F/CDD/004
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FACULTY OF ENGINEERING AND TECHNOLOGY

OUTCOME BASED EDUCATION

Curriculum and Syllabus

B.Tech -Robotics and Automation

(Full time) 2022

DEPARTMENT OF MECHANICAL ENGINEERING

VISION AND MISSION

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 canbe 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.

PROGRAM OUTCOMES

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

Table 2: Revision/modification done in syllabus content:

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/ Modification done
1.	EBRA22002	Electrical and Electronics Circuits	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 – Oscillators - RC Phase shift - Wein Bridge – Hartley - Collpit's analysis Oscillator topic removed from IV unit ,introduced as V unit	Unit –IV- Transistor biasing - CE, CB and CC – Amplifiers - Current gain - Voltage gain - Frequency response - Power amplifiers - Types of Feedback Amplifiers	20%
			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–	

			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 motors 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	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%
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%

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 Programming and Simulation		New Course has been introduced	100%

		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.NO	New courses (Subjects)	New Courses	Value added courses	Life skill	Electives	Inter Disciplinary	Focus on employability/ entrepreneurship/ 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 CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
1	EBEN22001	Technical English	**Ty**	**2**	**0/0**	**0/0**	**2**	**HS**
2	EBMA22001	Mathematics – I	**Ty**	**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.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
1	EBMA22003	Mathematics – II	**Ty**	**3**	**1/0**	**0/0**	**4**	**BS**
2	EBPH22002	Engineering Mechanics	**Ty**	**3**	**0/0**	**0/0**	**3**	**BS/PC**
3	EBCH22002	Industrial Chemistry	**Ty**	**3**	**0/0**	**0/0**	**3**	**BS**
4	EBME22001	Engineering Graphics	**Ty**	**2**	**0/0**	**2/0**	**3**	**ES/PC**
5	EBRA22001	Manufacturing Processes	**Ty**	**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.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
1	EBMA22005	Mathematics III for Mechanical and Civil Engineers	**Ty**	**3**	**1/0**	**0/0**	**4**	**BS**
2	EBRA22002	Electrical and Electronics Circuits	**Ty**	**3**	**1/0**	**0/0**	**4**	**PC**
3	EBRA22003	Electrical Machines	**Ty**	**3**	**0/0**	**0/0**	**3**	**PC**
4	EBME22005	Machine Drawing	**Ty**	**2**	**0/0**	**2/0**	**3**	**PC**
5	EBME22006	Strength of Materials	**Ty**	**3**	**1/0**	**0/0**	**4**	**PC**
6	EBEC22ID4	Analog and Digital Electronics	**Ty**	**3**	**0/0**	**0/0**	**3**	**ID**
7	EBCC22ET1	Universal human values : Understanding harmony	**ETL**	**1**	**0/0**	**2/0**	**2**	**ID**
PRACTICALS								
1	EBRA22L01	Electrical and Electronics Circuits Lab	**Lb**	**0**	**0/0**	**3/0**	**1**	**PC**
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**
					Credits Sub 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	**Ty**	**3**	**1/0**	**0/0**	**4**	**BS**
2	EBRA22004	Basics of Robotics	**Ty**	**3**	**0/0**	**0/0**	**3**	**PC**
3	EBRA22005	Kinematics and Dynamics of Machinery	**Ty**	**3**	**1/0**	**0/0**	**4**	**PC**
4	EBRA22006	Instrumentation and Control Engineering	**Ty**	**3**	**0/0**	**0/0**	**3**	**PC**
5	EBCC22I04/ EBCC22I05	TheIndian Constitution/ TheIndian Traditional Knowledge**(Audit Course)**	**IE**	**2**	**0/0**	**0/0**	**0**	**ID**
PRACTICALS								
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**	**PC**
3	EBRA22L03	Basics of Robotics Lab	**Lb**	**0**	**0/0**	**3/0**	**1**	**PC**
4	EBRA22L04	Instrumentation and Control Lab	**Lb**	**0**	**0/0**	**3/0**	**1**	**PC**
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**
							Credits Sub Total 20	

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	**Ty**	**3**	**0/0**	**0/0**	**3**	**ID**
2	EBRA22007	Design of Machine Elements	**Ty**	**3**	**1/0**	**0/0**	**4**	**PC**
3	EBEC22ID6	Processors and Controllers	**Ty**	**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	**Ty**	**3**	**0/0**	**0/0**	**3**	**PE**
6	EBXX22OEX	Open Elective I	**Ty**	**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								
1	EBEC22IL5	Processors and Controllers Lab	**Lb**	**0**	**0/0**	**3/0**	**1**	**ID**
2	EBCS22IL4	Artificial Intelligence and Machine Learning Lab	**Lb**	**0**	**0/0**	**3/0**	**1**	**ID**
3	EBRA22I02	Technical Skill II	**IE**	**0**	**0/0**	**2/0**	**1**	**SC**
Credits Sub Total							**23**	

SEMESTER VI								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBME22011	CAD,CAM&CIM	**Ty**	**3**	**0/0**	**0/0**	**3**	**PC**
2	EBME22013	Industrial Automation	**Ty**	**3**	**0/0**	**0/0**	**3**	**PC**
3	EBEC22ID7	Embedded System Design	**Ty**	**3**	**1/0**	**0/0**	**4**	**ID**
4	EBRA22EXX	Program Elective II	**Ty**	**3**	**0/0**	**0/0**	**3**	**PE**
5	EBXX22OEX	Open Elective II	**Ty**	**3**	**0/0**	**0/0**	**3**	**OE**
PRACTICALS								
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**	**0**	**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							**21**	

SEMESTER VII								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBRA22008	Kinematics and Dynamics of Robots	**Ty**	**3**	**1/0**	**0/0**	**4**	**PC**
2	EBRA22EXX	Program Elective III	**Ty**	**3**	**0/0**	**0/0**	**3**	**PE**
3	EBRA22009	Industrial Applications of Robots	**Ty**	**3**	**0/0**	**0/0**	**3**	**PC**
4	EBRA22010	Machine Vision System	**Ty**	**3**	**0/0**	**0/0**	**3**	**PC**
5	EBRA22011	Autonomous Mobile Robots	**Ty**	**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 Simulation Lab	**Lb**	**0**	**0/0**	**3/0**	**1**	**PC**
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**	**P**
5	EBFL22IXX	Foreign Language	**IE**	**1**	**0/0**	**1/0**	**1**	**HS**
						Credits Sub Total		**22**

SEMESTER VIII								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/ Lb/ ETL/IE**	**L**	**T/ S.Lr**	**P/R**	**C**	**Category**
1	EBCC22ID1	Engineering Economics and Industrial Management	**Ty**	**3**	**0/0**	**0/0**	**3**	**ID**
2	EBRA22EXX	Program Elective IV	**Ty**	**3**	**0/0**	**0/0**	**3**	**PE**
3	EBRA22EXX	Program Elective V	**Ty**	**3**	**0/0**	**0/0**	**3**	**PE**
PRACTICALS								
1	EBRE22L07	Project Phase – II	**Lb**	**0**	**0/0**	**12/12**	**8**	**P**
							Credits Sub Total:	**17**

TOTAL CREDITS: 166

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

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

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

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

Open Elective courses offered to Robotics and Automation Students

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

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

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

Open labs offered to Robotics and Automation Students

COMPUTER SCIENCE AND ENGINEERING								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb /ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
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**
INFORMATION TECHNOLOGY								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb /ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
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**
ELECTRONICS AND COMMUNICATION ENGINEERING								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb /ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
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**

ELECTRICAL AND ELECTRONICS ENGINEERING								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb /ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
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								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb /ETL/IE**	**L**	**T/ SLr**	**P/R**	**C**	**Category**
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**	**C**	**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**
4	EBBT22OL4	Basic Bioinformatics Lab	Lb	0	0/0	3/0	1	**OL**
CHEMICAL ENGINEERING								
S.NO.	**SUBJECT CODE**	**SUBJECT NAME**	**Ty/Lb/ ETL**	**L**	**T/ SLr**	**P/R**	**C**	**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 Name : **TECHNICAL ENGLISH**	Ty/Lb / ETL/IE	L	T/SLr	P/ R	C
	Prerequisite :Nil	**Ty**	**2**	**0/0**	**0/0**	**2**

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

To refresh and stimulate students' English learning through Content Integrated Language Learning to have an in-depth understanding of the components of English language and its use in communication that they are competent in inter-personal and academic communication for a successful career.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Refresh and stimulate their English learning through Content Integrated Language Learning
CO2	Have an in-depth understanding of the components of English language and its use in communication.
CO3	Strengthen their vocabulary and syntactic knowledge for use in academic and technical communication
CO4	Learn to negotiate meaning in inter-personal and academic communication for a successful career
CO5	Engage in organized academic and professional writing for life-long learning and research

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO9	PO1 0	PO1 1	PO12
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	1	-	2	3	3	1	3
CO4	1	2	1	1	3	-	1	-	2	2	1	2
CO5	1	2	1	-	2	1	-	1	3	3	1	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4	
CO1	3		1	1	
CO2	3		1	1	
CO3	3	2	1	1	
CO4	3	2	1	1	
CO5	3	2	1	1	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
			√						

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

Unit I Vocabulary Development: **6**

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 **6**

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: subject-verb agreement

Unit III Reading **6**

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 **6**

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 **6**

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 Language Learning for Engineers, 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.

SubjectCode: EBMA22001	SubjectName:MATHEMATICS–I	Ty/Lb /ETL	L	T/ SLr	P/R	C
	Prerequisite:Nil	Ty	3	1/0	0/0	4

L:LectureT:TutorialSLr:SupervisedLearning
P:ProjectR:ResearchC:CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVES:

- Apply the Basicconcepts in Algebra
- Use the Basic concepts in Matrices
- Identify and solve problem sinTrigonometry
- Understand the Basic concept sin Differentiation
- Apply the Basic concept sin Functions of Several variables

COURSEOUTCOMES(Cos):(3 –5)
Students completing the course were able to

CO1	Find the summation of the given series of binomial,exponential& logarithmic
CO2	Transformation–diagonalmatrix into an equivalent diagonal matrix using orthogonal Transformation.
CO3	Find expansion of trigonometric function into an infinite series and to separate a complex function 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	Evaluate thepartial/ total differentiation and maxima/minima of a function of several variables.

MappingofCourseOutcomes withProgramOutcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3			2	2			3	3		3
CO2	3	3			3	1						3
CO3	3	3			2				2	3		1
CO4	3	3			1				2	3		2
CO5	3	3				2			2	2		3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
	√								

SubjectCode: EBMA22001	SubjectName:MATHEMATICS–I	Ty/Lb /ETL	L	T/ SLr	P/R	C
	Prerequisite:Nil	Ty	3	1/0	0/0	4

UNIT I ALGEBRA **12**

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

UNIT II MATRICES **12**

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 **12**

Expansions of Sin n , Cos n in powers of Sin and Cos Expansion of Tan n – Expansions of Sin^n andCos^n in terms of Sines and Cosines of multiples of – Hyperbolic functions –Separation into real andimaginaryparts.

UNIT IV DIFFERENTIATION **12**

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 **12**

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).

Subject Code	Subject Name :ENGINEERING PHYSICS	Ty/Lb/ ETL	L	T/ SLr	P/R	C
EBPH22ET1	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

- Outline the relation between Science, Engineering & Technology.
- Demonstrate competency in understanding basic concepts.
- Apply fundamental laws of Physics in Engineering & Technology.
- To identify & solve problems using physics concepts.
- Produce and present activities associated with the course through effective technical communication

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Demonstrate competency in understanding basic concepts.
CO2	Utilize scientific methods for formal investigations & demonstrate competency with experimental methods and verify the concept to content knowledge.
CO3	Identify and provide solutions for engineering problems.
CO4	Relate the technical concepts to day to day life and to practical situations.
CO5	Think analytically to interpret concepts.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	2	2	2	1		1	2		1
CO2	3	3	2	2	2	2	1		2	2	1	1
CO3	3	3	3	2	2	2	1	1	1	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	1	2	1	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	1	1
CO2	3	2	1	1
CO3	3	2	1	1
CO4	3	2	1	1
CO5	3	2	1	1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
	√								

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 **12**

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 **12**

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 **12**

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 **12**

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-CO_2 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 **12**

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

.

Total No of Periods: 60

TEXT BOOKS

1Brijlal,M.N.Avadhanulu&N.Subrahmanyam,TextBookofOptics,S.ChandPublications,25th edition,20
2.R. Murugeshan,ElectricityandMagnetism,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,PropertiesofMatter,S.ChandCo.,NewDelhi,1982*
4. *NSubrahmanyam&Brijlal,TextbookofOptics,S.ChandCo.,NewDelhi,1989*
5. *R.Murugeshan,Electricityand Magnetism,S.Chand&Co.,NewDelhi,1995*
6. *ThygarajanK&AjayGhatak,LaserTheoryand Applications,Macmillan,NewDelhi,1981*

Subject Code	Subject Name **ENGINEERING CHEMISTRY**	Ty/Lb/ ETL	L	T/SLr	P/R	C
EBCH22ET1	**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

To deduce practical application of theoretical concepts
To provide and insight into fundamental concepts of chemical thermodynamics
To articulate the water treatment methods
To impart the knowledge in electrical conductance and EMF
To create awareness about the modern Nano composites along with concepts of polymers
To introduce analytical tools for characterization techniques.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Apply relevant instrumentation techniques to solve complex problems
CO2	Recall the fundamentals and demonstrate by understanding the first principles of Engineering sciences.
CO3	Examine the appropriate techniques to interpret data to provide valid conclusion
CO4	Demonstrate the collaboration of science and Engineering to recognize the need for life long learning.
CO5	Analyse the impact of contextual knowledge to access the health and society issues.

Mapping of Course Outcome with Program Outcome (POs)

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

COs/PSOs	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3		3	3	
CO2	3		2	3	
CO3	3		3	3	
CO4	3		3	3	
CO5	3		3	3	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
	√								

SubjectCode: EBCH22ET1	Subject Name:ENGINEERING CHEMISTRY	Ty/Lb /ETL	L	T/ SLr	P/R	C
	Prerequisite:Nil	ETL	2	0/0	2/0	3

UNIT -I CHEMICAL THERMODYNAMICS **12**

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).

UNIT -II TECHNOLOGY OF WATER **12**

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 **12**

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 **12**

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 **12**

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

Total No.of periods: 60

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)

Subject Code	Subject Name :**BASIC ELECTRICAL & ELECTRONICS ENGINEERING**	Ty/Lb/ ETL	L	T/SLr	P/R	C
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.
- 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)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3							2	1
CO2	3	3	3	2	2		2				2	
CO3	3	2	3	2	3		2		2			1
CO4	3	2		2			2				2	1
CO5	3	2	3	2	3				2		2	1

COs/PSOs	PSO1	PSO2	PSO3		
CO1	3				
CO2	3				
CO3	3				
CO4	3				
CO5	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
		√							

SubjectCode: EBEE22ET1	Subject Name : BASIC ELECTRICAL & ELECTRONICS ENGINEERING	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:Nil	ETL	2	0/0	2/0	3

UNIT I ELECTRIC CIRCUITS 12

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

UNIT II MACHINES & MEASURING INSTRUMENTS 12

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 12

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 12

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 12

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*

Subject Code	Subject Name :**ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**
EBCC22I01	Prerequisite : Nil	**IE**	**1**	**0/0**	**1/0**	**1**

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 how entrepreneurship Education transforms individuals into successful leaders.
- Identify individual potential &S have career dreams
- Understand difference between ideas & opportunities
- Identify components & create action plan.
- Use brainstorming in a group to generate ideas.

COURSE OUTCOMES (Cos)
Students completing this course were able to

CO1	Develop a Business plan & improve ability to recognize business opportunity
CO2	Do a self-analysis to build an entrepreneurial career.
CO3	Articulate an effective elevator pitch.
CO4	Analyze the local market environment & demonstrate the ability to find an attractive market
CO5	Identify the required skills for entrepreneurship & develop

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		2	2	3	2	2	2		2	2	2	1
CO2	3	2		3	2	3	2	3	3	3	2	2
CO3		2	2	2		3		3	3	3		
CO4		3	2	2	2	2		3	2	2	3	
CO5		2	2	3	2	2	3	3	2	2	3	1

COs/PSOs	PSO1	PSO2	PSO3	PSO4	
CO1	2		3		
CO2	2		3		
CO3	2		3		
CO4	2		3		
CO5	2		3		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
							√		

SubjectCode: EBCC22I01	SubjectName:ORIENTATION TO ENTREPRENEURSHIP & PROJECT LAB	Ty/Lb/ ETL/IE	L	T/SLr	P/R	C
	Prerequisite:Nil	IE	1	0/0	1/0	1

UNITI CHARACTERISTICS OF A SUCCESSFULL ENTREPRENEUR 03

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 03

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

UNIT III DESIGN THINKING 03

Introduction to Design thinking – Myth busters – Design thinking Process - Customer profiling – Wowing your customer – Personal selling – concept & process – show & tell concept – Introduction tothe conceptofElevatorPitch

UNIT IV RISK MANAGEMENT 03

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

UNIT V PROJECT 03

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

IDEA GENERATION, EVALUATION & PROJECT PRESENTATION 15

Total No.of Periods: 30

Subject Code: EBCS22ET1	C PROGRAMMING AND MS OFFICE TOOLS	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	ETL	1	0/0	2/0	2

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 :

The student should be made to:

- learn a programming language.
- learn problem solving techniques.
- write programs in C and to solve the problems.
- familiarize the students in preparation of documents and presentations with office automation tools.

COURSE OUTCOMES (COs) :After Completing the course, the student can be able to

CO1	Understand and trace the execution of programs written in C language.
CO2	Write the C code for a given algorithm.
CO3	Apply Arrays and Functions concepts to write Programs
CO4	Apply Structures and pointers concepts for writing Programs
CO5	perform documentation , accounting operations and presentation skills

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	1	1	1	1	1	1	2	2
CO2	2	2	2	2	1	1	1	1	1	1	2	2
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

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

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓					

Subject Code: EBCS22ET1	C PROGRAMMING AND MS OFFICE TOOLS	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
	Prerequisite: Nil	ETL	1	0/0	2/0	2

UNIT I INTRODUCTION **3**

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

UNIT II DECISION MAKING STATEMENTS AND LOOPING STATEMENTS **3**

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 **3**

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 **3**

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 **3**

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

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 **30 periods**

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

SEMESTER II

Subject Code: **EBMA22003**	Subject Name **: MATHEMATICS-II**	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Mathematics -I	**Ty**	**3**	**1/0**	**0/0**	**4**

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 :

The student should be made to:

To be able to understand basic concepts in integration
To understand the concepts in multiple integrals
To use the basic concepts in ordinary differential equations
To be able to apply concepts of analytical geometry
To be able to understand the basic concept of vector calculus

COURSE OUTCOMES (COs) :

CO1	Integrate the given function by using methods of integration and to find the area under curve and the volume of a solid by revaluation
CO2	Evaluate the multiple integrals /area/volume and to change the order of integration
CO3	Apply concepts in Ordinary Differential equations and to solveeulers differential equation
CO4	Find equation of planes,lines and sphere and shortest distance between skew lines
CO5	Verify green/stokes/gauss divergence theorem

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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**	**PSO2**	**PSO3**	**PSO4**
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 Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
	√											

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

UNIT I INTEGRATION **12**

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 **12**

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 **12**

First order differential equations–Second and higher order linear differentialequationswith 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 **12**

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

UNIT V VECTOR CALCULUS **12**

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: EBPH22002	SubjectName:ENGINEERING MECHANICS	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:Engineering Physics	Ty	3	0/0	0/0	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

OBJECTIVE:

- Basic principles of stress, strain and elastic constants.
- To draw shear force and bending moment diagram
- To find deflection of beams.

COURSEOUTCOMES(COs):(3-5)

CO1	Articulate a strong foundation in understanding kinematics & Kinetics
CO2	Identify and use the fundamentals of mechanics, static and dynamic equilibrium
CO3	Enhance the problem solving skill in statics and dynamics
CO4	Develop analytical skills to identify different types of motion
CO5	Articulate models to acquire knowledge on mathematical, analytical skills

MappingofCourseOutcomes withProgramOutcomes (POs)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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
CO5	3	2	2	2	2	1	1	1	2	2	1	1

Cos /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	1	2				
CO2	3	3	1	2				
CO3	3	3	1	2				
CO4	3	3	1	2				
CO5	3	3	1	2				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
	✓			✓								

SubjectCode: EBPH22002	SubjectName:ENGINEERING MECHANICS	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:Engineering Physics	Ty	3	0/0	0/0	3

UNIT ISTATICS OF PARTICLE **9**

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 **9**

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 **9**

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 **9**

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 **9**

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.

Total No.of Periods:45

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*

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

OBJECTIVES :

1.Tounderstand and apply the basic concepts of fuels and combustion in automobiles.
2. To analyze the moisture and protein in food through physical and chemical methods.
3.To detect the industrial development aiming at job creators.
4.To demonstrate the operations of pulp and paper Industry.
5. To illustrate the fundamentals of industrial wastewater treatment.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	**Reproduce the understanding of industry oriented chemical science**
CO2	**Analyze the solutions for industry based problems for sustainable development following professional ethics.**
CO3	**Apply appropriate techniques for industrial development as a resource of lifelong learning.**
CO4	**Develop the reasoning nature by the knowledge acquired to assess the health and safety issues.**
CO5	**Describe the tools used to apply the engineering knowledge**

Mapping of Course Outcome with Program Outcome (POs)

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

COs/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3		3	3
CO2	3		3	3
CO3	3		3	3
CO4	3		3	3
CO5	3		3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
	√								

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

UNIT I FUELS & COMBUSTION 9

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 9

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 9

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 cosmetics-moisturizing cream, talcum powder, Nail enamel, Lipstick. Disinfectants- phenyl, hand sanitizer,bleach,causticsoda,naphthalene balls production.

UNIT V INDUSTRIAL WASTES AND TREATMENT PROCESS 9

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.

TotalNo.ofPeriods: 45

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.

Subject Code	Subject Name : **ENGINEERING GRAPHICS**	**Ty/Lb/ ETL**	**L**	**T/SLr**	**P/R**	**C**
EBME22001	Prerequisite : Nil	**Ty**	**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

- To acquire knowledge in geometrical drawing.
- To expose the students in computer aided drafting**.**

COURSE OUTCOMES (Cos)
Students completing this course were able to

CO1	Utilize the concept of Engineering Graphics Techniques to draft letters, Numbers, Dimensioning in Indian Standards
CO2	Demonstrate the drafting practice visualization and projection skills useful for conveying ideas in engineering applications.
CO3	Identify basic sketching techniques of engineering equipments
CO4	Demonstrate the projections of Points, Lines, Planes and Solids. And
CO5	Draw the sectional view of simple building drawing.

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	PO1	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	PSO1	PSO2	PSO3	PSO4
CO1		2		
CO2		2		
CO3		2		
CO4		2		
CO5		2		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
		✓		√					

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

CONCEPTS AND CONVENTIONS (Not for examination) **7**

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 **12**

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 **8**

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

UNIT IV ISOMETRIC PROJECTION **8**

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

UNIT V ORTHOGRAPHICS PROJECTIONS **8**

Orthographic projection of simple machine parts – missing views

BUILDING DRAWING **7**

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
2. Gopalakrishnan, K.R. (2014) Engineering Drawing (Vol.I& II Combined) Subhas Stores, Bangalore.
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.

Subject Code: EBRA22001	SubjectName: MANUFACTURING PROCESSES	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:Nil	Ty	3	0/0	0/0	3

L:LectureT:Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVES: The student will learn:

- basics and advanced manufacturing processes for metals.
- Selecting the appropriate manufacturing process based on the applications.

COURSEOUTCOMES(COs): (3- 5) Studentswill be ableto:

CO1	Enhance Knowledge of casting and metal joining process.
CO2	Understand the various manufacturing process for metal
CO3	Demonstrate the operation of various manufacturing process
CO4	Substantiate the advanced method of manufacturing process
CO5	Recommend the suitable manufacturing processes depending on the requirements

Mapping of Course Outcomes with Program Outcomes(Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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
CO4	3	1	3	2	1	1	2		3	3	1	3
CO5	3	1	3	2	1	1	2		3	3	1	3

Cos /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	2
CO2	3	3	3	2
CO3	3	3	3	2
CO4	3	3	3	2
CO5	3	3	3	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✓								

SubjectCode: EBRA22001	SubjectName:MANUFACTURING PROCESSES	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:Nil	Ty	3	0/0	0/0	3

UNIT- I: METAL CASTING PROCESSES **9**

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 **9**

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 **9**

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 **9**

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 **9**

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.*

Subject Code	Subject Name : **COMMUNICATIVE ENGLISH LAB**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**
EBCC22I02	Prerequisite :Nil	**IE**	**1**	**0/0**	**1/0**	**1**

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

- To engage students in meaningful oral English communication and organized academic and professional reading and writing for a successful career.

COURSE OUTCOMES (Cos)

Students completing this course were able to

CO1	Engage in meaningful oral communication in English with writing as a scaffolding activity.
CO2	Have an in-depth understanding of the components of English language and its use in oral communication.
CO3	Strengthen their vocabulary and syntactic knowledge for use in academic and technical communication
CO4	Learn to negotiate meaning in inter-personal and academic communication for a successful career.
CO5	Engage in organized academic and professional writing for life-long learning and research

Mapping of Course Outcome with Program Outcome (POs)

Cos/POs	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	PSO1	PSO2	PSO3	PSO4
CO1	2		1	
CO2	2		1	
CO3	2		1	
CO4	2		1	
CO5	2		1	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project
			√						

Subject Code	Subject Name :**COMMUNICATIVE ENGLISH LAB**	**Ty/Lb/ ETL/IE**	**L**	**T/SLr**	**P/R**	**C**
EBCC22I02	Prerequisite :Nil	**IE**	**1**	**0/0**	**1/0**	**1**

UNIT I LISTENING **6**

Authentic audios and videos

Prescribed Book: English Pronunciation in use – Mark Hancock,

UNIT IISPEAKING **6**

Individual- Solo: Self introduction, Describing, anchoring, welcome address, vote of thanks,

Pair & Group: Role play- formal -informal, narrating stories, film review, analyzing newspaper headings and reports, interpreting Advertisement pamphlets

Group discussion, mock interviews, formal presentation, power point presentation

Prescribed Book: J. C. Richards with J. Hull &S.Proctor, Interchange, Cambridge University Press, 2015.

UNIT III READING **6**

Extensive, focused reading,

Strategies for effective reading - Reading comprehensions – Note making- summarizing- paraphrasing, Review

Suggested reading: Short stories, news paper reports, film reviews

UNIT IV WRITING **6**

Extensive writing practices – note taking, Cognitive and metacognitive strategies to inculcate a sense of organizing ideas into coherent sentences and paragraphs, Formal letters, Business letters. Resume with covering letter

UNIT V NON VERBAL COMMUNICATION/ CHARTS, DIAGRAMS AND TABLE **6**

Interpretation of charts Flow chart, pie chart, bar diagram, table, tree diagram, etc.

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

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

Subject Code: **EBCS22ET2**	Subject Name: **PYTHON PROGRAMMING**	**Ty / Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: C Programming and MS office tools	**ETL**	**1**	**0/0**	**2/0**	**2**

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

OBJECTIVE : The student should be made to:

- Develop a basic understanding of *programming* and the *Python programming* language
- Write programs in Python to solve real world problems
- See the value of *programming* in a variety of different disciplines,especially as it relates in engineering.

COURSE OUTCOMES (COs) :After Completing the course, the student can be able to

CO1	Remember the syntax and semantics of python programming language
CO2	Understand how functional and operations are to be utilized
CO3	Applythe fundamental programming constructs like variables, conditional logic, looping, and functions to build basic programs
CO4	design object-oriented programs with Python classes
CO5	Apply the knowledge to solve various real worldproblems

Mapping of Course Outcomes with Program Outcomes (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

H/M/L indicates Strength of Correlation H- High, M- Medium, L-Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills	Inter Disciplinary		
										✓		

Subject Code: **EBCS22ET2**	**PYTHON PROGRAMMING**	**Ty / Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
	Prerequisite: C Programming and MS office tools	**ETL**	**1**	**0/0**	**2/0**	**2**

UNIT I: INTRODUCTION **9**

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 **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.

UNIT III: FUNCTIONS **9**

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

UNIT IV:LISTS, TUPLES, DICTIONARIES **9**

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

UNIT V: OBJECT ORIENTED PROGRAMMING OOP IN PYTHON **9**

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

Total No. of Hours: 45

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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

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:

- To acquire knowledge of the Environment and Ecosystem & Biodiversity
- To acquire knowledge of the different types of Environmental pollution
- To know more about Natural Resources
- To gain understanding of social issues and the Environment
- To attain familiarity of human population and Environment

COURSE OUTCOMES (COs): (3 – 5)
Students completing the course were able to

CO1	Know about Environment and Ecosystem & Biodiversity
CO2	Comprehend air, water, Soil, Marine, Noise, Thermal and Nuclear Pollutions and Solid Waste management and identify the importance of natural resources like forest, water, and food resources
CO3	Discover water conservation and watershed management
CO4	Identify its problems and concerns climate change, global warming, acid rain, ozone layer depletion etc.,
CO5	Explain family welfare programmes and role of information technology in human health and environment

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1						2	3	2				1
CO2						2	3			2		1
CO3						2	3	2				1
CO4						2	3	2		2		1
CO5						2	3			2		1

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engg Sciences	Humanities & Social Sciences	Program core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skills	Soft Skills
			√						

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

UNIT I ENVIRONMENT AND ECOSYSTEM

Definition, Scope and Importance ofenvironment – need for public awareness – concept, structure and functionof ecosystem- producers, consumers and decomposers – energy flow in the ecosystem. Biodiversity atnationalandlocallevels–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.andDr. K.Sankaran.**ElementsofEnvironmentalandHealthScience.**Karaikudi:KPSVPublications,5th Edition,July,2013.*
*2. Ifthikarudeen,Etal,**EnvironmentalStudies**,SoorajPublications,2005.*
*3. R.Murugesan,**EnvironmentalStudies,**MillenniumPublishers andDistributors, 2nd Edition,July,2009.*

SEMESTER III

Subject Code: EBMA22005	Subject Name :Mathematics III for Mechanical and Civil Engineers	Ty/Lb/ ETL/IE	L	T/S Lr	P/R	C
	Prerequisite:Mathematics I&II	**Ty**	**3**	**1/0**	**0/0**	**4**

L:LectureT:Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVES: The student will learn

- Basic mathematical tools and techniques which emphasize the development of rigorous logical thinking and analytical skills.
- Theory and applications of partial differential equation, its applications, Fourier series, transforms and Laplace transformation.

COURSEOUTCOMES(COs):(3-5) The students will be able to

CO1	Understand the concepts of Partial Differential equations
CO2	Determine the Fourier series solutions
CO3	Apply the concepts of PDE in Wave and Heat problems
CO4	Apply Laplace transforms
CO5	Apply Fourier transforms

MappingofCourseOutcomes withProgramOutcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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
CO4	3	2	1	2	1	3	2	1	1	1	1	2
CO5	3	3	1	2	1	2	2	1	1	2	2	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	2	1	1	3				
CO2	2	1	1	3				
CO3	2	1	1	3				
CO4	2	1	1	3				
CO5	2	1	1	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	ProgramCore	Program Electives	OpenElectives	Practical /Project	Internships/Techni cal	SoftSkills			
	✓											

Subject Code: EBMA22005	Subject Name :Mathematics III for Mechanical and Civil Engineers	Ty/Lb/ETL	L	T/S Lr	P/R	C
	Prerequisite:Mathematics I&II	Ty	3	1/0	0/0	4

UNIT- I: PARTIAL DIFFERENTIAL EQUATIONS **12**

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 **12**

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 **12**

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 **12**

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 **12**

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

Total No.ofPeriods :60

TEXTBOOKS

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

REFERENCES

1. *Singaravelu (2009),Transforms andPartialDifferential Equations,MeenakshiAgency.*
2. *Kreyszig E.(2011),Advanced Engineering Mathematics(9th ed.),JohnWiley&Sons.*
3. *Grewal B.S.(2012),HigherEngineering Mathematics,KhannaPublishers.*

Subject Code: EBRA22002	Subject Name: **ELECTRICAL AND ELECTRONICS CIRCUITS**	Ty / Lb/ETL	L	T /S. Lr	P/ R	C
	Prerequisite: Basic Electrical and Electronics Engineering	Ty	3	1/0	0/0	4

L: LectureT:Tutorial SLr : Supervised LearningP : ProjectR : Research C:

CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

To give an understanding of:

The principle of AC and DC Circuits using network theorems

Designing and developing rectifiers, amplifiers and oscillators as required

COURSEOUTCOMES(COs):(3-5)

Studentswillbe able to

CO1	Understand the fundamentals of Analog DC circuits.
CO2	Describe the significance of AC circuits.
CO3	Discuss the working of diodes and its applications
CO4	Apply the electronic devices to develop an amplifier
CO5	Implement an oscillator generating desired frequency

MappingofCourseOutcomeswith ProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 /PSOs	PSO1	PSO2	PSO3	PSO4
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 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills	Interdisciplinarysubject		
				✓								

Subject Code: EBRA22002	SubjectName:ELECTRICAL AND ELECTRONICS CIRCUITS	Ty/Lb/ ETL	L	T/ S.Lr	P/ R	C
	Prerequisite: Basic Electrical and Electronics Engineering	**Ty**	**3**	**1/0**	**0/0**	**4**

UNIT I:DC CIRCUITS **12**

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'sTheorem–Maximumpowertransfertheorem

UNIT II :AC CIRCUITS **12**

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 **12**

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 **12**

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

UNIT V:OSCILLATORS **12**

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

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

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

REFERENCES:

1. *Milman,Halkias(2010)IntegratedElectronic,TataMcGrawhillpublication*
2. *BoylestadNashelsky(2009)ElectronicDevices andCircuittheory, (10th ed.),PHI*

Subject Code:	**Subject Name: ELECTRICAL MACHINES**	**Ty/Lb/ ETL**	**L**	**T / S.Lr**	**P/ R**	**C**
EBRA22003	**Prerequisite: Basic Electrical and Electronics Engineering**	**Ty**	**3**	**0/0**	**0/0**	**3**

L: LectureT:Tutorial SLr :SupervisedLearningP :ProjectR: Research C:Credits
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

CO1	Understand the fundamentals of DC Machines and their operation.
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
CO5	Develop brushless alternators,servomotors ,stepper motors and hysteresis motors for dedicated power based application

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	**3**	**2**	**1**	**1**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**
CO2	**3**	**2**	**1**	**1**	**3**	**1**	**2**	**3**	**3**	**3**	**2**	**2**
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**	**1**	**2**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
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 Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/ Technical Skill	Soft Skills			
				√								

Subject Code: EBRA22003	Subject Name: ELECTRICAL MACHINES	Ty/Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Basic Electrical and Electronics Engineering	Ty	3	0/0	0/0	3

UNIT I: D.C. MACHINES **9**

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 **9**

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 **9**

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 **9**

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 **9**

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

Total no. of Periods: 45

TEXTBOOKS:

1. B L Theraja& A K Theraja, A textbook of Electrical Technology, Schand Publishers, 2014.
2. Murugesh Kumar K.,,, Electric Machines VoI",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.

Subject Code: EBME22005	Subject Name: MACHINE DRAWING	T / L/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Basic Engineering Graphics	Ty	2	0/0	2/0	3

L : Lecture T : Tutorial S Lr : Supervised Learning P : Practical R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: The purpose of study is to impart knowledge in fundamentals of machine drawing and assembly drawings.

COURSE OUTCOMES (COs) : The student will be able to

CO1	Understand the code of practice and BIS specification of basic machine elements.
CO2	Apply the fundamentals of machine drawing like fits, limits and tolerance analysis in manufacturing.
CO3	Assemble the various machine parts of IC Engine components, Tail stock, Cotter Joint, Screw jack etc.
CO4	Sketch the isometric view and orthographic view of various machine parts .
CO5	Employ CAD tools to convert part drawing into orthographic views.

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	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	PSO1	PSO2	PSO3	PSO4				
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 Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	Humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internships / Technical Skill	Soft Skills			
				✓								

SubjectCode: EBME22005	SubjectName:MACHINE DRAWING	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:Basic Engineering Graphics	Ty	2	0/0	2/0	3

UNIT- I-DRAWING STANDARDS **6**

Code of practicefor EngineeringDrawing, BIS specifications–Weldingsymbols,rivetedjoints, keys,andfasteners – Reference to hand book for the selection of standard components like bolts, nuts, screws, keysetc.

UNIT- II-INTRODUCTION TO MACHINE DRAWING **9**

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 **24**

Preparing the assembly views (with minimum four components) of various industrial orientedequipment.(E.g.Pistonandconnectionrod,Couplingandshafts,Plummerblock,Tailstock,CotterJoint, KnuckleJoint,UniversalJointandScrewJack)

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

Preparing isometric view of various industrial oriented machine components-Selection of machine componentsfrom 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

TEXT BOOK:

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

***REFERENCE**:*

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

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

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

- Basic principles of stress,strain and elastic constants
- To draw shear force and bending moment diagrams
- To find deflection of beams

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concepts of mechanics of solids
CO2	Analyze the stresses involved due to different types of loading
CO3	Apply the different theories of mechanics
CO4	Derive the expression for deflection and bending moment
CO5	Use mathematical approach to analyze the stresses involved

MappingofCourseOutcomeswithProgramOutcomes(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	PSO1	PSO2	PSO3	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 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkil	Soft Skills			
				✓								

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

UNIT–I: STRESS, STRAIN AND DEFORMATION OF SOLIDS **12**

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 theirrelationship –strain energyduetoaxialload– stressdue to suddenlyappliedloadand impactload.

UNIT- II: BEAMS -LOADS AND STRESSES **12**

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 alongthe 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 **12**

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 **12**

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 **12**

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.*

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

L: LectureT :Tutorial SLr : Supervised LearningP : ProjectR : Research C: CreditsT/L/ETL:Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To introduce the basics of linear integrated circuits.
- Toexpress the applications of operational amplifiers.
- To understand the fundamentals of number systems and Boolean algebra.
- 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	Recognize the basics of linearIC's and characteristics of operational amplifier
CO2	Express various applicationsof op-amp.
CO3	Understand the fundamentals of Number systems and Boolean Algebra
CO4	Design the combinational and Sequential logic circuits.
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	PO12
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 /PSOs	PSO1	PSO2	PSO3	PSO4
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 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓					

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

UNIT I INTRODUCTION TO INTEGRATED CIRCUITS 9

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 andCompensation techniques.

UNIT II APPLICATIONS OF OP AMP IC 741 9

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 9

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 9

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 9

Characteristics of RTL, DTL, TTL, Families – Schottky, Clamped TTL, ECL, IIL –Classification of memories-ROM- ROM organization - PROM – EPROM – EEPROM –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.*

Subject code: EBCC22ET1	SubjectName:UNIVERSAL HUMAN VALUES: UNDERSTANDING HARMONY	Ty/ Lb/ ETL	L	T/S. Lr	P/ R	C
	Prerequisite:Nil	ETL	1	0/0	2/0	2

L:LectureT:Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

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

COURSEOUTCOMES(COs):(3-5): The students will be able to

CO1	Relate self and surroundings and identify responsibility in life
CO2	Associate human relationship and nature to handle problems and provide sustainable solutions
CO3	Develop critical ability and engage in reflective and independent Thinking
CO4	Show commitment towards understanding of values
CO5	Apply Human values in day to day setting in real life

MappingofCourseOutcomes withProgramOutcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO2	PSO3	PSO4	PSO5			
CO1	3	2	3					
CO2	2	2	3					
CO3	3	2	2					
CO4	3	1	2					
CO5	2	2	1					

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓					

SubjectCode: EBCC22ET1	SubjectName: UNIVERSALHUMANVALUES: UNDERSTANDING HARMONY	Ty/Lb /ETL	L	T/S. Lr	P/ R	C
	Prerequisite:Nil	ETL	1	0/0	2/0	2

OBJECTIVE:

1. Development of a holistic perspective based on self-exploration about themselves(humanbeing),family,societyandnature/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 andcourage to act.

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 andProsperity-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,meaningof Prosperityindetail.
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. Understanding the harmony in the society(society being an extension of

5. family):Resolution,Prosperity,fearlessness(trust)andco-existence as comprehensive Human Goals
6. Visualizing a universal harmonious order in society-Undivided Society,Universal 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
4. Competence in professional ethics:an Ability to utilize the professional competence for 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

1. *JeevanVidya:EkParichaya,ANagaraj,JeevanVidyaPrakashan,Amarkantak,1999.*
2. *HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.*
3. *TheStoryofStuff(Book).*
4. *TheStoryofMyExperimentswithTruth-byMohandasKaramchandGandhi.*
5. *SmallisBeautiful-E.FSchumacher.*
6. *SlowisBeautiful-CecileAndrews*
7. *EconomyofPermanence-JCKumarappa*
8. *BharatMeinAngrejiRaj–PanditSunderlal*
9. *RediscoveringIndia-byDharampal*

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

L:LectureT:TutorialSLr:SupervisedLearningP:ProjectR: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES: The student will learn

- To verify practically the electric circuits theoretically analyzed by networktheorems
- To verify experimentally the electronic circuits

COURSEOUTCOMES(COs):(3-5)
The Students will be able to:

CO1	Design electrical circuits based on network theorems and compare the experimental values with theoretical calculations.
CO2	Analyse the typical characteristics of PN and Zener diodes by performing experiments in their different modes of operation.
CO3	Understand the I/P O/P characterstics of BJT and FET transistors by designing circuits and experimentally verifying their characterstics.
CO4	Design oscillators of various categories and verify their frequency of operation
CO5	Implement the working principles of electronic devices to design rectifiers and voltage regulators

MappingofCourseOutcomeswithProgramOutcomes(Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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/PSOs	PSO1	PSO2	PSO3	PSO4
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 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	HumanitiesandSocial Sciences	Program Core	ProgramElectives	OpenElectives	Practical /Project	Internships /Technical	Soft Skills			
				✓			✓					

SubjectCode: EBRA22L01	Subject Name:ELECTRICAL AND ELECTRONICS CIRCUITS LAB	Ty / Lb/ ETL	L	T/S.Lr	P/ R	C
	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 ofThevenin's Theorem.
6. Verification of Nodal andMeshAnalysis.

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

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

L:LectureT:TutorialSLr:SupervisedLearningP:ProjectR: Research C:Credits

T/L/ETL: Theory/Lab/Embedded Theoryand Lab

OBJECTIVES:

- To Study various types of DC machines and Transformers which mainly covers experiments with real machines and students gain practical experience in using various DC machines, transformers, starters etc.
- Various types of experiments related to Electrical machinery like Load characteristics, Load test, Brake test, Parallel Operation, Loss separation, OC and SC characteristics are performed.
- To study the characteristics of synchronous motors, induction motors and other special machines.

COURSE OUTCOMES(COs):(3-5)

The Students will be able to

CO1	Design circuits meant for open circuit characterstics and load tests on DC Shut generators.
CO2	Analyse the characteristics DC shunt Motors and DC series motors by performing load test experiments on these machines
CO3	Understand the significance of speed control characteristics of a DC shunt motor
CO4	Assess the characteristics of single phase transformer by performing O.C ,S.C tests and load tests and on Alternator and single phase induction motor by performing load tests respectively
CO5	Remember the concepts of Universal and Reluctance motors

Mapping of Course Outcomes with Program Outcomes(POs)

Cos/Pos	**PO1**	**PO2**	**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**	**2**	**3**	**2**	**2**	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**	**1**	**3**	**2**	**2**	**3**	**2**	**3**	**3**

Cos/PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**2**	**1**	**2**	**2**
CO2	**2**	**1**	**2**	**2**
CO3	**2**	**1**	**2**	**1**
CO4	**2**	**1**	**2**	**2**
CO5	**2**	**1**	**2**	**2**

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	Engineering Sciences	Humanities and SocialScie	Program Core	Program Electives	OpenElectives	Practical /Project	Internships /Technical	Soft Skills			
				✓			√					

Subject Code: **EBRA22L02**	Subject Name: **ELECTRICAL MACHINES LAB**	**Ty /Lb/ ETL**	**L**	**T/S.Lr**	**P/ R**	**C**
	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: EBME22L03	SubjectName: STRENGTH OF MATERIALS LAB	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite: Strength of Materials	**Lb**	**0**	**0/0**	**3/0**	**1**

L: LectureT:Tutorial SLr : Supervised LearningP : ProjectR : Research C: CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:Thestudent will learn

- Experimental methods of finding mechanical properties of materials

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the stress strain diagram of steel rod.
CO2	Determine the Hardnesstesting of Steel, CopperandAluminium
CO3	Estimate the Spring constant, under Tension and Compression
CO4	Estimate the notch toughness of steel using Izodimp attesting machine
CO5	Study the mechanical properties of Steel and Cast iron specimen using Universal testing machine.

MappingofCourseOutcomeswithProgramOutcomes(Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	2	2	2	2	3	3	2	2
CO2	3	3	2	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	**PSO1**		**PSO2**		**PSO3**		**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 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
				✓			✓					

Subject Code: EBME22L03	**SubjectName:STRENGTH OF MATERIALS LAB**	**Ty / Lb/E TL**	**L**	**T /S.Lr**	**P/R**	**C**
	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,underTension and Compression
7. Estimation of notch toughness of steel using Charpy impact testing machine

Total No.of Periods: 45

SEMESTER IV

Subject Code	Subject Name	Ty/Lb/ ETL	L	T/ S.Lr	P/R	C
EBMA22008	**:STATISTICAL AND NUMERICAL METHODS**					
	Prerequisite: Mathematics -III	**Ty**	**3**	**1/0**	**0/0**	**4**

L:LectureT:Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVES :

The student should be made to:

To be able to apply the concepts in Statistics
To understand the concepts in Probability
To understand the concepts in Numerical methods
To be able to solve Algebraic and Transcendental equations.
To understand the concepts in Interpolation.

COURSEOUTCOMES(COs):(3-5) The students will be able to

CO1	Analyze Statistical data
CO2	Understand probability theory
CO3	Understand the concepts in Numerical methods
CO4	Solve algebraic and Transcendental equations
CO5	Apply Interpolation concepts

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	2	3	1	1	1	2	2	1	3
CO2	3	3	1	3	2	2	1	1	2	1	2	2
CO3	2	3	1	2	2	3	3	1	1	2	2	3
CO4	2	3	1	1	1	3	3	1	1	2	1	2
CO5	3	2	1	3	1	2	3	1	1	2	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	1	1	3
CO2	2	1	1	3
CO3	2	1	1	3
CO4	2	1	1	3
CO5	2	1	1	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	ProgramCore	Program Electives	OpenElectives	Practical /Project	Internships/Technical Skill	SoftSkills			
	✓											

Subject Code **EBMA22008**	Subject Name **:STATISTICAL AND NUMERICAL METHODS**	**Ty/Lb/ ETL**	**L**	**T/ S.Lr**	**P/R**	**C**
	Prerequisite: Mathematics -III	**Ty**	**3**	**1/0**	**0/0**	**4**

UNIT I: BASICS OF STATISTICS **12**

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 **12**

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 **12**

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

UNIT IV: SOLUTION OF EQUATIONS **12**

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 **12**

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

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Total no.of Periods:60

ReferenceBooks:

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

Subject Code: EBRA22004	SubjectName: BASICSOF ROBOTICS	Ty / Lb/ETL	L	T /S.Lr	P / R	C
	Prerequisite:Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

L: LectureT:Tutorial SLr : SupervisedLearningP :ProjectR:ResearchC:CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To understand the concept of robot anatomy.
- To understand theconcepts 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.
CO3	Familiarize with various sensors and end effectors of a robot.
CO4	Recall theapplications of robots in manufacturing, medical, space and agricultural sectors.
CO5	Apply the concepts of UAVs in different domains.

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	2	3	2	1	3	2	3	3
CO2	3	3	3	3	3	2	1	1	2	2	1	3
CO3	3	3	3	3	3	1	1	2	3	3	3	2
CO4	3	3	3	3	3	1	1	2	3	3	2	2
CO5	3	3	3	3	3	1	1	2	3	3	3	2

COs /PSOs	PSO1	PSO2	PSO3	PSO3				
CO1	3	1	3	3				
CO2	3	2	3	1				
CO3	3	2	2	2				
CO4	3	2	3	2				
CO5	3	2	2	2				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical /Project	Internships /TechnicalSkill	Soft Skills			
				✓								

Subject Code: EBRA22004	SubjectName: **BASICS OF ROBOTICS**	**Ty / Lb/ETL**	**L**	**T /S.Lr**	**P / R**	**C**
	Prerequisite:Nil	**Ty**	**3**	**0/0**	**0/0**	**3**

UNITI: INTRODUCTION TO ROBOTICS **6**

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

UNIT II: FUNDAMENTALS OF ROBOTICS **12**

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 **9**

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 and Analysis-Training and Vision System-Robot Programing—methods-motion interpolation-WAIT,SIGNAL and DELAY Commands-Branching-Robot Language Structure-motion commands-computations and Operations-monitor mode commands

UNIT IV: APPLICATIONS OF ROBOTS **9**

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

UNIT V: UNMANNED VEHICLES **9**

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

Total no. ofPeriods:45

TEXTBOOKS:

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-in-medicine

SubjectCode: EBRA22005	Subject Name: KINEMATICS AND DYNAMICS OF MACHINERY	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite: Engineering Mechanics	Ty	3	1/0	0/0	4

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To understand the basic components and layout of linkages in the assembly of a system machine.
- To understand the principles in analyzing the assembly with respect to the displacement,velocity,and acceleration To understand the motion of a specified set of linkages, design few linkage mechanisms and cam mechanisms
- To understand the basic concepts of toothed gearing and kinematics of gear trains

COURSEOUTCOMES(COs):(3-5)
Students will be able to:

CO1	Understand the principles and concepts of kinematic pairs, chains.
CO2	Evaluate gear tooth geometry and select appropriate gears for the required applications.
CO3	Determine the frictional forces and friction coefficient in machine elements
CO4	Assess the different force calculations on different machine members
CO5	Implement Balancing and vibration mechanisms in machine elements

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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	1	2	2	1	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	2	2	3	3
CO3	1	3	2	3
CO4	1	3	2	2
CO5	1	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical /Project	Internships /TechnicalSkill	Soft Skills			
				✓								

SubjectCode: EBRA22005	Subject Name: KINEMATICS AND DYNAMICS OF MACHINERY	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite: Engineering Mechanics	Ty	3	1/0	0/0	4

UNIT I: KINEMATICS OF MACHINES **12**

Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematicsanalysisinsimplemechanisms–velocityandaccelerationpolygons–Analyticalmethods–computerapproachcams–classifications–displacementdiagrams-layoutofplatecamprofiles–derivativesoffollowersmotioncirculararcandtangentcams.

UNIT II: GEARS AND GEAR TRAINS **12**

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 **12**

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

UNIT IV:FORCE ANALYSIS **12**

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 andInertia Torque – D'Alembert's principle – superposition principle – dynamic Force Analysis in simple machinemembers.

UNIT V: BALANCING AND VIBRATION **12**

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.

Total No.of Periods:60

TEXTBOOKS:

1. AmbekarA.G.,"MechanismandMachineTheory"PrenticeHallofIndia,NewDelhi,2007
2. Shigley J.E., Pennock G.R andUickerJ.J., "Theory of Machines and Mechanisms", Oxford University Press,2003

REFERENCES:

1. *ThomasBevan,"TheoryofMachines",CBSPublishersandDistributors,1984.*
2. *Ghosh.A,andA.K.Mallick,"TheoryandMachine", AffiliatedEast-West Pvt.Ltd.,NewDelhi,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.*

SubjectCode: EBRA22006	SubjectName:**INSTRUMENTATION AND CONTROL ENGINEERING**	**Ty /Lb/ ETL**	**L**	**T /S.Lr**	**P/R**	**C**
	Prerequisite:Basic Electrical and Electronics Engineering	**Ty**	**3**	**0/0**	**0/0**	**3**

L: LectureT:TutorialSLr : SupervisedLearningP:Project R: ResearchC:Credits
T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To introduce the terminologies associated with the measuring system.
- To impart knowledge onsensorsand transducer for temperature measurements.
- To understandand calibrate the method of measuring pressure, displacement and velocity.
- To introduce basics of control system
- To mathematically model the physical systems

COURSEOUTCOMES(COs):(3-5)
Studentswillbe able to:

CO1	Identify the different factors involved in measuring system
CO2	Understand construction and working principles of various types of transducers for pressure and temperature measurement
CO3	Comprehend different equipments for displacement, velocity and flow measurement.
CO4	Remember the different classifications of control systems.
CO5	Implement mathematical models of different physical systems.

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**				
CO1	3	**M**	3	3				
CO2	3	1	3	3				
CO3	3	1	3	3				
CO4	3	2	3	3				
CO5	3	3	3	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSkill	Soft Skills			
				✓								

Subject Code:	SubjectName:**INSTRUMENTATION AND CONTROL ENGINEERING**	**Ty /Lb/ ETL**	**L**	**T /S.Lr**	**P/R**	**C**
EBRA22006	**Prerequisite:Basic Electrical and Electronics Engineering**	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT I: MEASURINGSYSTEM **9**

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 **9**

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 **9**

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 andinductive, 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 **9**

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 **9**

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

TotalNo.of Periods: 45

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.

Subject Code: EBCC22I04	Subject Name :THE INDIAN CONSTITUTION(Audit Course)	Ty /Lb/ ETL/IE	L	T/SLr	P/ R	C
	Prerequisite:Nil	IE	2	0/0	0/0	0

L:LectureT: Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits
T/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

- To provide an overview of the history of the making of Indian Constitution
- To understand the preamble and the basic structures of the Constitution.
- To Know the fundamental rights,duties and the directive principles of state policy
- To understand the functionalityof the legislature,the executive and the judiciary

COURSEOUTCOMES (COs) :(3-5)
The Students will be able to

CO1	Understand the history of making of Indian Constitution
CO2	Understand the preamble and the basic structures of theConstitution
CO3	Describe the fundamental rights,duties and the directive principles of statepolicy
CO4	Describe the Emergency powers of the government
CO5	Understand the Special Provisions for Jammu and Kashmir,Nagaland and Other Regions and Amendments

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1						3	1	1	1	1		
CO2						3	1	1	1	1		
CO3						3	1	1	2	1		
CO4						3	1	1	2	1		
CO5						3	1	1	2	1		

COs/PSOs	PSO1	PSO2	PSO3
CO1	1	1	2
CO2	1	1	2
CO3	1	1	2
CO4	1	1	2
CO5	1	1	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EnggSci	Humanities & SocialScie	ProgramCore	ProgramElectives	OpenElectives	Practical/Project	Internships/Technical Skill	SoftSkills			
			✓									

Subject Code: EBCC22I04	SubjectName:THE INDIAN CONSTITUTION (Audit course)	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
	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),EthicsandPoliticsoftheIndianConstitution,OxfordUniversity 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.*

Subject Code: EBCC22I05	Subject Name : THE INDIAN TRADITIONAL KNOWLEDGE(Audit course)	Ty/Lb/ETL/IE	L	T/ SLr	P/R	C
	Prerequisite: Nil	**IE**	**2**	**0/0**	**0/0**	**0**

L:LectureT: Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits
T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE :

- To understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
- To understandtheTraditional Medicine, Traditional Production and Construction Technology
- To Know the History of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology
- To understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India

COURSEOUTCOMES (COs) :(3-5)
TheStudents willbe ableto

CO1	Understand the Pre- colonial and Colonial Period, Indian Traditional Knowledge System
CO2	Describe theTraditional Medicine, Traditional Production and Construction Technology
CO3	Understand the history of Physics and Chemistry, Traditional Art and Architecture and Vastu Shashtra, Astronomy and Astrology
CO4	Understand the Origin of Mathematics, Aviation Technology in Ancient India, Crafts and Trade in Ancient India
CO5	Understand the TKS and the Contemporary World, Indian union and IT Revolution

Mappingof CourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		3	3	1		2				2		1
CO2		3	3	1		2				2		1
CO3		3	3	1		2				2		1
CO4		3	3	1		2				2		1
CO5		3	3	1		2				2		1

COs/ PSOs	PSO1	PSO2	PSO3	PSO4
CO1	1	1	2	
CO2	1	1	2	
CO3	1	1	2	
CO4	1	1	2	
CO5	1	1	2	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓					

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

UNIT I **6**

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

UNIT II **6**

Traditional Medicine, Traditional Production and Construction Technology

UNIT III **6**

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

UNIT IV **6**

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

UNIT V **6**

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

Subject Code: EBEC22IL4	Subject Name : ANALOG AND DIGITAL ELECTRONICS LAB	Ty /Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electrical and Electronic Circuits Lab	**Lb**	**0**	**0/0**	**3/0**	**1**

L: Lecture T :Tutorial SLr : SupervisedLearningP: Project R: Research
C:CreditsT/L/ETL:Theory/Lab/Embedded Theoryand Lab

OBJECTIVES:

- To measure different parameters of operational amplifier
- To examine the various applications of op-amp
- To design and implement Combinational Logic Circuits
- To experiment Sequential Logic Circuits

COURSEOUTCOMES(COs):(3- 5)
The Students will be able to:

CO1	Analyse the different characteristics of operational amplifier IC741
CO2	Design different linear integrated circuits using IC741
CO3	Verify the truth tables of different logic gates.
CO4	Create different combinational logic circuits using logic gates.
CO5	Implement different sequential logic circuits using flip flops.

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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 /PSOs	PSO1	PSO2	PSO3	PSO4
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 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	HumanitiesandSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills	Interdisciplinary		
							✓			✓		

Subject Code: EBEC22IL4	Subject Name : ANALOG AND DIGITAL ELECTRONICS LAB	Ty /Lb/ ETL	L	T/SLr	P/R	C
	Prerequisite: Electrical and Electronic Circuits Lab	Lb	0	0/0	3/0	1

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

SubjectCode: EBME22L04	SubjectName: DYNAMICSLAB	Ty / Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Kinematics and Dynamics of Machinery	**L**	**0**	**0/0**	**3/0**	**1**

L: LectureT:Tutorial S Lr : Supervised LearningP : ProjectR : Research C: CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES:

- To Understand Working of simple mechanisms
- To find natural frequency of vibrating system at different models

COURSEOUTCOMES(COs):

CO1	Gain knowledge in kinematics and Dynamics of Machinery
CO2	Characterize the dynamic properties of component or equipments
CO3	Analyze the vibration characteristics
CO4	Apply various principles for dynamic solutions
CO5	Illustrate the method of static and dynamic balancing of masses

MappingofCourseOutcomeswithProgramOutcomes(POs)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4			
CO1	3	3	2	3			
CO2	3	3	2	3			
CO3	3	3	2	3			
CO4	3	3	2	3			
CO5	3	3	2	3			

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✓					✓			

SubjectCode: EBME22L04	SubjectName: DYNAMICSLAB	Ty / Lb /ETL	L	T /S.Lr	P/R	C
	Prerequisite:Kinematics and Dynamics of Machinery	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 Code: EBRA22L03	SubjectName:BASICS OF ROBOTICS LAB	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Basics of Robotics	Lb	0	0/0	3/0	1

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits
T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To Study different components of Robots
- To analyse different homing and moving actions of robots.
- To write program for perfoming different kinds of operations involving robot arm.

COURSEOUTCOMES(COs):Students will able to

CO1	Understand different components of robots.
CO2	Analyse the homing and moving action for robots.
CO3	Demonstrate Pick and Place movements for robots
CO4	Develop programs employing differentconditional and unconditional statements.
CO5	Perform different arithmetic operations using robots

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	1	2	3	3	3	2	2
CO5	3	2	3	3	3	1	2	3	3	3	2	2

Cos/PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	2	2	3				
CO3	3	3	2	3				
CO4	3	2	3	3				
CO5	3	2	3	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	Engineering Sciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSkill	Soft Skills			
				✓			√					

Subject Code: **EBRA22L03**	**SubjectName:BASICS OF ROBOTICS LAB**	**Ty /Lb/ ETL**	**L**	**T /S. Lr**	**P/ R**	**C**
	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

Subject Code: EBRA22L04	SubjectName:INSTRUMENTATION AND CONTROL LAB	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Instrumentation and Control Engineering	**Lb**	**0**	**0/0**	**3/0**	**1**

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits
T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- Enabling the students to know about sensors and the various types of sensors used for the measurement of various physical quantities
- To identify suitable instruments to meet the requirements of industrial applications
- 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

COURSEOUTCOMES(COs):(3- 5)Students will be able to:

CO1	Identify force measurement using Load Cell.
CO2	Understand displacement measurement using LVDT
CO3	Remember Thermocouple and Resistance Temperature Detectors, Determine measurement of strain
CO4	Study Thermistors,open loop and closed loop systems
CO5	Demonstrate the speed control of AC-DC servomotors and construct first and second order systems using PI/PD/PID controllers

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	1	2	3	3	3	2	2
CO5	3	2	3	3	3	1	2	3	3	3	2	2

Cos/PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	2	2	3
CO3	3	3	2	3
CO4	3	2	3	3
CO5	3	2	3	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	Engineering Sciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSkill	Soft Skills			
				✓			✓					

SubjectCode: EBRA22L04	Subject Name :INSTRUMENTATION AND CONTROL LAB	Ty / Lb/ET Lb	L	T /S.L r	P/ R	C
	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 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

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

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To create awareness in students, various top companies helping them improve their skillset matrix, leading to develop a positive frame of mind.
- To help students be aware of various techniques of candidate recruitment and help them prepare CV's and resume.
- To help student how to face various types of interview,preparing for HR,technical interviews.
- To help students improve their verbal reading,narration and presentation Skills by performing various mock sessions.

COURSEOUTCOMES(COs):(3-5)

CO1	Be aware of various top companies leading to improvement in skills amongst them.
CO2	Be aware of various candidate recruitment techniques like group discussion,interviews and Be able to prepare CV's and resumes.
CO3	Prepare for different types of interviews and be prepared for HRandtechnical interviews.
CO4	Improve their verbal,written and other skills by performing mock sessions.
CO4	Participation of group discussion and aptitude tests
CO5	Be aware of various top companies leading to improvement in skills amongst them.

Mapping of Course Outcomes with Program Outcomes(Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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
CO5	1	1	1	1	1	2	2	3	2	3	2	3
Cos/PSOs	PSO1		PSO2		PSO3		PSO4					
CO1												
CO2												
CO3												
CO4												
CO5												

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social 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	C
	Prerequisite:Nil	IE	0	0/0	2/0	1

UNIT I **6**

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

UNIT II **6**

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

UNIT III **6**

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 **6**

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

UNIT V **6**

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

TEXTBOOKS:

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

REFERENCES:

1. *Shaliniverma,(2012)Enhancingemployability@SOFTSKILLS.PublicationPearson*
2. KiranmaiDutt,P.GeethaRajeevan,C.L.Prakash,N.(2010)*ASubjectinCommunicationSkills.*PublicationFoundatio nBooks.
3. Nirakonar,(2011)*EnglishLanguageLaboratories*.PHILearning.
4. Anandamurugan,S.(2011)*PlacementInterviews*.PublicationTataMcGrawHillEducation.

SEMESTER V

SubjectCode:	SubjectName:ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
EBCS22ID5	Prerequisite: MATHEMATICS	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

Ty/Lb/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning

COURSEOUTCOMES(COs):Studentswill:

CO1	Understand different types of AI agents and know various AI search algorithms
CO2	Apply knowledge representation, reasoning, and machine learning techniques to real-world problems in terms of data management
CO3	Analyse the statistical data for decision making
CO4	Describe the concepts in machine learning
CO5	Apply knowledge of AI in robotics

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	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	PSO1	PSO2	PSO3	PSO4		
CO1				3		
CO2				3		
CO3				3		
CO4				3		
CO5				3		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓					

Subject Code: EBCS22ID5	SubjectName: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite: MATHEMATICS	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT I: INTRODUCTION OF AIAND ML **9**

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 andFunctions.

UNIT II: DATA MANAGEMENT **9**

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 **9**

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

UNIT IV: MACHINE LEARNING **9**

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

UNITV :AI IN ROBOTICS **9**

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics andcontrolof movement, Ethics andrisks of artificialintelligenceinrobotics

TotalNo.of Periods:45

TEXTBOOKS:

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

REFERENCES:

1. *NilsJ.Nilsson,“IntroductiontoMachineLearning”,2005.*
2. *Pang-NingTan,MichaelSteinbach.,Introduction to DataMining,Pearson,2019.*

Subject Code: EBRA22007	Subject Name : DESIGN OF MACHINE ELEMENTS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Mechanics, Strength of Materials, Kinematics and Dynamics of Machinery	**Ty**	**3**	**1/0**	**0/0**	**4**

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.
CO3	Select the appropriate V-belts and Chains for a given power and velocity ratio
CO4	Demonstrate the working of rolling contact bearings
CO5	Develop clutches based on varying friction drives

Mapping of Course Outcomes with Program Outcomes (POs)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	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
CO4	3	3	3	3	3	2	L	3	3	3	2	2
CO5	3	3	3	3	3	3	3	3	3	3	3	3

Cos / PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	2	2	3				
CO3	3	3	2	3				
CO4	3	3	2	3				
CO5	3	3	2	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Sciences	Engineering Sciences	humanities and Social Sciences	Program Core	Program Electives	Open Electives	Practical / Project	Internsips / Technical Skill	Soft Skills			
				✓								

Subject Code: EBRA22007	Subject Name : DESIGN OF MACHINE ELEMENTS	Ty / Lb/ ETL	L	T / S.Lr	P/ R	C
	Prerequisite: Engineering Mechanics, Strength of Materials, Kinematics and Dynamics of Machinery	Ty	3	1/0	0/0	4

UNIT I : DESIGN OF GEARS **13**

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 **13**

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 **13**

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 **8**

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 **13**

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.

Total No. of Periods: 60

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:

1. Bandari V B, "Design of Machine Elements ", Tata McGraw Hill Publishers Co. Ltd., New Delhi, 2003.
2. 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

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

L: LectureT :Tutorial SLr : Supervised LearningP : ProjectR : Research C: CreditsT/L/ETL:Theory/Lab/Embedded Theory and Lab

OBJECTIVES:

- To study the basic architectures and operational features of the processors
- To master the assembly language programming using 8086
- To create an exposure to basic peripherals and interfacing techniques
- To study the architecture and assembly language programming of 8051 microcontrollerand understand the interfacing concepts of the peripheral devices with controller.
- To study analyse the architecture of Programmable Logic Controllers and design typical systems using ladder relay logic

COURSEOUTCOMES(COs):
The students will be able to

CO1	Understand the architecture of 8085 and 8086 microprocessor
CO2	Develop programs in 8086 microprocessor by understanding its instruction sets
CO3	Demonstratetheirabilityto interfaceperipheralswithmicroprocessors
CO4	Understand the architecture of 8051 microcontroller and its Instruction sets and design various interfacing units with 8051 microcontroller based systems
CO5	Implement typical industrial systems using ladder relay logic by analyzing the architecture of PLCs

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	2	2	3	1	1	2	2	2	1
CO2	3	2	3	1	2	3	2	2	2	3	1	2
CO3	3	3	3	3	3	3	1	2	2	3	2	2
CO4	2	2	2	1	3	3	2	3	3	3	3	2
CO5	3	3	2	3	3	2	2	3	2	2	1	3

COs/PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	2				
CO2	3	2	2	2				
CO3	2	2	3	2				
CO4	3	3	3	3				
CO5	3	2	3	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project		
							✓				

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

UNIT I- THE 8 and 16 Bit MICROPROCESSOR **9**

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 **9**

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

UNITIV-MICROCONTROLLER AND INTERFACING **9**

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 **9**

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 using8085, 8086,8051 and8096*",PHI2007.
4. Muhammad Ali Mazidi, Janice GillispieMazidi, RolinD.MCKinlay *"The 8051Microcontroller andEmbeddedSystems", 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.*

Subject Code: EBRA22ET1	Subject Name: POWER ELECTRONICS AND DRIVES	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	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:	
CO1	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	2	3	2	3	3	2	3	3	3	3	3
CO3	3	1	3	1	3	3	1	3	3	3	3	3
CO4	3	3	3	3	3	3	2	3	3	3	3	3
CO5	3	3	3	3	3	3	2	3	3	3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	2	2	1
CO2	3	1	2	1
CO3	3	2	2	2
CO4	3	1	2	2
CO5	3	2	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
				√								

Subject Code: EBRA22ET1	Subject Name: POWER ELECTRONICS AND DRIVES	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite: Electrical and Electronics circuits	**ETL**	**2**	**0/0**	**2/0**	**3**

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 12

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 12

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: 24

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

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:

1. Bimal K Bose,"ModernPowerElectronicsandACDrives",PearsonEducation,2002.
2. JosephVithyathil,"PowerElectronics",McgrawHill,USA,1995.
3Mohan ,Udeland and Robbins,"PowerElectronics",John Wiley and sons ,New York ,2003.4.VedamSubramaniam,"ThyristorcontrolofElectricalDrives",TataMcGraw-hill,NewDelhi,1998

Subject Code: EBOL22I01	Subject Name: ONLINE COURSE NPTEL/SWAYAM/Any MOOC APPROVED BY AICTE/UGC	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	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

SubjectCode: EBEC22IL5	Subject Name :PROCESSORS AND CONTROLLERS LAB	Ty /Lb/ ETL	L	T/SLr	P/R	C
	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

CO1	Ability to understand the Programming of 8085 and 8086 microprocessor.
CO2	Interfaceperipheralswith 8086microprocessor
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	3	3	3	3	3	2	2	2	2	3	3	3
CO2	3	3	3	3	3	2	2	2	2	3	3	3
CO3	3	3	3	3	3	2	2	2	2	3	3	2
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 /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	3	3
CO2	3	3	2	3
CO3	3	3	3	3
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/Technical Skill	Soft Skills			
							✓					

SubjectCode: EBEC22IL5	Subject Name :PROCESSORS AND CONTROLLERS LAB	T /L/ ETL	L	T/SLr	P/R	C
	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:	Subject Name : ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB	Ty / Lb/ ETL	L	T/ S.Lr	P/ R	C
EBCS22IL4	Prerequisite: ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	Ty	0	0/0	3/0	1

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

Ty/Lb/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- Study the concepts of Artificial Intelligence.
- Learn the methods of solving problems using Artificial Intelligence.
- Introduce the concepts of Expert Systems and machine learning

COURSE OUTCOMES (COs) : Students will able to:

CO1	Write a R program to merge two given lists into one list, given matrix into one list.
CO2	Demonstrate the working of the decision tree based ID3 algorithm
CO3	Write a program to implement the naïve Bayesian classifier for a sample training data set stored as a .CSV file.
CO4	Apply EM algorithm to cluster a set of data stored in a .CSV file
CO5	Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set using Java/Python ML library.

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	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	PSO1	PSO2	PSO3	PSO4		
CO1				3		
CO2				3		
CO3				3		
CO4				3		
CO5				3		

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓		✓			

SubjectCode: EBCS22IL4	SubjectName:ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING LAB	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING	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	P/ R	C
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 Code: EBME22011	SubjectName: CAD,CAM &CIM	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Prerequisite:Design of Machine Elements,	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/Embedded Theoryand Lab

OBJECTIVE

- To provide an overview of how computers are being used in design,development of Manufacturing plans and manufacture
- To understand the need for integration of CAD,CAM and CIM

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concepts and uses of various CAD devices
CO2	Apply various CAD modeling techniques
CO3	Understand the CNC machines and integeration of CAD/CAM
CO4	Analyze and write down part programming for lathe and milling operations
CO5	Apply group technology and computer aided process planning and understand the FMS concept and functions

MappingofCoursewithProgramOutcomes(Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2		3							
CO2	3	3	2		3							
CO3	3	3	2		3							
CO4	3	3	2		3							
CO5	3	3	2		3							

Cos/PSOs	PSO1	PSO2	PSO3	PSO4								
CO1		3	3	2								
CO2		3	3	2								
CO3		3	3	2								
CO4		3	3	2								
CO5		3	3	2								

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
				✓								

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

UNIT- I INTRODUCTION **9**

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 **9**

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:B-rep,CSG,Sweep representation,ASM,Primitive instancing,Cell Decomposition and Octree encoding

UNIT- III COMPUTER AIDED MANUFACTURING **9**

CAM Concepts,Objectives&scope,Nature&Typeofmanufacturingsystem,Evolution,BenefitsofCAM,Role 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 andcomponents,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 **9**

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 **9**

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 AssemblySystems.

Total No.of Periods:45

TEXTBOOKS

1) ChrisMcMohanandJimmieBrowne, *"CAD/CAM"*,AddisonWesleyPublications,2nd Ed.
2) HMT,(2000) *"Mechatronics"*,TataMcGraw–Hill Ed.
3) Mikkel.P.Groover,(2007)*"Automation,ProductionandComputerIntegratedManufacturing"*,PHI.,PvtLtd.

REFERENCEBOOKS

1. *MikellPGroover,"Automation,ProductionSystemsandComputerIntegratedManufacturing",PearsonEducation*
2. *Rao,Tewari,Kundra,"ComputerAidedManufacturing",McGrawHill*
3. *P.Radhakrishnan,"ComputerNumericalControl",NewCentralBookAgency*

Subject Code:EBME22013	SubjectName:INDUSTRIAL AUTOMATION	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Pre requisite: Instrumentation and Control Engineering	**Ty**	**3**	**0/0**	**0/0**	**3**

L: LectureT:Tutorial S Lr : Supervised LearningP : ProjectR : Research C: CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES:To gain

- Knowledge in hydraulic, pneumatic and mechatronics system in Automation.

OURSEOUTCOMES(COs):

CO1	Understand Pneumatic and hydraulic principles, components and functions
CO2	Analyze and Design the Pneumatic and hydraulic circuits for automation
CO3	Recognise the various components of mechatronics system
CO4	Discuss the various actuation systems and System models in automation
CO5	Design the Mechatronic system for the required automation

Mapping of Course Outcomes with Program Outcomes(POs)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	3	2	3				
CO3	3	3	2	3				
CO4	3	3	2	3				
CO5	3	3	2	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities and Social Sciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
				✓								

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

UNIT- I BASIC PRINCIPLES OF HYDRAULICS AND PNEUMATICS 8

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 10

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 8

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 8

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 11

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.

TotalNo.of Periods: 45

TEXTBOOKS

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

REFERENCES

1. *Michael B. Histand and David G. Alciatore, "Introduction to Mechatronics and Measurement Systems",McGraw-Hill InternationalEditions, 2000.*
2. *BradleyD.A.,DawsonD.,BuruN.C.and.LoaderA.J,"Mechatronics",ChapmanandHall,1993.*
3. *Lawrence J. Kamm, "Understanding Electro – Mechanical Engineering", An Introduction to Mechatronics,Prentice– HallofIndia Pvt., Ltd., 2000.*
4. *NitaigourPremchandMahadik,"Mechatronics",TataMcGraw-HillpublishingCompanyLtd,2003*

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

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To give an understanding of working of embedded system and its applications

COURSEOUTCOMES(COs):

CO1	Understand the basic concepts of an embedded system
CO2	Analyze the architecture of a typical embedded system.
CO3	Recognise the different operating systems for embedded system
CO4	Evaluate the different performance issues of embeddedsystem
CO5	Implement real time embedded systems based on the concepts studied

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1
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	3	3	3	3	1	3	3	3	3
CO5	3	3	3	2	3	3	3	3	2	3	2	2

COs /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2		2	1					
CO3	2		3					
CO4		3		3				
CO5	3		3					

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	Interdisciplinary	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
					√							

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

UNIT I: INTRODUCTION TO EMBEDDED SYSTEM **12**

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

UNIT II: ARCHITECTURE OF EMBEDDED SYSTEM **12**

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

UNIT III: OS FOR EMBEDDED SYSTEMS **12**

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

UNIT IV: PERFORMANCE ISSUES OF EMBEDDED SYSTEMS **12**

CPU Performance, CPU power consumption, Program level performance analysis, Analysis and optimization ofprogramsize,energyandpower,Evaluatingoperatingsystemperformance,Powermanagementandoptimization strategies for processes, Multiprocessors – CPUs and accelerators, Multiprocessor performanceanalysis.

UNIT V:DESIGN& IMPLEMENTATION **12**

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

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

SubjectCode: EBME22L09	SubjectNameINDUSTRIAL AUTOMATION LAB	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	Prerequisite:Industrial Automation	Lb	0	0/0	3/0	1

L: LectureT:Tutorial SLr :SupervisedLearningP : ProjectR:ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES:

- To practice simple programs on microprocessors and microcontrollers.
- To design and implement pneumatic and hydraulic circuits with automation studio software and with kits

COURSEOUTCOMES(COs):(3-5)Students will be able to:

CO1	Recognize the various components of Hydraulics and Pneumatic circuits
CO2	Design and implement hydraulic circuits with automation studio software and kit
CO3	Design and implement pneumatic circuits with automation studio software and kit
CO4	Understand the concepts and applications of robots
CO5	Write programming for controllers in automation

Mapping of Course Outcomes with Program Outcomes(Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	3	3	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	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	3	2	3				
CO3	3	3	2	3				
CO4	3	3	2	3				
CO5	3	3	2	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
				✓			✓					

SubjectCode: EBME22L09	SubjectName:INDUSTRIAL AUTOMATION LAB	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	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

Subject Code: EBME22L07	Subject Name: CAD/CAM LAB	Ty/Lb/ ETL	L	T/ SLr	P/R	C
	Pre requisite: CAD,CAM&CIM, Machine Drawing	Lb	0	0/0	3/0	1

L: LectureT:Tutorial SLr : SupervisedLearningP

:ProjectR:ResearchC:CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- Get practical knowledge through practice on CNC Machines and related software .

COURSEOUTCOMES(COs):(3-5)

CO1	Understand the concepts of metal cutting and related information
CO2	Acquire skill in special purpose machines
CO3	Select appropriate method of manufacturing based on the requirement
CO4	Understand the concepts and applications of powder metallurgy
CO5	Expose to various advanced manufacturing processes of precision components

MappingofCoursewithProgramOutcomes(Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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
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	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	3	2	3				
CO3	3	3	2	3				
CO4	3	3	3	3				
CO5	3	3	3	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
				✓								

Subject Code: EBME22L07	SubjectName:CAD/CAM LAB	Ty /Lb/ ETL	L	T /S.Lr	P/ R	C
	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

SubjectCode: EBCC22I07	SubjectName:SOFT SKILLS II QUALITATIVE AND QUANTITATIVE SKILLS	Ty / Lb/ETL/IE	L	T /S.Lr	P/ R	C
	Prerequisite:Nil	**IE**	**0**	**0/0**	**2/0**	**1**

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES:

- To bring behavioural patterns of students.
- To train them for corporate culture.
- To create self awareness.
- To build confidence.
- To train the students for facing the interviews and develop interpersonal relationship..

COURSE OUTCOMES(COs):(3- 5)

CO1	Recognize and apply arithmetic knowledge in avariety of contexts.
CO2	Ability to identify and critically evaluate philosophical arguments and defend them from criticism.
CO3	Gain the skill in solving H.C.F &L.C.M–Problem and Profit&Loss problems.
CO4	Gain the skill in solving the problems in Permutations&Combinations
CO5	Data Interpretation using different graphs.

Mapping of Course Outcomes with Program Outcomes(POs)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	3	1	3	3	3	3	1

Cos/PSOs	PSO1	PSO2	PSO3	PSO4
CO1				
CO2				
CO3				
CO4				
CO5				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project	Basic Science		
								✓				

SubjectCode: EBCC22I07	SubjectName: SOFT SKILLS II QUALITATIVE AND QUANTITATIVE SKILLS	Ty / Lb/ETL /IE	L	T /S.L r	P/ R	C
	Prerequisite:Nil	IE	0	0/0	2/0	1

UNIT I LogicalReasoningI **6**

Logical Statements –Arguments– Assumptions– CoursesofAction.

UNIT II LogicalReasoningII **6**

Logical conclusions–Deriving conclusions from passages–Themedetection.

UNIT III ArithmeticalReasoningI **6**

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

UNIT IVArithmeticalReasoningII **6**

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

UNIT V DataInterpretation **6**

Tabulation–Bar graphs–Piegraphs–Linegraphs.

Total No of Periods:30

REFERENCEBOOK:

1. *R.S.Agarwal, AmodernapproachtoLogicalReasoning,S.Chand&Co.,(2017).*
2. *R.S.Agarwal, AmodernapproachtoVerbalandNonverbalReasoning, S.Chand&Co.,(2017).*
3. *R.S.Agarwal,QuantitativeAptitudeforCompetitiveExaminations,S.Chand&Co.,(2017).*
4. *A.K.Gupta,LogicalandAnalyticalReasoning,RameshPublishing House,(2014).*
5. *B.S.Sijwali,Indusijwali,AnewapproachtoReasoning(VerbalandNonverbal),ArihantPub lishers,(2014).*

SubjectCode: EBRA22I03	SubjectName: TECHNICAL SKILL-III	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	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: EBRA22I04	Subject Name : MINI-PROJECT /INTERNSHIP	Ty / Lb/ETL	L	T /S.L r	P/ R	C
	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

SubjectCode: EBRA22008	Subject Name: KINEMATICS AND DYNAMICS OF ROBOTS	Ty /Lb / ETL	L	T /S.L r	P/ R	C
	Prerequisite:Kinematics and Dynamics of Machinery	**Ty**	**3**	**1/0**	**0/0**	**4**

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- Tounderstand the specifications and kinetics of robotics
- To understand the workspace analysis of Four axis,Five axis and Six axis robots
- To understand thedynamic analysis and forces of robots
- To understand the different motion of robots

COURSEOUTCOMES(COs):
Students will be able to:

CO1	Understand the different specifications of robots
CO2	Analyse work space analysis of different categories of robots
CO3	Solve differential motion and statics for three and four axis robots
CO4	Apply Langrangian mechanics ,determine moment of inertia,and derive dynamic equation for two axia planar articulated robot
CO5	Generate trajectory for path planning for robots

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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	1	2	2	1	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	2	2	3	3
CO3	1	3	2	3
CO4	1	2	2	2
CO5	1	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/Technical Skill	Soft Skills			
				✓								

SubjectCode: EBRA22008	Subject Name: KINEMATICS AND DYNAMICS OF ROBOTS	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Kinematics and Dynamics of Machinery	Ty	3	1/0	0/0	4

UNIT–I: INTRODUCTION 12

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 12

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 12

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

UNIT–IV DYNAMIC ANALYSIS AND FORCES 12

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

UNIT–V TRAJECTORYPLANNING 12

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

Total No.of Periods: 60

TEXTBOOKS:

1. RobertJ.Schilling,—FundamentalsofRoboticsAnalysisandControl‖,PHILearning,2009.
2. NikuSB,—IntroductiontoRobotics,Analysis,Systems,Applications‖,PrenticeHall,2001.

REFERENCES:

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

Subject Code:	Subject Name: INDUSTRIAL APPLICATIONS OF ROBOTS	Ty /Lb / ETL	L	T /S.L r	P/ R	C
EBRA22009	Prerequisite:Basics of Robotics	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- Togiveaconceptualunderstandingofusageofrobotsinmanufacturingindustries
- Toanalyserobotsforprocessingoperations
- Toanalysetherobotsforassembly,inspection,selectionandselectrobotsbasedonvariousdesignconsiderations

COURSEOUTCOMES(COs):(3- 5)
Studentswillbe able to

CO1	Understand the significance of robots in material transfer and machine loading and unloading processes
CO2	Recall the applications of robots for processing operations
CO3	Demonstrate assembly and Inspection techniques for robots
CO4	Appreciate the role of robots in safe and unsafe environments
CO5	Examine the factors involved in selection and design consideration of robots

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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	1	2	2	1	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	2	2	3	3
CO2	2	2	3	3
CO3	1	3	2	3
CO4	1	3	2	2
CO5	1	3	2	2

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / Technical	Soft Skills			
				✓								
Approval												

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

UNIT I: MATERIAL TRANSFER AND MACHINE LOADING/UNLOADING 9

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

UNIT II: ROBOT FOR PROCESSING OPERATIONS 9

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 9

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 9

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

UNIT V: SELECTION AND DESIGN CONSIDERATION OF ROBOTS 9

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. BernardHodges,"IndustrialRobotics",SecondEditon,JaicoPublishingHouse,1993

REFERENCES:

1. *DebSRandDebS,—RoboticsTechnologyandFlexibleAutomation\,TataMcGrawHillEducationPvt.Ltd, 2010.*
2. *SahaSK,—IntroductiontoRobotics,TataMcGrawHill EducationPvt.Ltd,2010*

Subject Code: EBRA22010	SubjectName:MACHINE VISION SYSTEM	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Programming and Mathematical knowledge,Basics of Robotics	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

- Tostudyandanalyzevisionsystem, algorithmsandroboticvision.

COURSEOUTCOMES(COs):Students will be able to:

CO1	Understand the basic concepts of vision system in robotics.
CO2	Discuss various vision algorithms in image processing.
CO3	Implement recognition of objects by various methodologies.
CO4	Appreciate the various applications of image processing in robotics
CO5	Get exposed to Robotic Operating system, hardware and software components of robots.

MappingofCourseOutcomeswithProgramOutcomes(POs)

Cos/Ps	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO2	PSO3	PSO4
CO1	3	3	2	
CO2	2	3	1	
CO3	2	3	3	
CO4	2	3	3	
CO5	3	3	2	

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
				✓								

Subject Code: EBRA22010	SubjectName:MACHINE VISION SYSTEM	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Programming and Mathematical knowledge,Basics of Robotics	Ty	3	0/0	0/0	3

UNIT I :VISION SYSTEM **9**

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

UNIT II :VISION ALGORITHMS **9**

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 **9**

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

UNIT IV: APPLICATIONS **9**

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 **9**

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:

1. Carsten Steger, Markus Ulrich, Christian Wiedemann, “Machine Vision Algorithms and Applications”,WILEY-VCH,Weinheim,2008.
2. DamianmLyons,“Cluster ComputingforRoboticsandComputerVision”,WorldScientific,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.

Subject Code: EBRA22011	Subject Name: AUTONOMOUS MOBILE ROBOTS	Ty /Lb/ ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Basics of Robotics	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To get to know about different configurations of mobile robots
- To analyse and understand mobile robot kinematics
- To understand and analyse perception concepts ,mobile robot locoalization and planning and navigation concepts

COURSEOUTCOMES(COs):(3- 5)
Studentswillbe able to:

CO1	Understand the different configurations of mobile robots
CO2	Solve kinematics equations involved in mobile robots design
CO3	Understand the working of different types of sensors in mobile robots
CO4	Design different techniques for mobile robot localization
CO5	Implement different planning and navigation techniques for mobile robots.

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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	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	PSO1	PSO2	PSO3	PSO4
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 Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / Technical	Soft Skills			
				✓								
Approval												

Subject Code: EBRA22011	Subject Name: AUTONOMOUS MOBILE ROBOTS	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Basics of Robotics	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION **9**

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 **9**

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

UNIT III: PERCEPTION **9**

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 **9**

The Challenge of Localization: Noise and Aliasing,To localize or not to localize: Localization-Based Navigation versus Programmed Solutions,Belief Representation, Single-hypothesis beliefMultiple-hypothesis beliefMap 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 **9**

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.

Total No.of Periods:45

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.

SubjectCode: EBRA22L05	SubjectName: ROBOT PROGRAMMING AND SIMULATION LAB	Ty /Lb / ETL	L	T/S.Lr	P/ R	C
	Prerequisite:Industrial Applications of Robots	**Lb**	**0**	**0/0**	**3/0**	**1**

L: LectureT:Tutorial S.Lr : SupervisedLearningP: ProjectR: Research C:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To program robot for different kinds of real time applications

COURSEOUTCOMES(COs):(3- 5)
Students will be able to

CO1	Program and simulate robot for line follower application
CO2	Design and develop robotic metal detector vehicle
CO3	Develop and simulate smart bot,surveillance bot and sixth sense and gesture based robot
CO4	Learn and develop haptic based robots,robot navigation system employing RFID and sensors
CO5	Develop warfield spying robot and surface cleaning robots

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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	2	3	3	3	1	2	1	3	3	3	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	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	3	2	3
CO4	3	3	2	3
CO5	3	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	BasicSciences	Engineering	Humanities	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships	Soft Skills			
				✓			✓					
Approval												

SubjectCode: EBRA22L05	SubjectName: ROBOT PROGRAMMING AND SIMULATION LAB	Ty /Lb / ETL	L	T/S.Lr	P/ R	C
	Prerequisite:Industrial 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

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

L: LectureT:Tutorial S.Lr : SupervisedLearningP: ProjectR: Research C:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To illustrate the design and simulation of various modules not limited to pneumatic, electro-pneumatic and PLCs, and enable the students to integrate various modules to form a final robotic product

COURSEOUTCOMES(COs):(3- 5)
Students will be able to

CO1	Analyze the various technical tools necessary for product development
CO2	formulate the mathematical model for the product
CO3	Design and develop a working prototype based on the mathematical model
CO4	Trouble shoot and debug any issues while fine tuning the product
CO5	Demonstrate the spirit of team work

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	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	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	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	3
CO2	3	2	3	3
CO3	3	3	2	3
CO4	3	2	3	3
CO5	3	3	2	3

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

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	C
	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 disciplinary concepts	**Lb**	**0**	**0/0**	**3/3**	**2**

Students should identify the topic of the Project and should collect the literatures and datas, at the end ofthe 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.

SubjectCode: EBFL22IXX	SubjectName: FOREIGNLANGUAGE	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
	Pre Requisite:Nil	IE	1	0/0	1/0	1

L : Lecture T : TutorialS.Lr : Supervised Learning P : ProjectR : Research C: CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE: The main objective of this course is to equip the students with one foreign language which will enable them for higherstudies/professional career abroad

\COURSEOUTCOMES(COs):(3-5)

CO1	Students will gain the knowledge of identifying phonetics of all the letters in one foreign language
CO2	Students will gain the knowledge of reading small words and in one foreign language
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

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO3	PSO4				
CO1								
CO2								
CO3								
CO4								
CO5								

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
			✓									

SubjectCode: EBFL22IXX	SubjectName: FOREIGNLANGUAGE	Ty/Lb/ ETL/IE	L	T/ SLr	P/R	C
	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	EBFL22I05/ HBFL22I05	CHINESE
6	EBFL22I06/HBFL22I06	RUSSIAN
7	EBFL22I07/HBFL22I07	SPANISH

SEMESTER VIII

Subject Code: EBCC22ID1	Subject Name :ENGINEERING ECONOMICS AND INDUSTRIAL MANAGEMENT	Ty/Lb/ ETL	L	T/S Lr	P/R	C
	Prerequisite:Nil	Ty	3	0/0	0/0	3

L:LectureT:Tutorial SLr:SupervisedLearningP:ProjectR:ResearchC:Credits

T/L/ETL:Theory/Lab./EmbeddedTheoryandLab.

OBJECTIVE: Thestudentwilllearn:

- Conceptsofindustrialmanagementandeconomics

COURSEOUTCOMES(COs): The student will be able to

CO1	Understand the various concepts of organizations and economics related to it
CO2	Expose to the behavior of the human in the organization
CO3	Analyze the demand and supply patterns and costs related to it
CO4	Illustrate the various methods of production with cost effectiveness
CO5	Identify the effect of cost on macro economics

MappingofCourseOutcomes(COs)withProgramOutcomes(POs)&ProgramSpecificOutcomes(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	PSO1	PSO2	PSO3	PSO 4				
CO1	2	3	3	3				
CO2	2	3	3	3				
CO3	2	3	3	3				
CO4	2	3	3	3				
CO5	2	3	3	3				

3/2/1 Indicates Strength Of Correlation, 3 – High, 2- Medium, 1- Low

Category	Basic Science	Engineering Science	Humanities and social Science	Program Core	Program elective	Open Elective	Inter Disciplinary	Skill Component	Practical /Project			
							✓					

Subject Code: EBCC22ID1	Subject Name :ENGINEERING ECONOMICS AND INDUSTRIAL MANAGEMENT	Ty/Lb / ETL	L	T/S.Lr	P/ R	C
	Prerequisite:Nil	Ty	3	0/0	0/0	3

UNIT I:Introduction to Management **9**

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 **9**

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 **9**

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 **9**

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 ofCost.

UNIT V: MacroEconomic Concepts **9**

National income concepts,Inflation,Balance of Payment,Circular flow of incomeMonetary and Fiscal Policy,Demonetization,ExchangeRates

TotalNo.ofPeriods:45

REFERENCE BOOKS:

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

SubjectCode: EBRA22L07	SubjectName:PROJECT PHASE-II	Ty / Lb/ETL	L	T /S.Lr	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

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

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE :

- To impart knowledge on maintenance , fundamentals and Safety Engineering practices

COURSE OUTCOMES (COs) : (3- 5)
Students will be able to

CO1	Understand the basic concepts of maintenance
CO2	Describe the total predictive maintenance
CO3	Define safety system analysis
CO4	Categorize different types of hazards
CO5	Implement safety systems in machine operations

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO 1	PO2	PO3	PO4	PO5	PO6	PO7	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	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	PSO1	PSO2	PSO3	PSO4
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 Strength of Corre1ation 3- high, 2- medium, 1-1ow

Category	Basic Sciences	Engineering Sciences	humanities and Socia1	Program Core	Program E1ectives	Open E1ectives	Practica1 / Project	Internships / Technica1 Ski1l	Soft Ski11s			
					✓							
Approva1												

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

UNIT I : MAINTENANCE: **6**

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

UNIT II: TOTAL PRODUCTIVE MAINTENANCE: **12**

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: **7**

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

UNIT IV: HAZARD ANALYSIS: **10**

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: **10**

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.

Total No. of Periods: 45

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.

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

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab7

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS to disciplines beyond Electrical and Mechanical engineering.

COURSE OUTCOMES (COs) : (3- 5)
Students will be able to

CO1	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	Implement the concept of MEMS in polymer and optical applications

Mapping of Course Outcomes with Program Outcomes (POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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
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	PSO1	PSO2	PSO3	PSO4				
CO1	1	1	3	3				
CO2	1	1	3	3				
CO3	1	1	3	3				
CO4	1	1	3	3				
CO5	1	1	3	3				

3/2/1 indicates Strength of Corre1ation 3- high, 2- medium, 1-1ow

Category	Basic Sciences	Engineering Sciences	humanities and Socia1 Sciences	ProgramCore	Program E1ectives	Open E1ectives	Practica1 / Project	Internships / Technica1 Skil1	Soft Ski1s			
					✓							
Approva1												

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

UNIT I INTRODUCTION **9**

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 **9**

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 **9**

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 **9**

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 **9**

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.

Total No. of Periods : 45

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.

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

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVE:

- Basic principles analysis of stress, strain in plates and rotating discs
- To analyze the stresses and deformations through advanced mathematical models.
- To estimate the design strength of various industrial equipments.

COURSE OUTCOMES (COs) : Student will be able to:

CO1	Understand the mathematical modeling of plates of varying loads
CO2	Solve the equibrium, compatability, boundary conditions and stress calculations.
CO3	Describe the various stresses and other boundary conditions on rotating discs
CO4	Compare the performance of infinite beam on elastic foundation subjected to varying loads
CO5	Analyse stresses in beams of different curvature and derive hertz equation for contact stresses

Mapping of Course Outcomes with Program Outcomes (POs)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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	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	PSO1	PSO2	PSO3	PSO4
CO1	2	3	1	1
CO2	3	1	2	2
CO3	2	3	2	1
CO4	2	3	2	1
CO5	2	3	2	1

3/2/1 indicates Strength of Corre1ation 3- high, 2- medium, 1-1ow

Category	Basic Sciences	Engineering Sciences	3u2anities and Socia1 Sciences	Program Core	Program E1ectives	Open E1ectives	Practica1 / Project	Interns3ips / Tec3nica1 Ski11	Soft Ski11s			
					✓							
Approva1												

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

UNIT I: ANALYSIS OF PLATES **8**

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 **10**

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 **10**

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 **8**

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 **9**

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.

Total No. of Periods : 45

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.

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

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits

T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: Students will learn

- To understand the application of computers in various aspects of Manufacturing viz., Design, Process planning, Manufacturing cost, Layout & Material Handling system
- To understand the Modern manufacturing systems
- To understand the concepts and applications of flexible manufacturing systems

COURSE OUTCOMES (COs) : Students will be able to:

CO1	Understand the CAM concepts with respect to manufacturing industry
CO2	Define production planning and process planning in manufacturing sector
CO3	Analyse cellular manufacturing techniques
CO4	Develop Flexiblke manufacturing and automated guided vehicle systems
CO5	Implement robotics in industrial sector

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4
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 indicates Strength of Correlation 3- high, 2- medium, L-Low

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 MANUFACTURING	Ty / Lb/ETL	L	T / S.Lr	P/ R	C
EBRA22E04	Prerequisite: CAD,CAM & CIM	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **10**

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 **9**

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 **8**

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 **8**

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.

Total No. of Periods : 45

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.

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

L : Lecture T : Tutorial SLr : Supervised Learning P : Project R : Research C: Credits
T/L/ETL : Theory/Lab/Embedded Theory and Lab

OBJECTIVES: To learn

- Fundamentals of Finite Element Analysis and their applications

COURSE OUTCOMES (COs) : Students will be able to:

CO1	Understand the mathematical models and basic concepts of finite element methods.
CO2	Analyse one dimensional problems in finite element analysis
CO3	Solve second order two dimensional equations involving scalar variable functions
CO4	Define two dimensional vector variable problems,stress and strain calculations
CO5	Implement isoparametric elements and remember advanced numerical techniques

Mapping of Course Outcomes with Program Outcomes (Pos)

Cos/Pos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4				
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 indicates Strength of Correlation 3- high, 2- medium, L-Low

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	P/ R	C
EBRA22E05	Prerequisite: Strength of Materials, Design of Machine Elements	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9**

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 **9**

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 **9**

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 **9**

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 **9**

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.

Total No. of Periods: 45

TEXT BOOKS:

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

REFERENCES:

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

PROGRAM ELECTIVE: II

SubjectCode: EBRA22E06	SubjectName:INDUSTRIAL NETWORKING	Ty / Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite: Instrumentation and Control Engineering	Ty	3	0/0	0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To understand the evolution of computer networks usingthelayerednetworkarchitecture.
- Understand the concepts of modbus.
- Befamiliar with different Ethernet systems
- Be familiar with wireless communications and itsapplications.

COURSEOUTCOMES(COs):(3- 5)
Students will be able to:

CO1	Understand the basic concepts of instrumentation and networking applicable in industries.
CO2	Discuss the concepts of modbus and profibus in industrial networking.
CO3	Apply Ethernet and CAN protocols in industrial systems
CO4	Remember wireless communications concepts in networking
CO5	Implementcommunication technologies in industrial applications

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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	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	PSO1	PSO2	PSO3	PSO4
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

3/2/1 indicates Strength of Correlation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	HumanitiesandSocialScience	Program Core	Program Electives	OpenElectives	Practical	Inernships /TechnicalSkill	Soft Skills			
					✓							
Approval												

SubjectCode: EBRA22E06	SubjectName:INDUSTRIAL NETWORKING	Ty / Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite: Instrumentation and Control Engineering	Ty	3	0/0	0	3

UNIT I INTRODUCTION **10**

Modern instrumentation and control systems – OSI model – Protocols – Standards – Common problems andsolutions – 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 **8**

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 **12**

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 **9**

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

UNIT V APPLICATIONS **6**

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 inelectricalsubstations.

Total No.of Periods: 45

TEXTBOOKS:

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

REFERENCES:

1. RichardZurawski,"TheIndustrialCommunicationTechnologyHandbook",TaylorandFrancis,2005
2. DominiqueParet,"MultiplexedNetworksforEmbeddedSystems",JohnWiley&Sons,2007
3. AlbertLozano-Nieto,"RFIDDesignFundamentalsandApplications",CRCPress,2011

SubjectCode: EBRA22E07	SubjectName:TOTAL INTEGERATED AUTOMATION	Ty /Lb / ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Analog and Digital Electronics,Processors and Controllers	**Ty**	**3**	**0/0**	**0/0**	**3**

L : LectureT:Tutorial SLr: Supervised LearningP: ProjectR:ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To gain awareness on complete automation in industries

COURSEOUTCOMES(COs) :(3- 5)
Students will be able to:

CO1	Understand the concept of TIA systems ,PACs and Vertical Integration Structure
CO2	Articulate the role of HMI systems in Industrial Automation.
CO3	Analyse SCADAs significance in automation
CO4	Assess different communication protocols involved in SCADA
CO5	Demonstrate the usage of DCS in industrial automation

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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
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	PSO1	PSO2	PSO3	PSO4
CO1	1	1	3	3
CO2	1	1	3	3
CO3	1	1	3	3
CO4	1	1	3	3
CO5	1	1	3	3

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringScience	HumanitiesandSocialScie	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSk	Soft Skills			
					✓							
Approval												

SubjectCode: EBRA22E07	SubjectName:TOTAL INTEGERATED AUTOMATION	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite :Analog and Digital Electronics,Processors and Controllers	Ty	3	0/0	0/0	3

UNIT I: TOTALLYINTEGRATEDAUTOMATION **9**

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

UNIT II: HMI SYSTEMS **9**

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) **9**

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 **9**

Proprietary and open Protocols – OLE/OPC – DDE – Server/Client Configuration – Messaging – Recipe – Useradministration– InterfacingofSCADAwith PLC, drive,and other fielddevice

UNIT V: DISTRIBUTED CONTROL SYSTEMS (DCS) **9**

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 SCADAand DCS.

Total No.ofPeriods: 45

TEXTBOOKS:

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

REFERENCES:

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

SubjectCode: EBRA22E08	SubjectName:MICRO ROBOTICS	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Basics of Robotics	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr:SupervisedLearningP :ProjectR: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To gain knowledge in microrobot working principle and its applications

COURSEOUTCOMES(COs):(3- 5)
Students will be able to:

CO1	Understand the micro machining technology concepts
CO2	Discuss different scaling laws and materials for MEMS
CO3	Analyse flexures,actuators and sensors for micro robots
CO4	Assess the usage of MEMS in designing microrobots
CO5	Implement microrobots using MEMS

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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
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	PSO1	PSO2	PSO3	PSO4
CO1	1	1	3	3
CO2	1	1	3	3
CO3	1	1	3	3
CO4	1	1	3	3
CO5	1	1	3	3

3/2/1 indicates Strength of Correlation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities	Program Core	Program Elective	OpenElectives	Practical/ Project	Internships/	Soft Skills			
					✓							
Approval												

SubjectCode: EBRA22E08	SubjectName:MICRO ROBOTICS	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Basics of Robotics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **5**

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

UNIT II SCALINGLAWS ANDMATERIALS FOR MEMS **10**

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 **10**

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: **9**

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

UNIT V IMPLEMENTATION OF MICROROBOTS **11**

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:

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

Subject Code: EBRA22E09	SubjectName:COGNITIVE ROBOTICS	Ty /Lb / ETL	L	T /S.L r	P/ R	C
	Prerequisite:Basicsof Robotics	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To study about cogniotive robots and its applications

COURSEOUTCOMES(COs):(3- 5)
Studentswillbe able to

CO1	Understand the model of cognition ,perception and reception
CO2	Define map building and execute program on map building
CO3	Analyse randomized path planning for cognitive robots
CO4	Describe SLAM for cognitive robots
CO5	Implement robot program using predefined packages for real time applications

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO 7	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
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	PSO1	PSO2	PSO3	PSO4				
CO1	1	1	3	3				
CO2	1	1	3	3				
CO3	1	1	3	3				
CO4	1	1	3	3				
CO5	1	1	3	3				

3/2/1 indicates Strength of Correlation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSki	Soft Skills			
					✓							
Approval												

Subject Code: EBRA22E09	SubjectName:COGNITIVE ROBOTICS	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite:Basics of Robotics	Ty	3	0/0	0	3

UNIT I CYBERNETIC VIEW OF ROBOT COGNITION AND PERCEPTION **6**

Introduction to the Model of Cognition, Visual Perception, Visual Recognition, Machine Learning, Soft Computing Tools and Robot Cognition.

UNIT II MAP BUILDING **12**

Introduction, Constructing a 2D World Map, Data Structure for Map Building, Explanation of the Algorithm, AnIllustration of Procedure Traverse Boundary, An Illustration of Procedure Map Building,Robot Simulation,Execution of theMap Building Program.

UNIT III RANDOMIZED PATH PLANNING **9**

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.

UNIT IV SIMULTANEOUS LOCALIZATION AND MAPPING (SLAM) **12**

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

UNIT V ROBOT PROGRAMMING PACKAGES: **6**

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.

Total No.of Periods :45

TEXTBOOKS:

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 Implementation‖, MIT Press,Cambridge,2005.

REFERENCES:

1. SebastianThrun,WolframBurgard,DieterFox,―ProbabilisticRobotics‖,MITPress,2005.

2. Margaret E. Jefferies and Wai-Kiang Yeap, "Robotics and Cognitive Approaches to Spatial Mapping",Springer-VerlagBerlin Heidelberg 2008. 15

SubjectCode: EBRA22E10	SubjectName: CLOUD ROBOTICS	Ty /Lb / ETL	L	T/S.Lr	P/ R	C
	Prerequisite:Basics of Robotics	**Ty**	**3**	**0/0**	**0/0**	**3**

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

To gain knowledge in Cloud Robotics and their applications

COURSEOUTCOMES(COs):(3- 5)
Students will be able to:

CO1	Understand the concepts of telerobotics and its brief history in cloud robotics
CO2	Define the communication and networking concepts in telerobotics system
CO3	Analyse the fundamentals of online robots
CO4	Design web software architecture for online robots
CO5	Implement mobile robots through online mode

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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
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	PSO1	PSO2	PSO3	PSO4				
CO1	1	1	3	3				
CO2	1	1	3	3				
CO3	1	1	3	3				
CO4	1	1	3	3				
CO5	1	1	3	3				

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	HumanitiesandSocialScien	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSkil	Soft Skills			
					✓							
Approval												

SubjectCode: EBRA22E10	SubjectName: CLOUD ROBOTICS	Ty /Lb/ ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Basics of Robotics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **5**

Telerobotics:Overviewandbackground –Brief history.

UNITII COMMUNICATIONS AND NETWORKING **13**

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 **10**

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

UNIT IV ONLINE ROBOTS **10**

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

UNIT V CASE STUDY **7**

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 Robotics‖, Springer Science and Business,2010.
2. Ken Goldberg, Roland Siegwart, ―Beyond Webcams – An Introduction to Online Robots‖, MIT Press,2010.

REFERENCES:

1. BorkoFurht,ArmandoEscalante,―Handbookof CloudComputing‖,SpringerScience&Business,2010.

2. PeterSinčák,PitoyoHartono,MáriaVirčíková,JánVaščák,Rudolf Jakša,―EmergentTrendsinRoboticsandIntelligentSystems‖, Springer, 2014.

SubjectCode: EBRA22E11	SubjectName: MEDICAL ROBOTICS	Ty / Lb/ETL	L	T/S.Lr	P/ R	C
	Prerequisite:Basics of Robotics	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- Gain knowledge in medica lrobot working principle and applications

COURSEOUTCOMES(COs):(3- 5)
Students will be able to:

CO1	Understand the working of various types of robots in medical field.
CO2	Analyse localization and tracking mechanism performed by medical robots
CO3	Demonstrate the usage of robots in surgical operations
CO4	Examine the role of robots in medical rehabilitation
CO5	Implement robots dedicated to perform medical surgeries

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	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
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	PSO1	PSO2	PSO3	PSO4				
CO1	1	1	3	3				
CO2	1	1	3	3				
CO3	1	1	3	3				
CO4	1	1	3	3				
CO5	1	1	3	3				

3/2/1 indicates Strength of Correlation 3-High,2-Medium, 1-Low

category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
					✓							
Approval												

SubjectCode:	SubjectName: MEDICAL ROBOTICS	Ty / Lb/ETL	L	T/S.Lr	P/ R	C
EBRA22E11	Prerequisite:BasicsofRobotics	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **7**

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

UNIT II LOCALIZATION AND TRACKING **8**

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

UNIT III SURGICAL ROBOTICS **10**

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 **12**

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

UNIT V ROBOTS IN MEDICAL CARE **8**

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

Total No.of Periods :45

TEXTBOOKS:

1. Mark W. Spong, Seth Hutchinson, and M. Vidyasagar, ―Robot Modeling and Control, Wiley Publishers,2006.
2. PaulaGomes,"Medicalrobotics Minimallyinvasivesurgery",Woodhead,2012.

REFERENCES:

1. AchimSchweikard,FlorisErnst,―MedicalRobotics‖,Springer,2015.
2. Jocelyne Troccaz, ―Medical Robotics‖, Wiley-ISTE, 2012. 3. Vanja Bonzovic, ‖Medical Robotics‖, I-techEducationpublishing,Austria,2008.

SubjectCode:	Subject Name: AERIAL ROBOTS	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
EBRA22E12	Prerequisite:Basics of Robotics,Kinematics and Dynamics of Machinery	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits
T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

To give an introduction to different categories of UAVs,Motors ,Propellers,Materials and Launching system analyse flight mechanics,aircraft performance ,control derive mathematical models for the control systems and flight operations and safety systems

COURSEOUTCOMES(COs):(3- 5)
Studentswillbe able to:

CO1	Understand different categories of UAVs regulations ,components of UAVs,materials and launching systems
CO2	Analyse and derive the flight mechanics and study the performance of the aerial robots
CO3	Define the flight control aspects of the aerial robots along with the communication aspects involving their usage
CO4	Derive the necessary mathematical model for the analysis of aerial robots
CO5	Appreciate the flight operations and safety operations involved in the aerial vehicular systems

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO12
CO1	3	3	3	3	2	3	2	1	3	3	3	3
CO2	3	3	3	3	3	2	1	1	2	3	3	3
CO3	3	3	3	3	2	3	2	1	3	3	3	3
CO4	3	3	3	3	2	3	2	1	3	3	3	3
CO5	3	3	3	3	2	3	2	1	3	3	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4			
CO1	3	2	3	3			
CO2	2	2	2	3			
CO3	3	2	2	3			
CO4	3	2	2	3			
CO5	3	2	2	3			

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

category	BasicSciences	EngineeringSciences	Humanities andSocialScienc	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSkill	Soft Skills			
					✓							
Approval												

Subject Code: EBRA22E12	Subject Name: AERIAL ROBOTS	Ty / Lb / ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Basics of Robotics,Kinematics and Dynamics of Machinery	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9**

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

UNIT II FLIGHT MECHANICS AND AIRCRAFT PERFORMANCE **9**

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 **9**

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 **9**

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

UNIT V FLIGHT OPERATIONS AND SAFETY SYSTEMS **9**

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:

1. Yasmina Bestaoui SebbaneA First Course in Aerial Robots and DronesCRC Press,2022
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

PROGRAM ELECTIVE: III

Subject Code: EBRA22E13	SubjectName:VIRTUAL INSTRUMENTATION	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Instrumentation and Control Engineering	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

To gain knowledge in the field of virtual instrumentation concepts

COURSEOUTCOMES(COs):(3- 5)Students will be able to:

CO1	Understand the concepts of virtual instrumentation.
CO2	Analyse different programming techniques in virtual instrumentation
CO3	Define data acquisition in programming of virtual instruments
CO4	Describe the working of various bus interfaces connected to the virtual instruments
CO5	Appreciate the usage of analysis tools in various fields of VIs

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	3	2	3
CO3	3	3	3	3
CO4	3	3	3	3
CO5	3	3	3	3

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
					√							
Approval												

SubjectCode: EBRA22E13	SubjectName:VIRTUAL INSTRUMENTATION	Ty /Lb/ ETL	L	T /S.L r	P/ R	C
	Prerequisite: Instrumentation and Control Engineering	Ty	3	0/0	0/0	3

UNIT I :REVIEW OF VIRTUAL INSTRUMENTATION **9**

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data–flowtechniques,graphical programmingindataflow,comparisonwithconventional programming.

UNIT II :PROGRAMMING TECHNIQUES **9**

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes,local and globalvariables, stringand fileI/O.

UNIT III: DATA ACQUISTION BASICS **9**

AOC.OAC. 010.Counters & timers.PC Hardware structure, timing.Interrupts OMA, software and hardwareinstallation.

UNIT IV: COMMON INSTRUMENT INTERFACES **9**

Current loop, RS.232C/RS.485, GPIB, System buses, interface buses: USB, PCMCIA, VXI, SCXI, PXI,etc.,networking basics for office&.Industrial applications,image acquisition and processing.Motioncontrol.

UNITV:USE OF ANALYSIS TOOLS **9**

Fourier transforms,power spectrum correlation methods,windowing&filtering,VI application in various fields.

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;Basicconceptsof Labview4,PrenticeHallInc.,NewJersey1998.

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

Subject Code: EBRA22E14	SubjectName:DIGITAL TWIN TECHNOLOGY	Ty / Lb/ETL	L	T /S. Lr	P/ R	C
	Prerequisite:Instrumentation and Control Engineering	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

To give an basic understanding of digital twin in current industrial sector and integrating IoT and other data communication techniques with Digital twin technology.

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the evolution of digital twin technology ,its components and utilities and sensors
CO2	Analyse the signal processing operations involved in digital twin and usage of Arduino controllers,PLCs for industrial applications
CO3	Solve image processing operations in digital twin techniques.
CO4	Integrate Digital Twin techniques with IoT ,edge and cloud computing and highlight its significance in manufacturing sectors
CO5	Implement Artificial Inteligence and Machine Learning techniques in Digital Twin techniques.

Mapping of CourseOutcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	2	3				
CO2	3	3	2	3				
CO3	3	3	3	3				
CO4	3	3	3	3				
CO5	3	3	3	3				

3/2/1 indicates Strength of Correlation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
					√							
Approval												

Subject Code: EBRA22E14	SubjectName:DIGITAL TWIN TECHNOLOGY	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Instrumentation and Control Engineering	Ty	3	0/0	0/0	3

UNIT I: EVOLUTION AND JOURNEY TOWARDS DIGITAL TWIN **9**

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 **9**

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

UNIT III:IMAGE PROCESSING FOR DIGITAL TWIN **9**

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 **9**

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 **9**

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

SubjectCode: EBRA22E15	SubjectName:DIGITAL CONTROL SYSTEM	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Instrumentation and Control Engineering	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/Embedded Theoryand Lab

OBJECTIVE:

- To understand the concept of Z–Transform
- To understand thesampled data systems
- To understand the statespace analysis and stability analysis
- To gain knowledge in pole placement and observer gain

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concept of Z-Transforms in signal processing
CO2	Describe sampled data system to various kinds of input signals
CO3	Solve steady state analysis of discrete time systems
CO4	Implement stability tests in discrete time systems
CO5	Formulate servo and other systems using pole placement and observer techniques

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	2	3	3	3	2	3
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	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	3				
CO2	3	3	2	3				
CO3	3	3	3	2				
CO4	3	3	3	2				
CO5	3	3	3	2				

3/2/1 indicatesStrength of Correlation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities and SocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
					√							
Approval												

SubjectCode: EBRA22E15	SubjectName:DIGITAL CONTROL SYSTEM	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Instrumentation and Control Engineering	Ty	3	0/0	0/0	3

UNIT I Z TRANSFORM **6**

Sampleddatatheory–Samplingprocess– Samplingtheorem–Signalreconstruction –Sample andhold circuits – ZTransform–Theorems onZTransforms–InverseZTransforms.

UNIT II SAMPLEDDATA SYSTEMS **8**

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

UNIT III STATESPACE ANALYSIS **11**

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

UNIT IV STABILITYANALYSIS: **11**

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: **9**

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

Total No. ofPeriods:45

TEXTBOOKS:

1. OgataK.,—Discrete-TimeControl systems‖,2ndEdition,PHILearningPvt.Ltd,2009.
2. KuoB.C.,—DigitalControlSystems‖,2ndEdition,OxfordUniversityPress,2007.

REFERENCES:

1. GopalM.,—ModernControlSystemsTheory‖,3rdEdition,NewAgeInternationalPublications,2014.
2. GopalM.,—DigitalControl Engineering‖,NewAgeInternational Publications,2003.
3. GopalM.,—DigitalControlandStateVariableMethods‖,3rdEdition,TMH,2008.
4. RichardC.DorfandRobertH.Bishop,—ModernControlSystems‖,12thEdition,PearsonEducation,2004.

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

L : Lecture T : Tutorial SLr : Supervised Learning P: Project R : Research C : CreditsT/L/ETL:Theory/Lab/Embedded Theoryand Lab

OBJECTIVE:

- To understand the fundamentals, architecture and challenges of Internet of Things.
- To understand the protocols used during connectivity of devices.
- To know the importance in securing the devices connected through IoT.
- To understand the implementation of IoT in industries.
- To design, monitor and control various electrical systems using IoT.

COURSEOUTCOMES(COs) :

CO1	Understand the architecture and challenges of IoT.
CO2	Analyse the protocols based on the application of smart devices.
CO3	Appreciate the security for data and smart devices.
CO4	Describe the real time application of IoT in industries.
CO5	Implement innovative systems using IoT .

MappingofCourseOutcomewith Program Outcome(POs)

Cos/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	3	3	3	3	3	3	3	3	3
CO2	3	3	3	3	3	3	2	2	2	3	3	2
CO3	3	3	3	3	3	3	3	3	1	3	3	3
CO4	2	3	1	3	3	3	2	2	3	3	3	2
CO5	3	3	3	3	3	2	3	3	2	3	2	3

COs /PSOs	PSO1	PSO2	PSO 3	PSO4
CO1	3	3	3	3
CO2	2	2	2	2
CO3	3	3	3	1
CO4	2	2	2	3
CO5	3	3	3	2

3/2/1 Indicates Strength Of Correlation,3–High,2-Medium,1-Low

Category	BasicSciences	Engg.Science	Humanities& socialScience	ProgramCore	ProgramElective	OpenElective	Practical/Project	Internships/TechnicalSkills	SoftSkills
					✓				
Approval									

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

UNIT I INTRODUCTION **9**

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

UNIT II PROTOCOLS **9**

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

UNIT III IoT SECURITY **9**

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

UNIT IV INDUSTRIAL IoT **9**

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

UNIT V APPLICATION BUILDING WITH IoT **9**

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

TotalNo.OfPeriods: 45

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.
2. Smart Buildings Digitalization: IoT and Energy Efficient Smart Buildings Architecture and Applications,O.V. Gnana Swathika, K. Karthikeyan, Sanjeevi kumar Padmanaban, CRC Press,2022.
3. https://www.electricaltechnology.org/2016/07/internet-of-things-iot-and-its-applications-in-electrical-power-industry.html

PROGRAM ELECTIVE: IV

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

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- Tolearntheconceptsof Signalsandsystemsandtheirapplicationsindigital signal Processing

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concepts of signals and systems
CO2	Solve Z-Transforms and draw realizations of systems based on z-transforms
CO3	Define DFT and FFT for processing of digital signals
CO4	Design digital filters based on various methodologies
CO5	Remember the various digital signal processors

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4
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 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
					√							
Approval												

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	Ty	3	0/0	0/0	3

UNIT I SIGNALS & SYSTEMS 9

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

UNIT II ZTRANSFORM& REALISATIONS 9

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 9

Discrete Fourier Transform (DFT) – Definition – Properties – Convolution of sequences – Linear convolution -circular convolution. Introduction to Radix – 2 FFT – Properties – DIT (FFT) – DIF (FFT) – Algorithms ofRadix–2FFT– ComputingInverse DFTbydoingadirectDFT

UNIT IV DESIGN OF DIGITAL FILTER 9

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 FIRfilters usingwindows.

UNIT V OVERVIEW OF DIGITAL SIGNAL PROCESSOR 9

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,ProgrammingandApplication”,TataMcGrawHill, New Delhi,2003.
3.AlanVOppenheim,"SignalsandSystems",PrenticeHallofIndiaPvt.Ltd,2ndEdition,1997Hwei P.Hsu,Schaum‟sOutlineSeries,“SignalsandSystems”,McGrawHillCompanies,2nd Edition

References:

1.A.V.Oppenheim, R.W. Schafer and J.R. Buck, “Discrete – Time Signal Processing”, 8th Indian reprint,Pearson 2004.

Subject Code: **EBRA22E18**	Subject Name: **NEURAL NETWORKS**	**Ty / Lb/ETL**	**L**	**T /S.Lr**	**P/ R**	**C**
	Prerequisite: Engineering Mathematics	**Ty**	**3**	**0/0**	**0/0**	**3**

L: LectureT:Tutorial SLr : Supervised LearningP : ProjectR : Research C:

CreditsT/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To understand the architecture, learning algorithm and issues of various feed forward and feedback neural networks
- To understand the biological neural network and to model equivalent neuron models

COURSEOUTCOMES(COs):(3-5)

Upon the completion of the course the students will be able to

CO1	Understand the basic working principle of neuron
CO2	Compare the operation of single layer and multi layer perceptron
CO3	Analyze the significance of back propagation algorithm
CO4	Demonstrate the computer simulation of feature mapping models
CO5	Implement a neuro dynamical model

MappingofCourseOutcomeswith ProgramOutcomes(POs)

COs/POs	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
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**			**1**	**1**

COs /PSOs	**PSO1**	**PSO2**	**PSO3**	**PSO4**
CO1	**1**	**2**	**2**	
CO2		**1**		
CO3	**3**	**3**	**3**	**3**
CO4	**3**	**3**	**3**	**3**
CO5	**3**	**3**	**3**	**3**

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills	Interdisciplinarysubject		
					✓							
Approval												

Subject Code: EBRA22E18	Subject Name: **NEURAL NETWORKS**	**Ty / Lb/ETL**	**L**	**T /S.Lr**	**P/ R**	**C**
	Prerequisite: Engineering Mathematics	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT –I INTRODUCTION **9**

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 **9**

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

UNIT - III BACK PROPAGATION **9**

Back Propagation and Differentiation, Hessian Matrix, Generalization, Cross Validation, Network Pruning Techniques, Virtues, and Limitations of Back Propagation Learning, Accelerated Convergence, Supervised Learning

UNIT - IV SELF-ORGANIZATION MAPS (SOM) **9**

Two Basic Feature Mapping Models, Self-Organization Map, SOM Algorithm, Properties of Feature Map, Computer Simulations, Learning Vector Quantization, Adaptive Pattern Classification

UNIT - V NEURO DYNAMICS **9**

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

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

SubjectCode: EBRA22E19	SubjectName:WIRELESS COMMUNICATION	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Analog and Digital Electronics , Electrical and Electronics circuits	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES:

To Study wireless communication concepts and antenna techniques

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concept of wireless channels
CO2	Describe the concept of cellular architecture
CO3	Analyse digital signaling techniques for fading channels
CO4	Discuss multipath mitigation techniques
CO5	Implement antennas for wireless communication

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	2
CO2	2	1	1	2
CO3	1	2	1	2
CO4	1	2	2	2
CO5	1	2	2	2

3/2/1 indicates Strength of Correlation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/Project	Internships /TechnicalSkill	Soft Skills			
					√							
Approval												

SubjectCode: EBRA22E19	SubjectName:WIRELESS COMMUNICATION	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Analog and Digital Electronics , Electrical and Electronics circuits	Ty	3	0/0	0/0	3

UNIT I WIRELESSCHANNELS **9**

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 **9**

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 **9**

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 **9**

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 **9**

MIMO systems–spatial multiplexing -System model-Pre-coding- Beam forming- transmitterdiversity,receiver diversity-Channelstateinformation-capacityinfadingand non-fadingchannels.

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.andRamji Prasad,"OFDMforwirelessmultimediacommunications",ArtechHouse,2000.

SubjectCode: EBRA22E20	SubjectName: VLSI DESIGN	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Analog and Digital Electronics	**Ty**	**3**	**0/0**	**0/0**	**3**

L: LectureT:Tutorial SLr : Supervised LearningP: Project R:ResearchC:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVE:

- To learn the basics of MOS Transistors.
- To study the design of combinational logic circuit using CMOS.
- To learn CMOS sequential logic circuits design.
- To learn arithmetic building blocks
- 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
CO4	Describe arithmetic bulding blocks using CMOS transistor
CO5	Implement digital design using FPGAs

Mapping of Course Outcomes with Program Outcomes(POs)

COs/POs	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1	PO1
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	2	2	3	3	3	1	3	3	1	1
CO5	3	3	2	3	2	3	3	1	3	3	3	1

COs /PSOs	PSO1	PSO2	PSO3	PSO4				
CO1	3	3	3	1				
CO2		2		3				
CO3	2		1					
CO4	2			3				
CO5	3	2	1	1				

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringScience	HumanitiesandSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships /TechnicalSki	Soft Skills			
					√							
Approval												

SubjectCode: EBRA22E20	SubjectName: VLSI DESIGN	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Analog and Digital Electronics	Ty	3	0/0	0/0	3

UNIT I MOS TRANSISTOR PRINCIPLE **9**

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 **9**

Examples of Combinational Logic Design, Elmore‟s constant, Pass transistor Logic, Transmission gates, staticanddynamic CMOS design, Powerdissipation– Lowpowerdesign principles

UNIT III SEQUENTIAL LOGIC CIRCUITS **9**

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 **9**

Datapathcircuits,Architecturesforripplecarryadders,carrylookaheadadders,Highspeedadders, accumulators,Multipliers, dividers, Barrelshifters,speed and areatradeoff

UNIT V IMPLEMENTATION STRATEGIES **9**

Full custom and Semi custom design, Standard cell design and cell libraries, FPGA building block architectures,FPGAinterconnectroutingprocedures.

Total No.of Periods :45

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:

1. N.Weste,K.Eshraghian,“Principlesof CMOSVLSIDesign”,SecondEdition,AddisionWesley1993
2. 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

Subject code: EBRA22E21	Subject Name: INTERNET OF THINGS	Ty / Lb/ETL	L	T /S. Lr	P/ R	C
	Prerequisite: Instrumentation and Control Engineering,Processors and Controllers and Python Programming	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

Ty/Lb/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

- To study basic of IoT and M2M.
- To studyIoT with Cloud Environment.
- To design IoT systems with Python and Study physicalDevices

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concepts of IoT and its various levels
CO2	Define domain specific IoT and M2M
CO3	Analyse integration of IoT with cloud services
CO4	Describe the significance of Python with respect to IoT
CO5	Implement IoT systems using development boards like Arduino and Galileo

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	2	2	2	2	2	1	1	3	2	3	3
CO2	2	2	3	3	3	1	3	1	3	2	3	3
CO3	3	3	3	3	3	3	3	2	3	2	3	2
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	PSO1	PSO2	PSO3	PSO4		
CO1	3	3	3	3		
CO2	3	3	2	3		
CO3	3	3	2	3		
CO4	3	3	2	3		
CO5	3	3	2	3		

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
					✓							
Approval												

Subject Code: EBRA22E21	SubjectName:INTERNET OF THINGS	Ty / Lb/ETL	L	T /S. Lr	P/ R	C
	Prerequisite: Instrumentation and Control Engineering,Processors and Controllers andPython Programming	Ty	3	0/0	0/0	3

UNIT I: INTRODUCTION TO IoT **9**

DefinitionandCharacteristicsofIoT-ThingsinIoT-IoTprotocols-LogicalDesignofIoT-IoTenablingtechnologies-IoT levels

UNIT II: DOMAIN SPECIFIC IoT AND M2M **9**

Home Automation-Cities-Environment-Energy-Retail-Logistics-Agriculture-Health and Lifestyle-Introduction toM2M-DifferencebetweenIoTand M2M-SDNand NFVfor IoT

UNIT III:IoT SYSTEM MANAGEMENT AND CLOUD **9**

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:IoT SYSTEMS-LOGICAL DESIGN USING PYTHON **9**

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 **9**

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. AdrianMcEwenandHakimCassimally,"DesigningtheInternetofThings",Wiley,FirstEdition,2014
3.CHillarGastn,"InternetofThingswithPython",Packtpublishing,firstedition,2016

REFERENCES:

1. DominiqueDGuinardandVladM.Trifa,"BuildingtheWebofthingswithexamplesinNode.jsandRaspberryPi",ManningPublicationsCo,2016
2. MarcoSchwartz,"InternetofThingswiththeRaspberryPi:BuildInternetofThingsProjectsUsingtheRaspberryPiPlatform",Kindle Edition

PROGRAM ELECTIVE: V

SubjectCode: EBRA22E22	SubjectName:HUMAN COMPUTER INTERACTION	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Basics of Computers and applications	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

Ty/Lb/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

- Learn the foundations of Human Computer Interaction
- Be familiar with the design technologies for individuals and persons with disabilities
- Manage HCI

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concepts of Humans with respect to computers
CO2	Analyse the usage of computers in HCI
CO3	Discuss the uses of HCI in multiple domains
CO4	Design HCI systems for diverse populations
CO5	Investigate HCI with respect to technology transfer and other issues

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	PSO1	PSO2	PSO3	PSO4		
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 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships / TechnicalSkil	Soft Skills			
					✓							
Approval												

SubjectCode: EBRA22E22	SubjectName:HUMAN COMPUTER INTERACTION	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite:Basics of Computers and applications	Ty	3	0/0	0/0	3

UNIT I: HUMANS IN HCI **9**

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 **9**

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 **9**

HCI in health care-designing emotions for games,entertainment interfaces and interactive eproducts-motor vehicle driver interfaces-HCI in aerospace-usercentered design in games

UNITIV:DESIGNING FOR DIVERSITY **9**

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 **9**

Technology transfer-augmenting cognition in HCI-human values, ethics and design, cost justification-future trends in HCI

Total No. ofPeriods:45

TEXTBOOKS:

1. AlanDix,JanetFinlay,GregoryAbowd,RussellBeale,“HumanComputerInteraction”,3rdEdition,Pearson 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.*

Subject Code: EBRA22E23	SubjectName:ADVANCED MACHINE LEARNING	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Artificial Intelligence and Machine Learning	Ty	3	0/0	0/0	3

L: LectureT: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)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	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

COs /PSOs	PSO1	PSO2	PSO3	PSO4		
CO1	2	3	1	2		
CO2	2	3	1	2		
CO3	2	3	1	2		
CO4	2	3	1	2		
CO5	2	3	1	2		

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	Program Electives	OpenElectives	Practical/ Project	Internships / Technical	Soft Skills			
					✓							
Approval												

Subject Code: EBRA22E23	SubjectName:ADVANCED MACHINE LEARNING	Ty / Lb/ETL	L	T /S.L r	P/ R
	Prerequisite: Artificial Intelligence and Machine Learning	Ty	3	0/0	0/0

UNITI: INTRODUCTION TO MACHINE LEARNING **9**

Machine Learning – Machine learning applications – learning association – supervised learning – learning a classfrom examples – learning multiple classes – regression – model selection and generation – Bayestan decisiontheory– losses andrisk– discriminatefunctions – association rules.

UNIT II:PARAMETRIC AND MULTI VARIATE METHODS **9**

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 **9**

Clustering - Mixtures densities – k mean clustering – special and hierarchal clustering – Nonparametric densityestimation – generalization to multivariate data – nonparametric classification – outlier data – decision trees –univariatetrees– pruning–rule extractionfromtrees–multivariatetrees.

UNIT IV: LINEAR DISCRIMINATION AND MULTILAYER PERCEPTRONS **9**

Lineardiscrimination–generalizingthelinearmodel–pairwiseseparation–logisticdiscrimination–discriminationbyregression–multilayerpreceptrons–MLP–backpropagationalgorithms–trainingprocedures – tuning – dimensionality reduction – deep learning – local models – competitive learning – radialbasis – normalized basis– learningvector quantization -mixture ofexperts.

UNIT V: KERNEL MACHINES AND GRAPHICAL MODELS **9**

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.*

SubjectCode: EBRA22E24	SubjectName:RANDOMIZED ALGORITHMS	Ty /Lb/ ETL	L	T /S. Lr	P/ R	C
	Prerequisite: Programming and Mathematical knowledge	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : Supervised LearningP :Project R:ResearchC:Credits

Ty/Lb/ETL:Theory/Lab/EmbeddedTheoryandLab

OBJECTIVE:

- To understand the mathematical foundations needed for understanding and designing randomized algorithms
- To appreciate the need for randomized algorithms
- To expose the students to probabilistic methods
- To understand the concept of random walk
- To expose the students to different types of applications of randomized algorithms

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concept of randomized algorithms
CO2	Define Probabilistic methods for random variables
CO3	Analyse algebraic techniques and applications for randomized algorithms
CO4	Define Geometric and Graph algorithms
CO5	Implement Hash and online algorithms

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12
CO1	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

COs /PSOs	PSO1	PSO2	PSO3	PSO4		
CO1	2	3	1	2		
CO2	2	3	1	2		
CO3	2	3	1	2		
CO4	2	3	1	2		
CO5	2	3	1	2		

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialScien	Program Core	Program Elective	OpenElectives	Practical/ Project	Internships / Tec	Soft Skills			
					✓							
Approval												

SubjectCode: EBRA22E24	SubjectName:RANDOMIZED ALGORITHMS	Ty /L b/ ETL	L	T /S. Lr	P/ R	C
	Prerequisite: Programming and Mathematical knowledge	**Ty**	**3**	**0/0**	**0/0**	**3**

UNIT I :INTRODUCTION TO RANDOMIZED ALGORITHMS **9**

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 **9**

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 **9**

Fingerprinting Techniques – Verifying Polynomial Identities – Perfect Matching in Graphs – Pattern Matching –VerificationofMatrixMultiplicationStructuringProblems–Ra-Data ndomTreaps – SkipLists– HashTables.

UNIT IV :GEOMETRIC AND GRAPH ALGORITHMS **9**

RandomizedIncrementalConstruction–ConvexHulls–Duality–TrapezoidalDecompositions– LinearProgramming– Graph Algorithms– Min-cut–MinimumSpanningTrees.

UNIT V: HASHING AND ONLIN EALGORITHMS **9**

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*.

SubjectCode: EBRA22E25	SubjectName:GRAPH ALGORITHMS	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Programming and Mathematical knowledge	Ty	3	0/0	0/0	3

L: LectureT:Tutorial SLr : SupervisedLearningP:Project R: ResearchC:Credits

Ty/Lb/ETL:Theory/Lab/Embedded TheoryandLab

OBJECTIVE:

- To understand the concept and need of graphs
- To understand various graph algorithms
- To understand the various applications of graph in real world problems

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the concepts of graphs and various sub graphs
CO2	Define various path and tree algorithms
CO3	Analyse matching concepts in graphs
CO4	Discuss Eulerian and Hamiltonian graphs
CO5	Implement Graph isomorphism

MappingofCourseOutcomeswithProgramOutcomes(POs)

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

COs /PSOs	PSO1	PSO2	PSO3	PSO4		
CO1	2	3	1	2		
CO2	2	3	1	2		
CO3	2	3	1	2		
CO4	2	3	1	2		
CO5	2	3	1	2		

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialSciences	Program Core	ProgramElectives	OpenElectives	Practical/ Project	Internships/TechnicalSkill	Soft Skills			
					✓							
Approval												

SubjectCode: EBRA22E25	SubjectName:GRAPH ALGORITHMS	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Programming and Mathematical knowledge	Ty	3	0/0	0/0	3

UNIT I:INTRODUCTION: **6**

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: **7**

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.Depth-firstandbreadth-firstalgorithms forfindingblocks.

UNIT III:MATCHING: **11**

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: **11**

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: **10**

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.

Total No.of Periods :45

TEXTBOOKS:

1. WillianKocay,DonaldL.Kreher,Graphs,Algorithms,andOptimization,CRCPress,2013.
2. JonathanGross andJayYellen, GraphTheoryand its Applications, CRCPress,2006.

REFERENCES:

1. DouglasBWest,IntroductiontoGraphTheory,PHILearningPvt.Ltd.,2012.
2. NaveedSherwani,AlgorithmsforVLSIPhysical DesignAutomation,Springer,2013.
3. Bang-Jensen,Jørgen,Gutin,GregoryZ.,Diagraphs:Theory,AlgorithmsandApplications,Springer-Verlag,2010.

Subject Code: EBRA22E26	SubjectName:SYSTEM SOFTWARE	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Basics of computer software and hardware	Ty	3	0/0	0/0	3

L: LectureT:Tutorial S.Lr : SupervisedLearningP:Project R: Research C:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES

- Tounderstandtheconceptofassemblers, loaders, andlinkers.
- Understandfundamentalconceptsofmacroprocessingandemulators.
- Understandtheconceptofvirtual machines.

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand the basic concepts of assemblers and its functions
CO2	Define loaders and linkers
CO3	Describe macroprocessors and emulators
CO4	Remember virtual machines
CO5	Implement system software in real world

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	3	2	3	1	2	3	1	3	3
CO5	3	3	3	3	2	3	1	2	3	1	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	1	3	1
CO3	2	1	2	3
CO4	2	1	2	3
CO5	2	1	2	3

3/2/1 indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	Engineering Sciences	Humanities andSocialSciences	Program Core	Program Electives	OpenElectives	Practical/ Project	Internships / TechnicalSkill	Soft Skills			
					√							
Approval												

Subject Code: EBRA22E26	SubjectName:SYSTEM SOFTWARE	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Basics of computer software and hardware	Ty	3	0/0	0/0	3

UNIT I ASSEMBLERS **16**

ReviewofComputerArchitecture–MachineInstructionsandPrograms–Assemblers–BasicAssemblerFunctions– Assembler Features– AssemblerDesignOptions

UNIT II LOADERS AND LINKERS **8**

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 **10**

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 **6**

Pascal P-Code VM – Object-Oriented VMs – Java VM Architecture – Common Language Infrastructure –Dynamic Class Loading.

UNIT V ADVANCED FEATURES **5**

InstructionSetIssues–Profiling–Migration–Grids–Codeoptimizations-GarbageCollection-Examplesofrealworldimplementations of systemsoftware

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,TechniquesandTools”,AddisonWesley,Longman, 1999.*
4. *DhamdhereDM,“CompilerConstructionPrinciplesandPractice”,MacmillanCompany,1997.*
5. *HolubAllenI,“CompilerDesigninC”,PrenticeHall,2001.*

Subject Code: EBRA22E27	SubjectName:NATURAL LANGUAGE PROCESSING	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Programming knowledge	Ty	3	0/0	0/0	3

L: LectureT:Tutorial S.Lr : SupervisedLearningP:Project R: Research C:Credits

T/L/ETL:Theory/Lab/EmbeddedTheoryand Lab

OBJECTIVES

- To tag a given text with basic Language features
- To design an innovative application using NLP components
- To implement a rule based system to tackle morphology/syntax of a language
- To design a tag set to be used for statistical processing for real-time applications
- To compare and contrast the use of different statistical approaches for different types of NLP applications.

COURSEOUTCOMES(COs):(3- 5)

CO1	Understand basic concepts of NLP,different kinds of language modeling and related concepts
CO2	Analyse different algorithms with respect to NLPs
CO3	Solve syntactic analysis with respect to NLPs
CO4	Define semantic and pragmatics for NLPs
CO5	Implement Discourse analysis and lexical resources for NLPs

MappingofCourseOutcomeswithProgramOutcomes(POs)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
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	3	2	3	1	2	3	1	3	3
CO5	3	3	3	3	2	3	1	2	3	1	3	3

COs /PSOs	PSO1	PSO2	PSO3	PSO4
CO1	3	3	2	3
CO2	3	1	3	1
CO3	2	1	2	3
CO4	2	1	2	3
CO5	2	1	2	3

3/2/1indicatesStrengthofCorrelation 3-High,2-Medium, 1-Low

Category	BasicSciences	EngineeringSciences	Humanities andSocialScience	Program Core	Program Electives	OpenElectives	Practical/ Project	Internships / Technic	Soft Skills			
					√							
Approval												

Subject Code: EBRA22E27	SubjectName:NATURAL LANGUAGE PROCESSING	Ty / Lb/ETL	L	T /S.Lr	P/ R	C
	Prerequisite: Programming knowledge	Ty	3	0/0	0/0	3

UNIT I INTRODUCTION **9**

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 **9**

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 **9**

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 **9**

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 **9**

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

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 Python‖, 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 Java‖, O_Reilly Media, 2015.