Internships/	Soft Skills					
Approval														

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SubjectCode:	SubjectName:MICRO ROBOTICS	Ty /Lb/	L	T /S.L	P/ R	С	
<b>EBRA22E08</b>		ETL		r			
	Prerequisite:Basics of Robotics	Ту	3	0/0	0/0	3	

#### UNIT I INTRODUCTION

MST (Micro System Technology) – Micromachining - Working principles of Microsystems - Applications of Microsystems.

#### UNIT II SCALINGLAWS ANDMATERIALS FOR MEMS

EDUCATIO

Introduction- Scaling laws- Scaling effect on physical properties, scaling effects on Electrical properties, scaling effect on physical forces. Physics of Adhesion - Silicon-compatible material system - Shape memoryalloys -Material properties: Piezo resistivity, PiezoelectricityandThermoelectricity.

#### UNIT III FLEXURES, ACTUATORS AND SENSORS

Elemental flexures - Flexure systems - Mathematical formalism for flexures.Electrostatic actuators, Piezo-electric actuators, Magneto-strictive actuators. Electromagnetic sensors, Optical-based displacement sensors, Motiontrackingwith microscopes.

#### **UNIT IV MICROROBOTICS:**

Introduction, Task specific definition of micro-robots - Size and Fabrication Technology based definition of micro robots - Mobility and Functional-based definition of micro-robots - Applications for MEMS based micro-robots.

#### UNIT V IMPLEMENTATION OF MICROROBOTS

Arrayed actuator principles for micro-robotic applications – Micro-robotic actuators - Design of locomotivemicro-robot devices based on arrayed actuators. Micro-robotics devices: Micro-grippers and other micro-tools -Micro-conveyors - Walking MEMS Micro-robots – Multi-robot system: Micro-robot powering, Micro-robotcommunication.Micro-fabrication principles - Design selection criteria for micromachining - Packaging and Integration aspects –Micro-assemblyplatforms and manipulators. Total No.of Periods: 45

#### **TEXTBOOKS:**

1. MohamedGad-el-Hak, —TheMEMSHandbook, CRCPress, NewYork, 2002.

2. YvesBellouard, --MicroroboticsMethodsandApplications^{||}, CRCPress,Massachusetts,2011.

#### **REFERENCES:**

 Nadim Maluf and Kirt Williams, _\An Introduction to Microelectromechanical systems Engineering\, ArtechHouse,MA, 2002.
 JulianWGardner,—Microsensors: PrinciplesandApplications\,John Wiley&Sons, 1994.

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Subject Code	e: 1	Subject	Name:	COGN	Ту /Гр	L	T /S I	<b>P/ R</b>	С						
EBRA22E0	9								/		r				
	]	Prerequ	isite:B	Basicso	f Robo	tics			ETL Ty	3	0/0	0/0	3		
L: LectureT:T	lutoria	l SI	Lr : Suj	pervise	dLearn	ingP:P	roject	R: Rese	earchC:	Credits					
T/L/ETL:The	ory/La	ab/Embe	ddedT	heorya	nd Lab	-	-								
OBJECTIVE	E:														
• T	o stuc	ly about	cognic	otive ro	bots ar	nd its ap	pplicati	ons							
COURSEOU	TCO	MES(C	Os):(3	- 5)											
Studentswill	be abl	e to													
CO1	U	Indersta	nd the	model	of cogr	ition ,	percept	ion and	nd reception						
CO2	Ľ	Define map building and execute program on map build								uilding					
<u>CO3</u>	A	Analyse randomized path planning for cognitiv							robots						
CO4		Describe	SLAM	l for co	gnitive	robots			6	1.1	1.				
CO5	11 ~	mpleme	nt robo	t progr	am usu	ng prec	lefined	packag	es for r	eal time	applic	cations			
Mapping of C	Cours	e Outco	mes w	ith Pro	ogram	Outcol	mes(P(	Js)	DOG			011	<b>DO10</b>		
COS/POS	POI	PO2	P03	PO4	P05	PO6	PO 7	PUð	P09	POI			POIZ		
CO1	3	3	3	2	2	2	2	2	3	2	3		3		
CO2	3	3	3	2	2	2	2	2	3	2	3		3		
CO3	3	3	3	2	2	2	2	2	3	2	3		3		
CO4	3	3	3	2	2	2	2	2	3	2	3		3		
CO5	3	3	3	2	2	2	2	2	3	2	3		3		
COs /PSOs	P	SO1	PS	<b>502</b>	PS	503	P	SO4							
CO1		1	1	1	3		3								
CO2		1	1	1	3		3								
CO3		1	1	1	3		3								
CO4		1	1	1	3		3								
CO5		1	1	1	3		3								
3/2/1 indicate	es Stre	ength of	<u>Corre</u>	elation	3-1	High,2	-Mediu	ım, 1-L	<b>OW</b>						
Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	▲ ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSki	Soft Skills						
Approval															



Introduction, Representation of the Robots Environment, Review of configuration spaces, Visibility Graphs, Voronoi diagrams, Potential Fields and Cell Decomposition, Planning with moving obstacles, Probabilistic Roadmaps, Rapidly exploring grandomtrees, Execution of the Quadtree-Based Path Planner Program.

Introduction to the Model of Cognition, Visual Perception, Visual Recognition, Machine Learning, Soft

Introduction, Constructing a 2D World Map, Data Structure for Map Building, Explanation of the Algorithm, AnIIlustration of Procedure Traverse Boundary, An Illustration of Procedure Map

University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

#### UNIT IV SIMULTANEOUS LOCALIZATION AND MAPPING (SLAM)

Problem Definition, Mathematical Basis, Example: SLAM in Landmark Worlds, Taxonomy of the SLAMProblem, Extended Kalman filter, Graph-Based Optimization Techniques, Particle Methods Relation of Paradigms.

#### **UNIT V ROBOT PROGRAMMING PACKAGES:**

EDUCATIO

SubjectName:COGNITIVE ROBOTICS

UNIT I CYBERNETIC VIEW OF ROBOT COGNITION AND PERCEPTION

**Prerequisite:Basics of Robotics** 

Computing Tools and Robot Cognition.

UNIT II MAP BUILDING

Robot Parameter Display, Program for BotSpeak, Program for Sonar Reading Display, Program for Wandering Within the Workspace, Program for Tele-operation, A Complete Program for Autonomous Navigation.

#### **TEXTBOOKS:**

**Subject Code:** 

**EBRA22E09** 

1. Patnaik, Srikanta, "Robot Cognition and Navigation An Experiment with Mobile Robots", Springer-VerlagBerlinand Heidelberg, 2007.

2. Howie Choset, Kevin LynchSeth Hutchinson, George Kantor, Wolfram Burgard, Lydia Kavraki, andSebastian Thrun, —Principles of Robot Motion-Theory, Algorithms, and Implementationl, MIT Press, Cambridge, 2005.

#### **REFERENCES:**

 SebastianThrun, WolframBurgard, DieterFox, —ProbabilisticRobotics, MITPress, 2005.
 Margaret E. Jefferies and Wai-Kiang Yeap, "Robotics and Cognitive Approaches to Spatial Mapping", Springer-VerlagBerlin Heidelberg 2008. 15 6

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#### **Total No.of Periods :45**

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#### B.Tech Robotics and Automation-2022 Regulation

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SubjectCode:	Subj	ectNam	e: CI	LOUD R	OBOTI	ICS		Ту	L	T/S.Lr	P/ R	C
EBRA22E10								/LD /				
	Duon	anicito	Docios	of Dobo	tion			ETL	2	0/0	0/0	2
L: LectureT:Tut	orial	SLr :	Supervi	sedLearr	ningP:Pr	oject R	: Resea	rchC:Cr	redits	0/0	0/0	3
T/L/ETL:Theory	v/Lah/F	Embedde	- dTheor	vand Lab		5						
OBJECTIVE:	/ <b>Lu</b> o/ L	mocuu		yuna Luc	, 							
То	gain kr	owledge	e in Clo	ud Robot	ics and	their ap	plication	ns				
COURSEOUT	COME		):(3-5)									
Students will be	e able t	t <b>o:</b>										
CO1	Unders	stand the	e concep	ots of tele	robotics	s and its	brief hi	story in	cloud	robotics		
CO2	Define	the con	nmunica	tion and	network	king con	cepts in	telerob	otics s	ystem		
CO3	Analys	se the fu	ndamen	tals of or	line rot	oots						
CO4	Design	web so	ftware a	rchitectu	re for o	nline ro	bots					
CO5	Impler	nent mo	bile rob	ots throu	gh onlin	e mode						
MappingofCou	rseOut	tcomesv	vithProg	gramOu	tcomes(	(POs)						
COs/POs	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	2	3	2	3	3
CO2	3	3	3	2	2	2	2	2	3	2	3	3
CO3	3	3	3	2	2	2	2	2	3	2	3	3
CO4	3	3	3	2	2	2	2	2	3	2	3	3
CO5	3	3	3	2	2	2	2	2	3	2	3	3
COs /PSOs	PS	501	PS	<b>SO2</b>	PS	503	PS	04				
CO1		1		1	3		3					
CO2		1		1	3		3					
CO3		1		1	3		3					
CO4		1		1	3		3					
CO5	14	<u>1</u>	1 - 4	1	3	M. P	3					
5/2/1 Indicates5	orrengi	noiCor	relation	3-	Hign,2-	Meanu	n, 1-L0	w				
Category	BasicSciences	Engineerin gSciences	Humanities andSocialScien	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSkil	Soft Skills			
Approval					✓ 							
FF												

# (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India. SubjectCode: SubjectName: CLOUD ROBOTICS Ty L T P/ R C EBRA22E10 ETL ETL Image: CLOUD ROBOTICS <td

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UNIT I INTRODUCTION	UNIT I	<b>INTRODUCTION</b>
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Telerobotics: Overview and background -Brief history.

EDUCATION

#### UNITH COMMUNICATIONS AND NETWORKING

**Prerequisite:Basics of Robotics** 

The Internet – Wired Communication Links – Wireless Links – Properties of Networked Telerobotics – Buildinga Networked Telerobotic system – State command Presentation – Command Execution/ State generation –CollaborativeControl

#### UNIT III FUNDAMENTALS OF ONLINE ROBOTS

Introduction – Robot Manipulators – Teleoperation – Teleoperation on a local network – Teleoperation via a constrained link.

#### UNIT IV ONLINE ROBOTS

Introduction to networked robot system on the Web–SoftwareArchitecture and design–Interfaced design.

#### UNIT V CASE STUDY

Performance of mobile robots controlled through the web-System Description-Software Architecture.

#### **Total No.of Periods:45**

#### **TEXTBOOKS:**

- 1. Bruno Siciliano, Oussama Khatib, —Springer Handbook of Roboticsl, Springer Science and Business, 2010.
- 2. Ken Goldberg, Roland Siegwart, —Beyond Webcams An Introduction to Online Robotsl, MIT Press, 2010.

#### **REFERENCES:**

 BorkoFurht, ArmandoEscalante, —Handbookof CloudComputingl, SpringerScience&Business, 2010.
 PeterSinčák, PitoyoHartono, MáriaVirčíková, JánVaščák, Rudolf Jakša, —EmergentTrendsinRoboticsandIntelligentSystemsl, Springer, 2014.

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SubjectCode:	Su	bjectNa	me: N	MEDIC	AL ROI	BOTICS	STy/	т	L	T/S.Lr	P/ R	С
EBRA22E11	1							1				
	Pr	erequisi	te:Basic	s of Ro	botics		Ty		3	0/0	0/0	3
L: LectureT:T	utorial	SLr	: Super	visedLea	arningP:	Project	R: Rese	archC:C	Credits	I	I	l
T/L/ETL:Theo	ory/Lab	/Embedd	dedTheo	ryand L	ab							
OBJECTIVE	:			2								
• 6	lain kno	owledge	in medi	ca lrobo	t workin	g princij	ple and	applicat	ions			
COURSEOU	тсом	IES(CO	s):(3- 5)									
Students will	be able	e to:										
CO1	U	nderstan	d the wo	orking o	f various	s types o	f robots	in med	ical fiel	d.		
CO2	А	nalyse lo	ocalizati	on and t	racking	mechani	sm perf	ormed b	y medi	cal robots		
CO3	D	emonstra	ate the u	sage of	robots ir	n surgica	l operat	ions				
CO4	E	xamine t	he role o	of robots	s in med	ical reha	bilitatio	n				
CO5	In	nplemen	t robots	dedicate	ed to per	rform m	edical su	urgeries				
Mapping of C	Course	Outcom	es with	Progra	m Outco	omes(P(	Ds)					
COs/POs	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	2	2	2	2	2	3	2	3	3
CO2	3	3	3	2	2	2	2	2	3	2	3	3
CO3	3	3	3	2	2	2	2	2	3	2	3	3
<u>CO4</u>	3	3	3	2	2	2	2	2	3	2	3	3
CO5	3	3	3	2	2	2	2	2	3	2	3	3
COs /PSOs	P	<u>SO1</u>	PS	<u>502</u>	PS 2	503	PS 2	504				
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<u>CO2</u>		1		1	3		3					
<u>CO3</u>		1		1	3		3					
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3/2/1 mulcate	s Stren		Si l'elat		<u>5-111gn,</u>		<u>, 1-1</u>	0w				
category	BasicSciences	EngineeringSciences	Humanities and Social Science	Program Core	<ul> <li>▲ ProgramElectives</li> </ul>	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
Approval												

		Periyar	E.V.R. High Road, Maduravoyal, Chenn	ai-95. Tamilnadu, I	ndia.		
etCo	de: Sul	ojectName:	MEDICAL ROBOTICS	Ту /	L	T/S.Lr	P/R

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SubjectCode:	SubjectName: MEDICAL ROBOTICS	Ty/	L	T/S.Lr	<b>P/ R</b>	С
		Lb/ETL				
<b>EBRA22E11</b>	Prerequisite:BasicsofRobotics	Ту	3	0/0	0/0	3

#### UNIT I INTRODUCTION

Types of medical robots - Navigation - Motion Replication - Imaging - Rehabilitation and Prosthetics - State of artofrobotics in the field of healthcare.

#### UNIT II LOCALIZATION AND TRACKING

EDUCATIO

Position sensors requirements - Tracking - Mechanical linkages - Optical - Sound-based - Electromagnetic -Impedance-based-In-bore MRItracking-Videomatching-Fiberoptictrackingsystems-Hybrid systems.

#### UNIT III SURGICAL ROBOTICS

Minimally invasive surgery and robotic integration – surgical robotic sub systems - synergistic control. ControlModes - Radiosurgery - Orthopedic Surgery - Urologic Surgery and Robotic Imaging - Cardiac Surgery –Neurosurgery– case studies.

#### UNIT IV REHABILITATION AND ROBOTS IN MEDICAL CARE

Rehabilitation for Limbs - Brain-Machine Interfaces - Steerable Needles –case studies- Assistiverobots–types of assistive robots–case studies.

#### UNIT V ROBOTS IN MEDICAL CARE

DESIGN OF MEDICAL ROBOTS: Characterization of gestures to the design of robots-Design methodologies-Technological choices-Security.

#### **TEXTBOOKS:**

1. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, —Robot Modeling and Control, Wiley Publishers, 2006.

 $\label{eq:2.2} 2. \ Paula Gomes, "Medical robotics Minimally invasive surgery", Woodhead, 2012.$ 

#### **REFERENCES:**

1. AchimSchweikard, FlorisErnst, —MedicalRobotics, Springer, 2015.

2. Jocelyne Troccaz, —Medical Robotics^{II}, Wiley-ISTE, 2012. 3. Vanja Bonzovic, ^IMedical Robotics^{II}, *I*-techEducationpublishing, Austria, 2008.



**Total No.of Periods :45** 

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SubjectCod	e:	Subje	ct Na	me:	<b></b>				Ty/	/ ГТІ	L		T/S.Lr	P/	С
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005		er usage										ving			
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	3	3	3	3	2	3	4	1	3		3	3	3		
CO2	3	3	3	3	3	2	1	1	2		3	3	3		
<u>CO3</u>	3	3	3	3	2	3	2	1	3		3	3	3		
<u>CO4</u>	3	3	3	3	2	3	2	1	3		3	3	3		
C05	3	3	3	3	2	3	2		3		3	3	3		
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CO3	3		2		2		3								
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category	BasicScienc	Engineering	Humanities	Program Co	<ul> <li>▲ ProgramEle</li> </ul>	OpenElectiv	Practical/ P1	Internships /Technical		Soft Skills					
Approval		_			_										
Аррготаг															

	Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilna	du, India	ι.			
Subject Code:	Subject Name: AERIAL ROBOTS	Ty/	L	Т	<b>P</b> /	С
		L		/S.L	R	
<b>EBRA22E12</b>		b		r		
		/				
		Ε				
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		L				
	Prerequisite:Basics of Robotics,Kinematics	Ту	3	0/0	0/0	3
	and Dynamics of Machinery					

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#### UNIT I **INTRODUCTION**

UAV Categories-Regulations-Laboratories-Components of UAVs-Motors and Propellers-Battery-Additional Equipment-UAV Materials-Launching Systems.

#### **UNIT II** FLIGHT MECHANICS AND AIRCRAFT PERFORMANCE

EDUCATIO

Modelling Presentation-Frames-Kinematic Modelling-Fixed wing Aircraft Dynamic Modelling-Quad Rotor Dynamic Model-Atmospheric pressure-Pressure altitude-Density altitude-Configuration Design-Analysis of Weather factors-Aviation weather information sources.

#### UNIT III **FLIGHT CONTROL**

Introduction-Architecture-Auto pilot-Sensors dedicated to the flight controller-sense and avoid technologies-camera and video-Radio communications-Ground control system-First person view-Data fusion.

#### UNIT IV MATHEMATICAL ANALYSIS

Introduction-Linear Control Methods-PID controller-Properties of Linear Systems-Linear Approaches for LTI models-Classical methods-Trim Trajectory Generation

#### FLIGHT OPERATIONS AND SAFETY SYSTEMS UNIT V

Situational Awareness-Flight operations-Aeronautical Decision making-Airport operations-Hazardous operations-Safety promotion-maintenance-Human factors-Risk analysis and Prevention

## **Total No.of Periods :45**

#### **TEXTBOOKS:**

- Yasmina Bestaoui SebbaneA First Course in Aerial Robots and DronesCRC Press,2022 1.
- 2. Yasmina Bestaoui Sebbane-Planning and Decision Making for Aerial Robots Springer, 2016

#### **REFERENCES:**

1.P.K Garg-Introduction to Unmanned Aerial Vehicles, New Age International Publishers, 2020 2.K.Nonami-Autonomous Flying Robots: Unmanned Aerial Vehicles and Micro Aerial Vehicles, Springer, 2010

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# **PROGRAM ELECTIVE: III**

# Construction of the first of th

Subject Code: EBRA22E13	Su	bjectNa	ame:VIR	TUAL	INSTR	UMEN	TATIC	DN	Ty / Lb/ET		Ր S.L	P/ R	С
	Pr En	erequis gineeri	ite:Instru	umenta	tion and	d Cont	rol		Ty	3 0	)/0	0/0	3
L: LectureT:	Futorial	SL	r : Superv	visedLe	arningP	Project	R: Re	searchC	C:Credits	11	I		
T/L/ETL:The	ory/Lat	/Embeo	idedTheo	ryand I	Lab								
0	BJECT	IVE:											
Тс	o gain ki	nowledg	ge in the f	ield of	virtual in	nstrume	entation	concep	ots				
COURSEOU	JTCON	IES(CO	<b>Ds</b> ):(3- 5)	Studen	ts will b	e able	to:						
CO1	1 Understand the concepts of virtual instrumentation.												
CO2	Analyse different programming techniques in virtual instrumentation												
CO3 Define data acquisition in programming of virtual instruments													
CO4	O4 Describe the working of various bus interfaces connected to the virtual instruments												
CO5	Appreciate the usage of analysis tools in various fields of VIs												
MappingofC	ourseO	utcome	eswithPro	ogram(	Dutcom	es(POs	)						
COs/POs	<b>PO1</b>	PO2	PO3	PO4	PO5	PO6	<b>PO7</b>	<b>PO8</b>	PO9	PO10	PO11	PO	12
<u>CO1</u>	3	3	3	3	3	1	2	3	3	3	2	3	
<u>CO2</u>	3	3	3	3	3	1	2	3	3	3	2	3	
<u>CO3</u>	3	2	3	3	3	2	1	3	3	3	3	3	
<u>CO4</u>	3	3	3	3	3	2	1	3	3	3	2	2	
CO5	3	3	3 DC	3	3 DC	$\frac{3}{2}$	3	3	3	3	3	3	
COs /PSOs		<u>PS01</u>		P802		PSU3		PS04					
$\frac{CO1}{CO2}$	3		3		2		3						
C02	3		3		2		3					-	
C03	3		3		3		3					-	
C04	3		3		3		3						
3/2/1 indicate	3 esStren	othofC	orrelation		3.High 2.Medi		Jium 1.Low						
5/2/1 mulcat		ginore			J-IIIgh	, <u>2-1vicu</u>	iuiii, 1-						
Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	<ul> <li>✓ ProgramElectives</li> </ul>	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills				
Approval													


SubjectCode:	SubjectName: VIRTUAL INSTRUMENTATION	Ту	L	Т	<b>P/ R</b>	С
		/Lb/		/S.L		
<b>EBRA22E13</b>		ETL		r		
	Prerequisite: Instrumentation and Control Engineering	Ту	3	0/0	0/0	3

<b>UNIT I :REVIEW OF VIRTUAL INSTRUMENTATION</b> Historical perspectives, advantages, block diagram and architecture of a virtual instrument data–flowtechniques,graphical programmingindataflow,comparisonwithconventional programming.	nt,
<b>UNIT II :PROGRAMMING TECHNIQUES</b> VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structu formula nodes.local and globalvariables, stringand fileI/O.	res,
UNIT III: DATA ACQUISTION BASICS AOC.OAC. 010.Counters & timers.PC Hardware structure, timing.Interrupts OMA, software ware installation.	ware and
UNIT IV: COMMON INSTRUMENT INTERFACES	
Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, V. PXI,etc.,networking basics for office &.Industrial applications,image acquisition and processing.Motioncontrol.	XI, SCXI,
UNITV:USE OF ANALYSIS TOOLS	
Fourier transforms, power spectrum correlation methods, windowing&filtering, VI applicat	tion in various

# **Total No.of Periods: 45**

# TEXTBOOK

1. Gupta,"Virtual InstrumentationUsingLabview2E"TataMcGraw-Hill Education,2010

# **REFERENCES:**

1. GaryJonson, LabviewGraphical Programming, SecondEdition, McGrawHill, NewYork, 1997

2. Sokoloff; Basic concepts of Labview4, PrenticeHallInc., NewJersey1998.

3. GuptaS., GuptaJ.P:, PCinterfacingforDataAcquisition&Process Control, SecondEdition, InstrumentSociety of America, 1994.



Subject Code EBRA22E14	e: Si 4	ubjectN	ame:DIC	GITAL	. TWIN	TECH	INOLO	)GY	Ty / Lb/ET	L	T /S.	<b>P/ R</b>	C
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	P	rerequi	site:Instr	ument	tation a	nd Co	ntrol	'	Гу	3	0/0	0/0	3
	E	ngineer	ing										
L: LectureT:	Tutori	al S	Lr : Supe	rvised	Learnin	gP:Proj	ect R:	Researc	hC:Crec	lits			
T/L/ETL:Th	eory/L	ab/Emb	eddedThe	eoryand	d Lab								
OBJECTIVE	E:												_
To give an ba	sic und	lerstand	ing of dig	ital tw	in in cu	rrent in	dustrial	sector	and integ	grating	IoT and	other of	lata
communicatio	on tech	niques v	with Digit	al twin	techno	logy.							
COURSEO	UTCO	<u>MES(C</u>	<u>COs):(3- </u>	5)	<u> </u>	1. 1		•			1	1	
COI	U	nderstar	nd the evo	olution	of digit	al twin	technol	ogy ,its	compor	ients an	d utilitie	s and	
	se	nsors	L 1						- : 4 - 1 4:		C	A . 1	
	A	naryse t	ne signal	proces	sing op	erations	s mvolv	eu in di	gital twi	n and u	sage of A	-srauin	IO
CO3	<u>c</u>	alve imp	S,FLUS IC	n maa	peration	prication di	oital twi	in techn	iques				
C03	ים יים	teorate	Digital T	win tee	hniques	with I	oT ada		oud cor	muting	and high	light	ite
	ci	onifican	ce in mar	win tee nifactu	ring sec	s with I	or ,eug			ipunig	and mgi	ingin l	us
CO5	In	nlemer	t Artifici	al Intel	igence :	and Ma	chine I	earning	technia	ues in I	Divital T	win	
000	te	chnique	s	ur miter	ingeniee			curinie	, teening	ues III I	Jigitur I	***	
Manning of	Cours		mes with	Prog	ram Au	tcome	s(POs)						
COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO	12
CO1	3	3	3	3	3	1	2	3	3	3	2	3	
CO2	3	3	3	3	3	1	2	3	3	3	2	3	
CO3	3	2	3	3	3	2	1	3	3	3	3	3	
CO4	3	3	3	3	3	2	1	3	3	3	2	2	
CO5	3	3	3	3	3	3	3	3	3	3	3	3	
COs /PSOs	P	SO1	PS	02	PS	503	PS	<b>SO4</b>					
CO1	3		3		2		3						
CO2	3		3		2		3						
<u>CO3</u>	3		3		3		3						
CO4	3		3		3		3				_		
CO5	3	41			3	1.0.1	3	1 1					
3/2/1 indicat	tes Str	ength o	I Correla	ation	<b>3-H</b>	gn,2-10	ledium,	, 1-Low	·				
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	cie	JgS	Soc	В	Ele	lec	l/ P	ech	Š				
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Approval													
Approval													

	Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tami	İnadu, India.				
Subject Code:	SubjectName:DIGITAL TWIN TECHNOLOGY	Ty/	L	Т	<b>P/ R</b>	(
EBRA22E14		Lb/ET		/S.L		
		L		r		
	Prerequisite:Instrumentation and Control	Ту	3	0/0	0/0	3
	Engineering					

(An ISO 21001 : 2018 Certified Institution)

# UNIT I: EVOLUTION AND JOURNEY TOWARDS DIGITAL TWIN

EDUCAT

Manufacturing and Industrial Revolution-Introduction to Digital Twin-Key Aspect of a Digital Twin Model-Components for Envisaging the Digital Twin-Utilities of Digital Twin-Sensor Electronics for Digital Twin-Need of electronics-sensor and transducer-types-performance indices of a sensor

# UNIT II: SIGNAL PROCESSING FOR DIGITAL TWIN

Signal as indirect means of monitoring-importance of signal processing in digital twin-Signal acquisition and its featuresarduino microcontroller-input/output module and PLC for industrial applications-Noise in signal-methods of signal processing.

# UNIT III: IMAGE PROCESSING FOR DIGITAL TWIN

Selection process zone or application zone-image acquisition-image enhancement-image segmentation-Feature extraction and object recognition

# UNIT IV:DATA COMMUNICATION-EDGE,FOG AND CLOUD COMPUTING

IoT and Network-IoT Framework-Introduction to the Edge ,Fog and Cloud Computing-necessity from Industry 4.0 perspective-Edge vs cloud computing-Application classification-Data communication technologies-Network Architectures for Edge/cloud computing-Real life example in manufacturing-5G in manufacturing

# UNIT V:ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

Requirement of Artificial intelligence in Digital Twin-Sensor Signal Processing-Analytics Pipeline Optimization Strategies-Digital Twin applications

## **Total No.of Periods:45**

# TEXTBOOK

1. Surya Kanta Pal,"Digital Twin-Fundamental Concepts to Applications in Advanced Manufacturing" Springer ,2022

# **REFERENCES:**

1.Manisha Vohra,Digital Twin Technology:Fundamentals and Applications,Wiley 2023 2.Gopal Chaudhary,Manju Khari,Digital TwinTechnology,CRC Press 2021



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EDUCATIONAL AND RESEARCH INSTITUTE	Sauted WITH OR DA

SubjectCode: EBRA22E15	5 Su	bjectNa	me:DIGI	TAL C	ONTRO	DL SYS	STEM		Ty / Lb/ETL	L	T /S.L	<b>P/ R</b>	C
	Day		4 T			Cantual	Encin		<b>T</b>	2	r 0/0	0/0	2
L: LectureT·T	utorial	SLr ·	<u>Supervis</u>	edLearn	ingP·Pre	viect R.	Researc	hC.Cre	<b>y</b> dits	3	0/0	0/0	3
T/L/ETL The	wy/Lab/	Embadd	ad Theorem	and Lak		<i>Jeet</i> 10.	researe						
		Embedd	ed Theory		)								
• To	o unders	tand the	concept o	f Z–Tra	ansform								
• To	o unders	tand the	sampled d	ata syste	ems								
• To	o unders	tand the	statespace	e analysi	is and sta	ability a	nalysis						
• To	o gain kr	nowledg	e in pole p	lacemei	nt and ol	oserver g	gain						
COURSEOU'	TCOM	ES(COs	):(3-5)										
CO1	Underst	and the	concept of	Z-Tran	sforms i	n signal	process	ing					
CO2	Describ	e sample	ed data sys	stem to v	various k	tinds of	input sig	gnals					
CO3	Solve st	eady sta	te analysis	s of disc	rete time	e system	S						
CO4	Impleme	ent stabi	lity tests i	n discret	te time s	ystems	amonto	ndaha	muan taahn				
CU5 Monning of (		lie servo	and other	system	s using p	$\frac{1}{2}$	cement a	ind obse	erver techn	iques			
COs/POs	PO1	PO2	$\mathbf{PO3}$	PO4		PO6	PO7	PO8	PO9	PO10	PO11	PO	12
CO3/1 O3	3	3	3	3	3	3	2	3	3	3	2	3	14
CO2	3	3	3	3	3	3	2	3	3	3	2	3	
CO3	3	2	3	3	3	2	3	3	3	3	3	3	
CO4	3	3	3	3	3	3	3	3	3	3	2	3	
CO5	3	3	3	3	3	3	3	3	3	3	3	3	
COs /PSOs	PS	01	PSC	)2	PS	03	PS	<b>504</b>					
	3		3		3		3						
C02	3		3		23		3						
CO4	3		3		3		2						
CO5	3		3		3		2						
3/2/1 indicate	sStreng	th of Co	orrelation	3-1	High,2-N	Aedium	, 1-Low	,					
								_					
Category	BasicSciences	EngineeringSciences	Humanities and SocialSciences	Program Core	✓ ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkil	Soft Skills				
Approval													

# CONTROL AND RESEARCH INSTITUTE DEMONSTRATE AUtonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennal-95. Tamilnadu, India.

SubjectCode:	SubjectName:DIGITAL CONTROL SYSTEM	Ту /	L	Т	<b>P/ R</b>	С
<b>EBRA22E15</b>		Lb/ETL		/S.Lr		
	Prerequisite: Instrumentation and Control Engineering	Ту	3	0/0	0/0	3

# UNIT I Z TRANSFORM

Sampleddatatheory–Samplingprocess–Samplingtheorem–Signalreconstruction–Sample andhold circuits – ZTransform–Theorems on ZTransforms–Inverse ZTransforms.

# UNIT II SAMPLEDDATA SYSTEMS

Pulse transfer function – Response of sampled data system to step and ramp inputs – mapping between s-planeandz-plane:Primarystripsand ComplementaryStrips.

# UNIT III STATESPACE ANALYSIS

State Space Representation of discrete time systems, Solving discrete time- state- space equations, Pulse TransferFunctionMatrix, Discretizationof continuous timestate–space equations.

# UNIT IV STABILITYANALYSIS:

Stability Analysis of closed loop systems in the Z-Plane.Jury stability test – Stability Analysis by use of the Bilinear Transformation and Routh Stability criterion.Stability analysis using Liapunov theorems.

# UNIT V POLE PLACEMENT AND OBSERVER DESIGN:

Controllability, Observability, Useful Transformations in State-Space analysis and Design, Design via PolePlacement, State Observers, Servo Systems.

# **TEXTBOOKS:**

1. OgataK., - Discrete-TimeControl systemsl, 2ndEdition, PHILearningPvt.Ltd, 2009.

2. KuoB.C., - DigitalControlSystems |, 2ndEdition, OxfordUniversityPress, 2007.

# **REFERENCES:**

 $1. \ Gopal M., -Modern Control Systems Theory {\tt I}, 3rd Edition, New Age International Publications, 2014.$ 

2. GopalM.,—DigitalControl Engineering, NewAgeInternational Publications, 2003.

3. GopalM., — DigitalControlandStateVariableMethods, 3rdEdition, TMH, 2008.

 $\label{eq:action} 4. \ Richard C. Dorfand Robert H. Bishop, \\ --Modern Control Systems {\tt I}, 12 th Edition, Pearson Education, 2004.$ 

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**Total No. ofPeriods:45** 

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EDUCATIONAL AND RESEARCH INSTITUT	South ED WITH ORDER
	A
University with Graded Autonomy Status	
(An ISO 21001 : 2018 Certified Institution)	

			Periya	ar E.V.R. H	igh Road, Ma	duravoyal, C	hennai-95. Tam	iilnadu, Inc	lia.					
SubjectCode: EBRA22E16	Subj ENG	ectNam INEER	e:IOT ING	FOR	ELECTR	ICAL			Ty/ Lb/ ETL	L	T/SLr	P/R		С
	Prer	equisite	:Nil						Ту	3	0/0	0/0	3	
L : Lecture T : T	Tutorial S	Lr : Sup	ervised	1 Learni	ng P: Proj	ect R : Re	esearch C :			1				
CreditsT/L/ETL	:Theory/I	Lab/Eml	bedded	Theory	and Lab									
<b>OBJECTIVE:</b>														
• To	understan	d the fu	ndame	ntals, aı	rchitecture	and chall	lenges of Int	ternet of	Things	•				
• To	understan	id the pr	otocol	s used d	uring com	nectivity of	of devices.							
• To	know the	importa	ince in	securin	g the devi	ces conne	cted through	n IoT.						
• To	understan	id the in	pleme	ntation	of IoT in i	industries.		_						
• To	design, m	ionitor a	nd con	trol var	ious electr	rical system	ms using Io	оT.						
COURSEOUT	COMES	(COs) :												
CO1	Under	stand th	e archi	tecture	and challe	enges of I	oT.							
CO2	Analy	se the p	rotocol	ls based	on the app	plication of	of smart dev	vices.						
CO3	Appre	ciate the	e secu	rity for	data and si	mart devid	ces.							
CO4	Descr	ibe the r	eal tim	e applic	cation of I	oT in indu	stries.							
CO5	Imple	ment ini	novativ	e syster	ns using I	oT.								
MappingofCou	rseOutco	mewith	n Prog	ram Ou	itcome(P(	Os)	<b>D</b> 0 <b>F</b>	Doo	DO	0	<b>D</b> 010	<b>D</b> 044		010
Cos/POs	PO1 2	PO2 2	PO3	PO4	PO5	PO6	P07	P08		9	PO10	<u>2011</u>	P	2
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CO2	5	5	3	3	5	3	4	2	4		3			4
<u>CO3</u>	3	3	3	3	3	3	3	3	1		3	3		3
<u>CO4</u>	2	3	1	3	3	3	2	2	3		3	3		2
	3	3	3	3	3	2	3	3	2		3	2		3
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Category		Engg.Science	Humanitiae &	socialScience	ProgramCore	ProgramElective	OpenElective	Practical/Project		Internships/Tech	calSkills	SoftSkills		
Approval														

EDUCATIONAL AND RESEARCH INSTITUTE	At NAAC
University with Graded Autonomy Status	
(An ISO 21001 : 2018 Certified Institution)	
Perivar E.V.R. High Road, Maduravoval, Chennai-95, Tamilnadu, India.	

SubjectCode: EBRA22E16	SubjectName:IOT FOR ELECTRICAL ENGINEERING	Ty/ Lb/ ETL	L	T/SLr	P/R	С
	Prerequisite:Nil	Ту	3	0/0	0/0	3

# UNIT I INTRODUCTION

Introduction–Need of IoT in Electrical Engineering–Characteristics of IoT–Challenges in implementation of IoT– Configuration and Scalability– Efficiency– Qualityof Service.

# UNIT II PROTOCOLS

Messaging protocols, Transport protocols, IPv4, IPv6, URI.

# UNIT III IoT SECURITY

Various security issues and need-architecture- requirement-challenges and algorithms.

# UNIT IV INDUSTRIAL IoT

Real-TimeMonitoringandControlofProcesses–DeployingSmartMachine–SmartSensor–SmartControllers – SCADA– Proprietary Communication.

## UNIT V APPLICATION BUILDING WITH IoT

Monitoring of Electrical Machines-SmartHomes -Building Automation-Lighting industry- Vehicle Charging Station.

# **TotalNo.OfPeriods: 45**

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# **TEXTBOOKS:**

- 1. Internet of Things, Vasudevan, Nagrajan and Sundaram, Wiley ,India.
- 2. IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things,
- David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, Cisco Press, 2017.
- 3. The Internet 'of Things: Enabling Technologies, Platforms, and Use Cases, Pethuru Raj, Anupama C. Raman, CRC Press, Taylor & Francis ,2017.

## **REFERENCES:**

- 1. Internet of Things: A Hands-on Approach, Arshdeep Bahga, Vijay Madisetti, 2014.
- Smart Buildings Digitalization: IoT and Energy Efficient Smart Buildings Architecture and Applications, O.V. Gnana Swathika, K. Karthikeyan, Sanjeevi kumar Padmanaban, CRC Press, 2022.
   https://www.electricaltechnology.org/2016/07/internet-of-things-iot-and-its-applications-in-electricalpower-industry.html



# **PROGRAM ELECTIVE: IV**

DEEMED TO BE UNIVERSITY University with Graded Autonomy Status
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Subject Code	: Su	bject Na	ame: D	IGITAI	LSIGN	AL PRO	DCESSI	NG	Ty / Lb/ETL	L	T /S.L	<b>P/ R</b>	C
EBRA22E17	7										r		
	Pro	erequisi	te: Analo	log and Digital Electronics,					Ту	3	0/0	0/0	3
	Pro	ocessors	and Con	trollers				1 9 9					
L: Lecture T: T	utorial	SLr : Each a d d	: Supervis	edLearn	ingP:Pro	oject R:	Researc	chC:Cre	dits				
1/L/ETL:Theo	bry/Lad/	Embedd	leatneory	and Lab									
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COURSEOU	TCOM	ES(COs	s):(3- 5)										
CO1	Un	derstand	d the conc	epts of s	ignals a	nd syste	ms						
CO2	So	lve Z-Tr	ansforms	and drav	w realiza	ations of	system	s based	on z-transf	forms			
CO3	De	fine DF	T and FF	for pro	cessing	of digita	al signal	s					
CO4	De	Design digital filters based on various methodologies											
CO5	Re	Remember the various digital signal processors											
MappingofCo	ourseOu	tcomes	withProg	ramOut	tcomes(]	POs)							
COs/POs	PO1	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	<b>PO9</b>	<b>PO10</b>	PO11	PO	12
CO1	3	3	3	3	3	2	1	1	1	1	1	2	
CO2	3	3	3	3	3	2	2	1	2	2	1	2	
CO3	3	3	3	3	3	1	1	1	1	1	2	1	
CO4	3	3	3	3	3	3	1	1	2	1	1	1	
CO5	3	3	2	2	2	2	2	2	2	2	2	2	
COs /PSOs	PS	01	PSC	02	PS	03	PS	<b>504</b>					
CO1	3		3		1		3						
CO2	3		3		1		3						
CO3	3		3		1		3						
CO4	3		3		1		3						
CO5	3		3		1		3						
3/2/1 indicate	sStreng	thofCor	relation	3-]	High,2-I	Medium	1, 1-Low	7		T	-		
Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills				
Approval					N								

Subject Code: EBRA22E17	Subject Name: DIGITAL SIGNAL PROCESSING	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite: Analog and Digital Electronics, Processors and Controllers	Ту	3	0/0	0/0	3

# UNIT I SIGNALS & SYSTEMS

Signal classifications – Signal Representation – Classification of Discrete time signals – Typical Discrete timesignals – operation on signals – Discrete time system – Classification of Discrete time systems – solution of differenceEquations.

# UNIT II ZTRANSFORM& REALISATIONS

Z Transform – Properties – System function – Inverse Z Transform – Realization of Digital filters – DirectForm-I,DirectForm-II, Transposed, parallel, cascade,Lattice-Ladder structure

# UNIT III DFT&FFT

Discrete Fourier Transform (DFT) – Definition – Properties – Convolution of sequences – Linear convolution -circular convolution. Introduction to Radix – 2 FFT – Properties – DIT (FFT) – DIF (FFT) – Algorithms of Radix–2FFT– ComputingInverse DFTbydoingadirectDFT

# UNIT IV DESIGN OF DIGITAL FILTER

Review of design techniques for analog low pass filters –Frequency transformation – Properties of IIR filterdesign – Characteristics of FIR filters with linear phase - Fourier series Method – frequency sampling Method –Designof FIR filters usingwindows.

# UNIT V OVERVIEW OF DIGITAL SIGNAL PROCESSOR

Overview of Digital Signal Processors – Application of Digital Signal Processor – Memory Architecture of DSPProcessor – Von Neumann Architecture – Harvard Architecture - Architecture of TMS320C5XProcessor –Addressingmodes– Pipelining.

## **Total No.of Periods :45**

## **Textbooks:**

1.Sanjit k. Mitra "Digital signal processing", A Computer Based Approach, Tata McGraw Hill, NewDelhi

2.B.Venkataramani, M.Bhaskar, "DigitalSignalProcessors, Architecture, Programming and Application", Ta taMcGrawHill, New Delhi, 2003.

3. A lan VO ppenheim, "Signals and Systems", Prentice Hallof India Pvt. Ltd, 2nd Edition, 1997 Hwei Value and Valu

P.Hsu,Schaum"sOutlineSeries, "SignalsandSystems", McGrawHillCompanies, 2ndEdition

## **References:**

1.A.V.Oppenheim, R.W. Schafer and J.R. Buck, "Discrete – Time Signal Processing", 8th Indian reprint, Pearson 2004.

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Subject Code:		Subject N	lame: NE	URAL	NETW	ORKS		,	Гу / Lb/ET	L	T /S	.L	<b>P/ R</b>	C
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	F	Prerequisi	te: Engin	eering N	<b>Iathen</b>	natics		,	Гу	3	0/	0	0/0	3
L: LectureT:T	utoria	l SLr :	Supervis	ed Learn	ingP :	ProjectI	R : Rese	arch C:						
CreditsT/L/E7	L:The	eory/Lab/E	Embedded	Theorya	nd Lab									
OBJECTIVE	:													
• To understand	d the a	rchitecture	chitecture, learning algorithm and issues of various feed forward and feedback neural networks											
• To understand	d the b	viological neural network and to model equivalent neuron models												
COURSEOUT	COM	IES(COs):(3-5)												
Upon the comp	letion	of the course the students will be able to												
CO1		Understan	d the basi	ic workin	ng prin	ciple of	neuron							
CO2		Compare	the operat	tion of si	yer perce	ptron								
CO3		Analyze th	he signific	cance of	rithm									
CO4		Demonstr	ate the co	mputer s	imulati	ion of fe	ature m	apping n	odels					
CO5		Implement a neuro dynamical model												
MappingofCo	ourse	Outcomes	utcomeswith ProgramOutcomes(POs)											
COs/POs	<b>PO1</b>	PO2	PO3	PO4	PO5	5 PO	6 PO	7 PO8	PO	)	PO10	PO PO	11 PC	D12
CO1	3	3	3	3	2	2	1		1		1			
CO2	3	3	3	3	3	2	1				1			
CO3	3	3	3	3	3	1	1		1			1		
CO4	3	3	3	3	3	1		1					1	
CO5	3	3	2	3	3							1	1	
COs /PSOs	1	PSO1	P	802		PSO3		PSO4						
	I		2		2									
C02	2		1		2		2							
CO4	3		3		3		3							
C04	3		3		3		3							
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Approval														

Subject Name: NEURAL NETWORKS Subject Code: Т Ty/ L Lb/ET /S.L

(An ISO 21001 : 2018 Certified Institution) Perivar E.V.R. High Road, Maduravoval, Chennai-95, Tamilnadu, India.

UNIT -I INTROD	UCTION

**EBRA22E18** 

A Neural Network, Human Brain, Models of a Neuron, Neural Networks viewed as Directed Graphs, Network Architectures, Knowledge Representation, Artificial Intelligence and Neural Networks

# **UNIT - II SINGLE LAYER AND MULTILAYER PERCEPTRON**

EDUCATIO

**Prerequisite: Engineering Mathematics** 

Adaptive Filtering Problem, Unconstrained Organization Techniques, Linear Least Square Filters, Least Mean Square Algorithm, Learning Curves, Learning Rate, Annealing Techniques, Perceptron -Convergence Theorem, Relation Between Perceptron and Bayes Classifier for a Gaussian Environment, Back Propagation Algorithm, XOR Problem, Heuristics, Output Representation and Decision Rule, Feature Detection

Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques,

# **UNIT - III BACK PROPAGATION**

# **UNIT - IV SELF-ORGANIZATION MAPS (SOM)**

Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification

Virtues, and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

# **UNIT - V NEURO DYNAMICS**

Dynamical Systems, Stability of Equilibrium States, Attractors, Neuro Dynamical Models, Manipulation of Attractors as a Recurrent Network Paradigm, Hopfield Models

**Total No.of Periods :45** 

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# Text book:

1. Neural Networks a Comprehensive Foundations, Simon Haykin, PHI edition.

# **References:**

1. Artificial Neural Networks - B. Yegnanarayana Prentice Hall of India P Ltd 2005

- 2. Neural Networks in Computer Intelligence, Li Min Fu TMH 2003
- 3. Neural Networks James A Freeman David M Skapura Pearson Education 2004.
- 4. Introduction to Artificial Neural Systems Jack M. Zurada, JAICO Publishing House Ed. 2006



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OBJECTIVES:	v wirolog	e comm	unication	n concer	ute and a	ntanna	tack	niques							
	COMES		3- 5)					inques							
CO1	Underst	and the $\frac{1}{2}$	concept	of wirele	ess chan	nels									
CO2	Describe	e the cor	ncept of	cellular	architec	ture									
CO3	Analyse	digital	signaling	g technic	ues for										
CO4	Discuss	multipa	th mitiga	nitigation techniques											
CO5	Impleme	ent anter	nnas for	nas for wireless communication											
MappingofCou	rseOutco	omeswit	hProgra	amOutc	omes(P	Os)									
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CO1	3	3	3	3	3	3	-	3	1	3	3		3	3	
CO2	3	3	3	2	3	3		3	3	2	3		2	2	
CO3	3	3	3	3	2	3	-	1	2	3	1		3	3	
CO4	3	3	3	2	3	3		3	3	2	3		2	2	
CO5	3	3	3	3	2	3		1	2	3	1		3	3	
COs /PSOs	PS	01	PS	02	PS	503		PS	04						
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SubjectCode:	SubjectName:WIRELESS COMMUNICATION	Ту /	L	Т	<b>P/ R</b>	С
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<b>EBRA22E19</b>		L		r		
	Prerequisite: Analog and Digital Electronics,	Ту	3	0/0	0/0	3
	Electrical and Electronics circuits					

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## UNIT I WIRELESSCHANNELS

Large scale path loss – Path loss models: Free Space and Two-Ray models -Link Budget design – Small scalefading- Parameters of mobile multipath channels - Time dispersion parameters Coherence bandwidth – Dopplerspread & Coherence time, Fading due to Multipath time delay spread – flat fading - frequency selective fading -Fadingdueto Doppler spread- fastfading- slowfading.

# **UNIT II CELLULARARCHITECTURE**

Multiple Access techniques- FDMA, TDMA, CDMA - Capacity calculations-Cellular concept Frequencyreuse - channel assignment- hand off- interference & system capacity- trunking & grade of service - Coverageandcapacityimprovement.

# UNIT III DIGITALSIGNALINGFORFADING CHANNELS

Structure of a wireless communication link, Principles of Offset-QPSK, p/4-DQPSK, Minimum Shift Keying, Gaussian Minimum Shift Keying, Error performance in fading channels, OFDM principle-Cyclic prefix, Windowing, PAPR.

# UNIT IV MULTIPATHMITIGATION TECHNIQUES

Equalisation - Adaptive equalization, Linear and Non-Linear equalization, Zero forcing and LMS Algorithms.Diversity – Micro and Macrodiversity, Diversity combining techniques, Error probability in fading channels withdiversityreception, Rake receiver,

# **UNIT V MULTIPLE ANTENNA TECHNIQUES**

MIMO systems-spatial multiplexing -System model-Pre-coding-Beam formingtransmitterdiversity, receiver diversity-Channelstateinformation-capacityinfadingand nonfadingchannels.

# **Total No. ofPeriods:45**

## **TEXTBOOKS:**

1. Rappaport, T.S., "Wirelesscommunications", SecondEdition, PearsonEducation, 2010.

2. Andreas.F.Molisch, "WirelessCommunications", JohnWiley–India, 2006.

## **REFERENCES:**

1. David Tse and Pramod Viswanath, "Fundamentals of Wireless Communication", Cambridge University Press, 2005.

2. UpenaDalal, "WirelessCommunication", OxfordUniversityPress, 2009.

3. VanNee, R. and Ramji Prasad, "OFDM forwireless multimedia communications", ArtechHouse, 2000.

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L: LectureT: Tutorial SLr : Supervised LearningP: Project R:ResearchC:Credits $TLZETL:TheoryLab/EmbeddedTheoryand Lab$ OBJECTIVE:  • To learn the basics of MOS Transistors. • To study the design of combinational logic circuits using CMOS. • To learn CMOS sequential logic circuits design. • To implement design using FPGA. COURSEOUTCOMES(COs):(3 - 5) CO1 Understand the concepts of MOS Transistors CO2 Analyse combinational logic circuits using CMOS transistor CO3 Define sequential logic circuits using CMOS transistor CO3 Define sequential logic circuits using CMOS transistor CO4 Describe arithmetic building blocks using CMOS transistor CO5 Implement digital design using FPGA. Mapping of Course Outcomes with Program Outcomes/POS CO3 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0		Pr	erequisi	ite: Analo	g and D	ngitai E	lectron	ics		1 y	3	0/0	0/0	3		
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SubjectCode: EBRA22E20	SubjectName: VLSI DESIGN	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite: Analog and Digital Electronics	Ту	3	0/0	0/0	3

## UNIT I MOS TRANSISTOR PRINCIPLE

NMOS and PMOS transistors, Process parameters for MOS and CMOS, Electrical properties of CMOS circuitsand device modeling, Scaling principles and fundamental limits, CMOS inverter scaling, propagation delays, Stickdiagram, Layoutdiagrams

## UNIT II COMBINATIONAL LOGIC CIRCUITS

Examples of Combinational Logic Design, Elmore"s constant, Pass transistor Logic, Transmission gates, staticanddynamic CMOS design, Powerdissipation– Lowpowerdesign principles

#### UNIT III SEQUENTIAL LOGIC CIRCUITS

Static and Dynamic Latches and Registers, Timing issues, pipelines, clock strategies, Memory architecture andmemory control circuits, Lowpower memorycircuits,SynchronousandAsynchronous design

## UNIT IV DESIGNING ARITHMETIC BUILDING BLOCKS

Datapathcircuits, Architectures for ripple carry adders, carry look ahead adders, Highspeed adders, accumulators, Multipliers, dividers, Barrelshifters, speed and areatrade off

## UNIT V IMPLEMENTATION STRATEGIES

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures, FPGA interconnectroutingprocedures.

#### **TEXTBOOKS:**

1. Jan Rabaey, Anantha Chandrakasan, B.Nikolic, "Digital Integrated Circuits: A Design Perspective", SecondEdition, Prentice Hallof India, 2003.

2. M.J.Smith, "ApplicationSpecificIntegratedCircuits", AddissonWesley, 1997

#### **REFERENCES:**

 N.Weste,K.Eshraghian, "Principlesof CMOSVLSIDesign", SecondEdition, AddisionWesley1993
 R.Jacob Baker, Harry W.LI., David E.Boyee, "CMOS Circuit Design, Layout and Simulation", Prentice Hallof India 2005 3. A.Pucknell, Kamran Eshraghian, "BASIC VLSI Design", Third Edition, Prentice Hall of India, 2007

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## **Total No.of Periods :45**

.G r_ EDUCATIONAL AND RESEARCH INSTITUTE **DEEMED TO BE UNIVERSITY** University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

Subject code:	Su	bject N	Name: INTERNET OF THINGS						Ty / Lb/ET	L	T /S.	<b>P/ R</b>	C			
EBRA22E21	L								L		Lr					
	Pr	erequis	ite: Insti	rument	ation a	nd Con	trol		Ту	3	0/0	0/0	3			
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	Analyse	e integra	ation of I	oT with	cloud s	services										
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C05	Implem	ent IoT	systems	using d	ino and G	alileo										
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CO4	3	3	3	3	3	3	3	2	3	3	3	3				
CO5	3	3	3	3	3	3	3	2	3	3	3	3				
COs /PSOs	PS	501	PS	02	PS	503	PS	504								
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<u>CO2</u>	3		3		2		3									
<u>CO3</u>	3		3		2		3									
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Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/Technical kill	Soft Skills							
Approval																

L T **P/ R** C **Subject Code:** SubjectName:INTERNET OF THINGS Ty/ /S. Lb/ET **EBRA22E21** L Lr Ty 3 0/0 0/0 3 **Prerequisite: Instrumentation and Control Engineering, Processors and Controllers** andPython Programming

# UNIT I: INTRODUCTION TO IoT

Definition and Characteristics of IoT-Things in IoT-IoT protocols-Logical Design of IoT-IoT enabling technologies-IoT levels

# UNIT II: DOMAIN SPECIFIC IoT AND M2M

Home Automation-Cities-Environment-Energy-Retail-Logistics-Agriculture-Health and Lifestyle-Introduction toM2M-DifferencebetweenIoTand M2M-SDNand NFV for IoT

# UNIT III:IoT SYSTEM MANAGEMENT AND CLOUD

Need for IoT system management-SNMP-NETCONF-YANG-NETOPEER-IoT design methodology-Case StudyforIoT System-WAMP-AutoBahnfor IoT-Xively-Django-AmazonWeb forIoT-SkyNet IoT.

## UNIT IV:10T SYSTEMS-LOGICAL DESIGN USING PYTHON

Introduction-Installing Python-Python data types and data structures-Control flow-Functions-Modules-Packages-FileHandling-Data/Time Operations-Classes-Pythonpackages of Interest for IoT.

# **UNIT V: IoT PHYSICAL DEVICES**

Raspberry Pi-Linux on Raspberry Pi-Raspberry Pi Interfaces-Programmig Raspbeery Pi with Python-Arduinoboards-OtherIoTdevices-DataanalyticsforIoT-IntelGalileoArduinoboardspecification (Withsimpleprograms)

# **Total No.of Periods :45**

## **TEXTBOOKS:**

1. Arshadeep Bahaga, Vijay Madisetti, "Internet of things-A hands –on approach", Universities press, First Edition2015

2. A drian McEwen and Hakim Cassimally, "Designing the Internet of Things", Wiley, First Edition, 2014

3. CHillarGastn,"InternetofThingswithPython", Packtpublishing, firstedition, 2016

# **REFERENCES:**

 $\label{eq:linear} 1. \ Dominique DGuinard and Vlad M. Trifa, ``Building the Web of things with examples in Node. js and Raspberry Pi'', Manning Publications Co, 2016$ 

2. MarcoSchwartz, "InternetofThingswiththeRaspberryPi:BuildInternetofThingsProjectsUsingtheRaspberryPiPlat form", Kindle Edition

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# **PROGRAM ELECTIVE: V**

-G EDUCATIONAL AND RESEARC **H INSTITUTE** DEEMED TO BE UNIVERSITY University with Graded Autonomy Status (An ISO 21001 : 2018 Certified Institution) Periyar E.V.R. High Road, Maduravoyal, Chennai-95. Tamilnadu, India.

SubjectCode	: Su	bjectNa	me:HUN	IAN CO	OMPUT	ER IN	<b>FERAC</b>	TION	Ty/	L	T /S I	<b>P/ R</b>	С
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Tv/Lb/ETL·T	heory/L	ab/Emb	eddedThe	orvandI	ah	-							
OBJECTIVE	<u>E:</u>			Juna	<u>-ue</u>								
•	Learn	the four	ndations o	of Huma	n Comp	uter Inte	eraction						
•	Be far	niliar w	ith the dea	sign tech	nologie	s for inc	lividual	s and pe	ersons wit	h disabil	ties		
•	Mana	ge HCI		e	C			1					
COURSEOU	TCOM	ES(CO	s):(3- 5)										
CO1	Un	Inderstand the concepts of Humans with respect to computers											
CO2	An	Analyse the usage of computers in HCI											
CO3	Di	Discuss the uses of HCI in multiple domains											
CO4	De	esign HCI systems for diverse populations											
CO5	Inv	nvestigate HCI with respect to technology transfer and other issues											
MappingofC	ourseO	utcomeswithProgramOutcomes(POs)											
COs/POs	<b>PO1</b>	PO2	PO3	PO4	PO5	<b>PO6</b>	<b>PO7</b>	<b>PO8</b>	PO9	PO10	PO11	PO	12
CO1	3	3	2	3	2	3	3	2	3	3	3		3
CO2	3	3	3	3	3	3	2	2	3	3	3		2
CO3	3	3	3	3	2	2	3	3	3	2	3		1
CO4	3	3	3	3	2	2	3	3	3	2	3		1
CO5	3	3	3	3	2	2	3	3	3	2	3		1
COs /PSOs	PS	501	PS	02	PS	03	PS	<b>SO4</b>					
CO1	3		3		3		3						
CO2	3		3		2		3						
CO3	3		3		2		3						
CO4	3		3		1		3						
CO5	3		3		1		3						
3/2/1 indicate	esStreng	gthofCo	rrelation	3	-High,2	-Mediu	m, 1-Lo	W		1	n		
ory	lces	IgSciences	s Sciences	ore	lectives	ives	Project	ps / TechnicalSkil					
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Approval													



SubjectCode:	SubjectName:HUMAN COMPUTER INTERACTION	Ty/	L	Т	<b>P/ R</b>	С
		Lb/ET		/S.L		
EBRA22E22		L		r		
	Prerequisite: Basics of Computers and applications	Ту	3	0/0	0/0	3

# UNIT I: HUMANS IN HCI

Introduction-implications for HCI-overview of HCI-Mentor models in HCI-emotions in HCI-cognitive architecture–taskloading and stress in HCI-theoretical framework and mitigation strategies-motivating ,influencing and persuading users –human error identification inHCI

# **UNIT II: COMPUTERS IN HCI**

Input technologies and techniques-sensor and recognition based input for interaction-visual displays-haptic interfaces-nonspeech auditory output-network based interaction-wearable computers-design of computer workstation

# UNIT III: APPLICATION/DOMAIN SPECIFIC DESIGN

HCI in health care-designing emotions for games, entertainment interfaces and interactive eproductsmotor vehicle driver interfaces-HCI in aerospace-usercentered design in games

## **UNITIV:DESIGNING FOR DIVERSITY**

The digital divide-the role of gender in HCI-IT and older adults-HCI for kids-IT for cognitive support-physical disabilities and computing technologies—an analysis of impairments-computing technologies for deaf and hard of hearing users

# UNITV:MANAGING HCI AND EMERGING ISSUES

Technology transfer-augmenting cognition in HCI-human values, ethics and design, cost justification-future trends in HCI

## **Total No. ofPeriods:45**

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## **TEXTBOOKS:**

- 1. AlanDix,JanetFinlay,GregoryAbowd,RussellBeale,"HumanComputerInteraction",3rdEdition,Pearso n Education,2004.
- 2. Preece J., Rogers Y., Sharp H., Baniyon D., Holland S. and Carey T. Human Computer Interaction, Addison-Wesley, 1994.

## **REFERENCES:**

- 1. BrianFling, "MobileDesignandDevelopment", FirstEdition, O"ReillyMediaInc., 2009.
- 2. BillScottandTheresaNeil, "DesigningWebInterfaces", FirstEdition, O"Reilly, 2009.

University with Graded Autonomy Status
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BRA22E23         Interreguisite: Artificial Intelligence and Machine Learning         Interreguisite: Artificial Intelligence and Machine Learning         Ty         3         0/0         0/0         3           L: Lecture T: Tutorial         SL: Supervised Learning           ProjectR: ResearchC: Credits Ty/Lb/ETL: Theory/Lab/Embedded Theoryand Lab           OBJECTIVE:           • To learn advanced machine learning techniques         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •         •<	Subject Code:	: Su	bjectNa	me:ADV	ANCE	D MAC	HINE	LEARN	NING	Ty / Lb/ET	L	T /S L	<b>P/ R</b>	C	
Prerequisite: Artificial Intelligence and Machine LearningTy30/00/03L: LectureT:TutorialSLr : SupervisedLearningP:ProjectR:ResearchC:CreditsTy/Lb/ETL:Theory/Lab/Embedded Theoryand LabOBJECTIVE:• To learn advanced machine learning techniques• To acquire knowledge about clustering and nonparametricmethods• To understand multilayer perceptrons and dimensionality reduction• To design and analyze machine learning experiments.COURSEOUTCOMES(COs):(3-5)CO1Understand the concept of Machine LearningCO2Analyse parametric and multivariate methodsCO3Define clustering and nonparametric methodsCO4Describe linear discrimination and multilayer perceptronsCO5Implement machine learning models using various algorithmsMappingofCourseOutcomeswithProgramOutcomes(POS)CO2232CO3PO10PO11PO12CO3Implement machine learning models using various algorithmsMappingofCourseOutcomeswithProgramOutcomes(POS)CO222CO323 <td colsp<="" td=""><td>EBRA22E23</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>LUILI</td><td></td><td>r</td><td></td><td></td></td>	<td>EBRA22E23</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>LUILI</td> <td></td> <td>r</td> <td></td> <td></td>	EBRA22E23									LUILI		r		
Machine LearningL: LectureT:TutorialSL: SupervisedLearningPProjectR:ResearchC:CreditsTy/Lb/ETL:Theory/Lab/Embedded Theoryand LabOBJECTIVE:• To acquire knowledge about clustering and nonparametricmethods• To understand multilayer perceptrons and dimensionality reduction• To design and analyze machine learning experiments.COURSEOUTCOMES(COS):(3-5)CO1Understand the concept of Machine LearningCO2Analyse parametric and multivariate methodsCO3Define clustering and nonparametric methodsCO4Describe linear discrimination and multilayer perceptronsCO5Implement machine learning models using various algorithmsMappingofCourseOutcomes/POSCO4Describe linear discrimination and multilayer perceptronsCO5Implement machine learning models using various algorithmsMappingofCourseOutcomes/POSCO4Describe linear discriminationCO3PO1PO2PSO3PSO3PSO3PSO4CO5Implement machine learningCO5CO42 <tr <td="" colspan="2">2</tr>		Pr	ereauisi	ite: Artifi	icial Inf	telligend	e and			Tv	3	0/0	0/0	3	
L: Lecture T: Tutorial SLr : SupervisedLearningP :ProjectR:ResearchC:CreditsTy/Lb/ETL:Theory/Lab/Embedded Theoryand Lab OBJECTIVE: • To learn advanced machine learning techniques • To acquire knowledge about clustering and nonparametricmethods • To understand multilayer perceptrons and dimensionality reduction • To design and analyze machine learning experiments. COURSEOUTCOMES(COs): (3-5) CO1 Understand the concept of Machine Learning CO2 Analyse parametric and multivariate methods CO3 Define clustering and nonparametric methods CO4 Describe linear discrimination and multilayer perceptrons CO5 Implement machine learning models using various algorithms MappingofCourseOutcomeswithProgramOutcomes(POS) CO3 3 3 2 3 3 2 2 3 3 2 3 2 3 2 3 2 3 2 3		Ma	achine I	Learning		enigen	ie und			-5		0,0	0,0	-	
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3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low	CO5	2		3		1		2							
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Subject Code:	SubjectName:ADVANCED MACHINE LEARNING	Ty/	L	Т	<b>P/ R</b>
		Lb/ETL		/S.L	
EBRA22E23				r	
	Prerequisite: Artificial Intelligence and Machine	Ту	3	0/0	0/0
	Learning				

# UNITI: INTRODUCTION TO MACHINE LEARNING

Machine Learning – Machine learning applications – learning association – supervised learning – learning a classfrom examples – learning multiple classes – regression – model selection and generation – Bayestan decisiontheory– losses and risk– discriminate functions – association rules.

## UNIT II: PARAMETRIC AND MULTI VARIATE METHODS

Parametricmethods –maximumlikelihood estimation–Baye"sestimator–parametricclassification–regression – tuning model – multivariate methods – multivariate data – multivariate normal distribution – multivariateregression–dimensionalityreduction–subsetselection –factoranalysis–multidimensional scaling–Isomap.

## UNIT III: CLUSTERING AND NON PARAMETRIC METHODS

Clustering - Mixtures densities - k mean clustering - special and hierarchal clustering - Nonparametric densityestimation - generalization to multivariate data - nonparametric classification - outlier data - decision trees - univariate trees - pruning-rule extraction from trees - multivariate trees.

# UNIT IV: LINEAR DISCRIMINATION AND MULTILAYER PERCEPTRONS

Lineardiscrimination-generalizingthelinearmodel-pairwiseseparation-logistic discriminationdiscriminationby regression-multilayer preceptrons-MLP-back propagational gorithmstraining procedures - tuning - dimensionality reduction - deep learning - local models - competitive learning - radial basis - normalized basis - learning vector quantization - mixture of experts.

#### **UNIT V: KERNEL MACHINES AND GRAPHICAL MODELS**

Kernel machine – optimal separating hyperplane – SVM – multiple kernel learning – large margin nearestneighbour classifier – graphical models– generative models –Separation - belief propagation – Hidden morkov models–Bayesian estimation –combining multiple learners–reinforcement learning.

**Total No.of Periods :45** 

## **TEXTBOOKS:**

- 1. EthemAlpaydin,"IntroductiontoMachine Learning"3rdEditionPHI-2014
- 2. SnilaGollapudi, "PracticalMachineLearning" PACKT-2016

#### **REFERENCES:**

- 1. TomMMitchell, "MachineLearning" McGraw-Hill -2013
- 2. DavidBarber "BayesianReasoningandMachineLearning" CambridgeUniversityPress-2015.

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	•	To exp	ose the s	tudents	s to prol	babilist	ic meth	ods					
	•	To und	lerstand t	he con	cept of	randon	n walk						
	•	To exp	ose the s	tudents	s to diff	erent ty	pes of a	applica	tions of r	andomi	zed algo	rithms	5
COURSEO	UTCO	MES(C	:Os):(3-	5)									
CO1	Ur	Iderstan	d the co	ncept of	f rando	mized a	lgorith	ms					
CO2	De	efine Pr	obabilisti	ic meth	ods for	randon	n variat	oles					
CO3	Ar	nalyse a	lgebraic	techniq	ues and	l applic	ations f	for rand	lomized	algorith	ms		
CO4	De	fine Ge	eometric	and Gr	aph alg	orithms	6						
CO5	Im	plemen	t Hash a	nd onli	ne algo	rithms							
Mappingof	Course	Outcon	neswithl	rograi	nOutco	omes(P	Os)	DOP	DOO	<b>DO10</b>	<b>DO11</b>		10
COS/POS	POI	POZ	PUS	PU4	P05	PU 6	PO 7	PUð	P09	POIO	POII	PU	12
C01	3	3	2	3	3	2	2	2	3	2	3		3
CO2	2	3	2	3	3	2	2	3	2	3	2		3
CO3	3	3	2	3	3	2	3	2	3	2	3		2
CO4	3	3	2	3	3	2	3	2	3	2	3		2
CO5	3	3	2	3	3	2	3	2	3	2	3		2
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CO5	2		3		1		2						
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Subject	Code:	SubjectName:RANDOMIZED ALGORITHMS	Ту	L	Т	<b>P/ R</b>	С
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			b/		Lr		
EBRA22	2E24		ETL				
		Prerequisite: Programming and	Ту	3	0/0	0/0	3
		Mathematical knowledge					

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# UNIT I :INTRODUCTION TO RANDOMIZED ALGORITHMS

EDUCATION

Introduction to Randomized Algorithms - Min-cut – Elementary Probability Theory – Models of RandomizedAlgorithms – Classification of Randomized Algorithms – Paradigms of the Design of Randomized Algorithms -GameTheoreticTechniques–GameTreeEvaluation–MinimaxPrinciple – RandomnessandNonUniformity.

## **UNIT II :PROBABILISTIC METHODS**

MomentsandDeviations-occupancyProblems-MarkovandChebyshevInequalities-Randomized Selection- Two Point Sampling - The Stable Marriage Problem - The Probabilistic Method - Maximum Satisfiability -Expanding Graphs-MethodofConditionalProbabilities- Markov Chains andRandom Walks-2-SATExample - RandomWalkson Graphs- RandomConnectivity

# UNIT III: ALGEBRAIC TECHNIQUES AND APPLICATIONS

Fingerprinting Techniques – Verifying Polynomial Identities – Perfect Matching in Graphs – Pattern Matching –VerificationofMatrixMultiplicationStructuringProblems–Ra-Data ndomTreaps – SkipLists–HashTables.

# UNIT IV :GEOMETRIC AND GRAPH ALGORITHMS

RandomizedIncrementalConstruction–ConvexHulls–Duality–TrapezoidalDecompositions–LinearProgramming–Graph Algorithms–Min-cut–MinimumSpanningTrees.

## UNIT V: HASHING AND ONLIN EALGORITHMS

Hashing–UniversalHashing-OnlineAlgorithms–RandomizedOnlineAlgorithms-OnlinePaging–AdversaryModels–Relatingthe Adversaries–Thek-serverProblem.

**Total No.of Periods :45** 

## **TEXTBOOKS:**

1. RajeevMotwaniandPrabhakarRaghavan, "RandomizedAlgorithms", CambridgeUniversityPress, 1995.

## **REFERENCES:**

1. JurajHromkovic, "DesignandAnalysisofRandomizedAlgorithms", Springer, 2010.

2. MichaelMitzenmacherandEliUpfal, "ProbabiltyandComputing-

RandomizedAlgorithmsandProbabilisticAnalysis", CambridgeUniversity Press, 2005.

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SubjectCode: EBRA22E25	Su	bjectName:GRAPH ALGORITHMS							Ty / Lb/ET L	Ty/LTPLb/ET/S.L/S.LLr					
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L: LectureT:T	utorial	SLr	: Supervis	sedLear	ningP:Pi	roject R	: Resear	rchC:Cr	redits						
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OBJECTIVE				-											
• Te	o under	stand the	e concept a	and nee	d of grap	phs									
• Te	o under	stand va	rious grap	h algori	thms										
• Te	o under	stand the	e various a	applicati	ons of g	raph in	real wor	ld prob	lems						
COURSEOU	тсом	ES(CO	s):( <b>3-</b> 5)												
CO1	Ur	derstan	d the conc	epts of	graphs a	nd vario	ous sub g	graphs							
CO2	De	efine var	ious path	and tree	algorith	nms									
CO3	Ar	nalyse m	atching co	oncepts	in graph	IS									
CO4	Di	scuss Ei	ilerian and	l Hamil	tonian g	raphs									
CO5	Im	plement	Graph is	omorphi	sm										
MappingofCo	ourseO	utcomes	withProg	gramOu	tcomes	(POs)	DOF	DOO	DOA	<b>DO10</b>	_ DO11		10		
COS/POs	<u>POI</u>	PO2	PO3	PO4	PO5	PO6	PO7	P08	PO9	PO10		PO 2	12		
C01	3	3	3	3	2	3	2	2	3	2	3	3			
CO2	2	3	3	3	1	3	2	2	3	2	3	3			
CO4	2	3	3	3	1	3	2	2	3	2	3	3			
CO5	2	3	3	3	1	3	2	2	3	2	3	3			
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gory	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSH l	Soft Skills						
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SubjectCode:	SubjectName:GRAPH ALGORITHMS	Ty /	L	Т	<b>P/ R</b>	С
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	Prerequisite: Programming and	Ту	3	0/0	0/0	3
	Mathematical knowledge					

# **UNIT I:INTRODUCTION:**

Graphs, subgraphs, matrix representations, degree sequence, connected graphs, vertex and edge connectivity, distance in graphs, weighted graphs, graph classes, interval graphs, clique, independent set, vertex cover. Trees -characterizations, rooted, unrooted, spanning tree, matrix tree theorem, Cayley formula.Graph operations -union, intersection, product. Digraphs-connectivity, tournament, transitive closure,topological order.Algorithms - time and space complexities.

# **UNIT II:PATH AND TREE ALGORITHMS:**

EDUCATIO

Shortest path problem, Dijkstra, s algorithm, Floyd, s algorithm for all pair shortest path, BellmanFord-Mooreshortest path algorithm for graphs with negative length edges. Minimum weight spanning tree – fundamentalcycles,cotrees and bonds,Prims andKruskals,,salgorithms,Cheriton-Tarjanalgorithm.Depthfirstandbreadth-firstalgorithms forfindingblocks.

# **UNIT III:MATCHING:**

Maximum and perfect matchings, augmenting path, Berge's, Konig's and Tutte's theorems, Hall's theorem, Hungarian algorithm, Edmond-Blossom algorithm. Kuhn Munkre algorithm for optimal assignment.NETWORK FLOW: Maximum flow in a network, minimum cut, Ford-Fulkerson algorithm, Max-flow min-cuttheorem.Similaritybetween matchingand flowtheories.

# **UNIT IV: EULERIAN ANDHAMILTONIANGRAPHS:**

Eulerian trails and tours. Optimal Chinese Postman Tour - Edmond, s and Johnson algorithm, Eulerian trail-Fleury.salgorithm.Hamiltonian cycles-Ores and Dirac'sconditions.Graycodes.Traveling Salesman problem-Christofide's algorithm.VERTEX COLORING: Vertex coloring and bounds. Sequential coloring, largestdegree first algorithms. Maximum clique and vertex coloring. Mycielski,,s construction for large chromatic number.

# **UNIT V:GRAPH ISOMORPHISM:**

Isomorphism, subgraph isomorphism, László Babai's quasi-polynomial time solution for graph isomorphismproblem.PLANAR GRAPHS: Euler's formula, dual graph, Kuratowski's theorem, 4-color problem, Wagner'stheorem.Planaritytesting-Hopcraft-Tarjan algorithm.

## **TEXTBOOKS:**

1. WillianKocay, DonaldL.Kreher, Graphs, Algorithms, and Optimization, CRCPress, 2013.

2. JonathanGross andJayYellen, GraphTheoryand its Applications, CRCPress, 2006.

## **REFERENCES:**

- 1. DouglasBWest, Introduction to GraphTheory, PHILearningPvt.Ltd., 2012.
- 2. NaveedSherwani,AlgorithmsforVLSIPhysical DesignAutomation,Springer,2013.
- 3. Bang-Jensen, Jørgen, Gutin, GregoryZ., Diagraphs: Theory, Algorithms and Applications, Springer-Verlag, 2010.

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# **Total No.of Periods :45**



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<u>CO1</u>	3	3	3	3	3	3	3	1	3	3	3	3	
<u>CO2</u>	3	3	3	2	3	3	3	3	2	3	2	2	
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Subject Code:	SubjectName:SYSTEM SOFTWARE	Ty/	L	Т	<b>P/ R</b>	С
		Lb/ET		/S.L		
EBRA22E26		L		r		
	Prerequisite: Basics of computer software	Ту	3	0/0	0/0	3
	and hardware					

# UNIT I ASSEMBLERS

ReviewofComputerArchitecture–MachineInstructionsandPrograms–Assemblers– BasicAssemblerFunctions– Assembler Features– AssemblerDesignOptions

# UNIT II LOADERS AND LINKERS

LoadersandLinkers–BasicLoaderFunctions–Machine-DependentLoaderFeatures–Machine-IndependentLoaderFeatures–LoaderDesignOptions-DynamicLinkingandLoading-Objectfiles-Contents of an object file – designing an object format – Null object formats- Code sections-Relocation–Symbolsand Relocation–Relocatablea.out-ELF.

## UNIT III MACROPROCESSORS AND EMULATORS

Macroprocessors – Basic Macro Processor Functions – Machine-Independent Macro Processor Features – Macro Processor Design Options - - Emulation - basic Interpretation – Threaded Interpretation – Interpretingacomplex instruction set–binarytranslation.

# UNIT IV VIRTUAL MACHINES

Pascal P-Code VM – Object-Oriented VMs – Java VM Architecture – Common Language Infrastructure –Dynamic Class Loading.

## UNIT V ADVANCED FEATURES

Instruction Set Issues-Profiling-Migration-Grids-Code optimizations-Garbage Collection-Examples of real world implementations of systems of tware

**Total No.of Periods:45** 

## **TEXTBOOKS:**

- 1. LelandL.Beck, "SystemSoftware", 3rded., Pearson Education, 1997.
- 2. JohnR. Levine, "Linkers&Loaders", MorganKauffman, 2003.

## **REFERENCES:**

1. JohnJDonovan, "SystemsProgramming", McGrawHill, 1999.

- 2. DhamdhereDM, "SystemsProgramming", TataMcGrawHill, 2001.
- 3. AhoAV, SethiRandUllmanJD, "Compilers: Principles, Techniques and Tools", AddisonWesley, Longman, 1999.
- 4. DhamdhereDM, "CompilerConstructionPrinciplesandPractice", MacmillanCompany, 1997.

5. HolubAllenI, "CompilerDesigninC", PrenticeHall, 2001.

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EDUCATIONAL AND RESEARCH INSTITUTE	Att Att
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#### SubjectName:NATURAL LANGUAGE **Subject Code:** Ty/ L Т P/RС PROCESSING Lb/ET /S.L **EBRA22E27** L r 0/0 **Prerequisite: Programming knowledge** Ty 3 0/03

(An ISO 21001 : 2018 Certified Institution) Perivar E.V.R. High Road, Maduravoval, Chennai-95, Tamilnadu, India.

# UNIT I INTRODUCTION

Origins and challenges of NLP – Language Modeling: Grammar-based LM, Statistical LM - Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Detecting and Correcting Spelling Errors, Minimum Edit Distance

# UNIT II WORD LEVEL ANALYSIS

Unsmoothed N-grams, Evaluating N-grams, Smoothing, Interpolation and Backoff – Word Classes, Part-of-Speech Tagging, Rule-based, Stochastic and Transformation-based tagging, Issues in PoS tagging – Hidden Markov and Maximum Entropy models.

# UNIT III SYNTACTIC ANALYSIS

Context-Free Grammars, Grammar rules for English, Treebanks, Normal Forms for grammar – Dependency Grammar – Syntactic Parsing, Ambiguity, Dynamic Programming parsing – Shallow parsing – Probabilistic CFG, Probabilistic CYK, Probabilistic Lexicalized CFGs - Feature structures, Unification of feature structures.

# UNIT IV SEMANTICS AND PRAGMATICS

Requirements for representation, First-Order Logic, Description Logics – Syntax-Driven Semantic analysis, Semantic attachments – Word Senses, Relations between Senses, Thematic Roles, selectional restrictions – Word Sense Disambiguation, WSD using Supervised, Dictionary & Thesaurus, Bootstrapping methods – Word Similarity using Thesaurus and Distributional methods.

# UNIT V DISCOURCE ANALYSIS AND LEXICAL RESOURCES

EDUCATIO

Discourse segmentation, Coherence – Reference Phenomena, Anaphora Resolution using Hobbs and Centering Algorithm – Coreference Resolution – Resources: Porter Stemmer, Lemmatizer, Penn Treebank, Brill's Tagger, WordNet, PropBank, FrameNet, Brown Corpus, British National Corpus (BNC).

# **Total No.of Periods: 45**

212

# **TEXT BOOKS:**

1. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.

2. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Pythonl, First Edition, O_Reilly Media, 2009.

# REFERENCES

1. Breck Baldwin, —Language Processing with Java and LingPipe Cookbook, Atlantic Publisher, 2015.

2. Richard M Reese, —Natural Language Processing with Javal, O_Reilly Media, 2015.



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