REGULATIONS 2022
B.E. ROBOTICS AND AUTOMATION

ABOUT THE DEPARTMENT:

B.E- Robotics and Automation program was established in the year 2020 with intake of 60 students. Currently, the department intake is 30.

Robotics and Automation is an interdisciplinary branch which amalgamates various fields of Engineering that include Mechanical, Electronics, Computer Science, Sensors and Instrumentation, Industrial Automation and many more.

The B.E Programme in Robotics and Automation has rapidly gained momentum owing to the increasing demand for robotics and automation engineers. The curriculum is thoughtfully curated for current industry requirement based on inputs from veterans in the relevant domains belonging to academia and industry. It equips the students in par with the industry standards and fosters an innovative attitude that leads them to become entrepreneurs.

VISION:

To be recognized as a leader in Robotics & Automation Engineering education by producing engineers with systems and multidisciplinary approach by keeping up with technological advancements.

MISSION:

To create opportunities for the students by imparting knowledge, experience and skills to become the leaders in Robotics & Automation education and research.
To contribute to the economy through meaningful partnerships with Governments, Institutions and Industry in the field of Robotics & Automation.
To produce successful professionals in Robotics and Automation by imparting high technical knowledge, strong fundamentals, practical skills and creative knowledge.

PROGRAMME EDUCATIONAL OBJECTIVES:

Bachelor of Robotics and Automation Engineering curriculum is designed to prepare the graduates having attitude and knowledge to

PEO 1-Graduates will have successful professional and technical career

PEO 2-Graduates will have strong foundation in basic sciences, mathematics and computational platforms

PEO 3-Graduates will have knowledge on the theory and practices in the field and service of robotics engineering and allied areas

PEO 4-Graduates will have Engross in life-long learning to keep themselves abreast of new developments

PEO 5-Graduates will have the ability to Practice and inspire high ethical values and technical standards

PROGRAMME OUTCOMES (POs):

Robotics and Automation 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 (PSOs):

PSO-1: To develop safe and efficient Automation and Robotic systems for the requirements and specifications.

PSO-2: To analyse and improve the performance of Manufacturing and Production systems by implementing the latest technological advancements.

PSO-3: To lead a professional or an entrepreneur career in industries by applying Engineering and Management principles and best practices

B.E- ROBOTICS AND AUTOMATION
CURRICULUM FOR SEMESTERS I TO VIII AND
SYLLABI FOR SEMESTERS I TO IV
SEMESTER 1

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
MANDATORY COURSE										
*	22IP100	Induction Programme	-	-	-	-	-	03 Weeks	0	-
THEORY COURSES										
1	22HST101	Professional English	L+P	2	0	4	0	6	4	HSMC
2	22BST101	Basic Mathematics For Engineers	L	3	1	0	0	4	4	BSC
3	22BST102	Engineering Physics	L	3	0	0	0	3	3	BSC
4	22BST103	Engineering Chemistry	L	3	0	0	0	3	3	BSC
5	22EST101	Problem Solving and Python Programming	L	3	0	0	0	3	3	ESC
6	22HSM101	Heritage of Tamils	L	1	0	0	0	1	1	HSMC
EMPLOYABILITY ENHANCEMENT COURSE										
7	22EET101	Engineering and Professional Skills	L+P	1	0	2	0	3	2	EEC
PRACTICAL COURSES										
8	22ESP101	Problem Solving and Python Programming Laboratory	P	0	0	4	0	4	2	ESC
9	22BSP101	Physics and Chemistry Laboratory	P	0	0	4	0	4	2	BSC
EMPLOYABILITY ENHANCEMENT COURSE										
10	22EEP101	Product Tinkering Laboratory	P	0	0	2	0	2	1	EEC
			TOTAL	**16**	**01**	**16**	**00**	**33**	**25**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category

SEMESTER II

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1		Language Elective	L+P	3	0	2	0	5	4	HSMC
2	22BST202	Statistics and Numerical Methods	L	3	1	0	0	4	4	BSC
3	22RAT201	Fundamentals of Robotics	L	3	0	0	0	3	3	PCC
4	22EST201	Basic Electrical, Electronics Engineering and Measurements	L	3	0	0	0	3	3	ESC
5	22EST202	Engineering Graphics	L+P	1	0	4	0	5	3	ESC
6	22HSM201	Tamils and Technology	L	1	0	0	0	1	1	HSMC
EMPLOYABILITY ENHANCEMENT COURSE										
7	22EET201	Innovation and Design Thinking*	L	2	0	0	0	2	2	EEC
MANDATORY COURSE										
8	22NXP201	NCC/NSS/YRC Credit Course Level- I	-	1	0	0	0	1	1#	-
PRACTICAL COURSES										
9	22ESP201	Engineering Product Laboratory	P	0	0	3	0	3	1.5	ESC
10	22ESP202	Basic Electrical, Electronics Engineering and Measurements Laboratory	P	0	0	3	0	3	1.5	ESC
			TOTAL	**17**	**01**	**12**	**00**	**30**	**23**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
 # NCC Credit Course level 1 is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.
***Common for all branches**

SEMESTER III

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22BST304	Transforms Partial and Differential Equations	L	3	2	0	0	5	4	BSC
2	22EST301	Fluid Mechanics and Thermodynamics	L	3	0	0	0	3	3	ESC
3	22RAT301	Electrical Control Drives and Digital Electronics	L	3	0	0	0	3	3	PCC
4	22RAT302	Design of Robot Elements-I	L+P	3	0	2	0	5	4	PCC
5	22HST301	Entrepreneurship and startups*	L	2	0	0	0	2	2	HSMC
PRACTICAL COURSES										
6	22RAP303	Drives and Control Actuators Laboratory	P	0	0	4	0	4	2	PCC
7	22RAP304	Fluid Mechanics and Thermal Laboratory	P	0	0	4	0	4	2	PCC
EMPLOYABILITY ENHANCEMENT COURSE										
8	22EEP301	Soft Skills*	P	0	0	2	0	2	1	EEC
			TOTAL	**14**	**02**	**12**	**00**	**28**	**21**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category

*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**

SEMESTER IV

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22RAT401	CNC Machines and Metrology	L	3	0	0	0	3	3	PCC
2	22RAT402	Material Handling Automation	L	3	0	0	0	3	3	PCC
3	22RAT403	Sensors and Instrumentation	L	3	0	0	0	3	3	PCC
4	22RAT404	Advance Control System	L	3	0	0	0	3	3	PCC
5	22RAT405	Design of Robot Elements-II	L+J	3	0	0	2	5	4	PCC
MANDATORY COURSE										
6	22BST401	Environmental Sciences and Sustainability	L	2	0	0	0	2	2	BSC
PRACTICAL COURSES										
7	22NXP401	NCC/NSS/YRC Credit Course Level-II	-	1	0	0	0	1	1#	-
8	22RAP405	Manufacturing Technology Laboratory	P	0	0	4	0	4	2	PCC
9	22RAP406	Sensors and Instrumentation Laboratory	P	0	0	4	0	4	2	PCC
EMPLOYABILITY ENHANCEMENT COURSE										
10	22EEP401	Quantitative Analysis and Logical Reasoning-I	P	0	0	2	0	2	1	EEC
			TOTAL	**18**	**00**	**10**	**02**	**30**	**23**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**
 # NCC Credit Course level II is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for the computation of CGPA.

SEMESTER V

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22RAT501	Fluid Power Systems and Industrial Automation	L+P	3	0	2	0	5	4	PCC
2	22RAT502	Microcontrollers and Embedded Systems	L	3	0	0	0	3	3	PCC
3	22RAT503	Automation System Design	L	3	0	0	0	3	3	PCC
PROFESSIONAL ELECTIVE										
4		Professional Elective I	L	3	0	0	0	3	3	PEC
EMPLOYABILITY ENHANCEMENT COURSE										
5	22EET501	Engineering Economics and Financial Management	L	3	0	0	0	3	3	HSMC
MANDATORY COURSE										
6		Mandatory Course - I	L	3	0	0	0	3	0	MCC
ENROLLMENT FOR B.E. / B. TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
7		Minor/Honour/remedial class **	L	3	0	0	0	3	3**	PEC**
PRACTICAL COURSES										
8	22RAP501	Microcontrollers and Embedded Systems Lab	P	0	0	4	0	4	2	PCC
9	22RAP502	Fluid Power Transmission Systems laboratory	P	0	0	4	0	4	2	PCC
EMPLOYABILITY ENHANCEMENT COURSE										
10	22EEP502	Internship*	P	0	0	0	0	0	1	EEC
			TOTAL	**21**	**00**	**10**	**00**	**31**	**21**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**

SEMESTER VI

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22RAT601	Robot Path Programming based Automation	L+P+J	3	0	1	2	6	4	PCC
2	22RAT602	Autonomous Robots	L+P	3	0	1	0	3	4	PCC
OPEN ELECTIVE										
3		Open Elective-I	L	3	0	0	0	3	3	OEC
PROFESSIONAL ELECTIVE										
4		Professional Elective - II	L	3	0	0	0	3	3	PEC
5		Professional Elective - III	L	3	0	0	0	3	3	PEC
MANDATORY COURSE										
6		Mandatory Course - II	L	3	0	0	0	3	0	MCC
7	22NXP601	NCC/NSS/YRC Credit Course Level- III	-	1	0	0	0	1	1#	-
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
8		Minor/Honour/remedial class**		3	0	0	0	3	3**	PEC**
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
9	22EEP601	Quantitative Analysis and Logical Reasoning-II	P	0	0	2	0	2	1	EEC
10	22EEP602	Comprehensive Assessment*		0	0	2	0	2	1	EEC
PRACTICAL COURSES										
11	22RAP603	Robot based Industrial Automation Laboratory	P	0	0	4	0	4	2	PCC
			TOTAL	**22**	**00**	**10**	**02**	**33**	**21**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**
 # NCC Credit Course level III is offered for NCC students only. The grades earned by the students will be recorded in the Mark Sheet, however the same shall not be considered for

the computation of CGPA.

SEMESTER VII

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
THEORY COURSES										
1	22RAT701	Computer Vision and Image Processing	L	3	0	0	0	3	3	PCC
2	22RAT702	Robot Process Automation	L	3	0	0	0	3	3	PCC
OPEN ELECTIVE										
3		Open Elective-II	L	3	0	0	0	3	3	OEC
PROFESSIONAL ELECTIVE										
4		Professional Elective-IV	L	3	0	0	0	3	3	PEC
5		Professional Elective-V	L	3	0	0	0	3	3	PEC
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
6		Minor/Honour/remedial class **	L	3	0	0	0	3	3**	PEC**
PRACTICAL COURSES										
7	22RAP703	Additive Manufacturing Laboratory	P	0	0	4	0	4	2	PCC
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
8	22EEP701	Product Design and Development	P	0	0	0	4	4	2	EEC
9	22EEP702	Internship*	P	0	0	0	0	0	1	EEC
		TOTAL		**18**	**00**	**04**	**04**	**26**	**20**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category
*** Common to all branches**
**** Common to all branches, selection from one minor vertical/approved honors subjects**

SEMESTER VIII

S.No	COURSE CODE	COURSE TITLE	MODE	PERIODS PER WEEK				TCP	C	CAT
				L	T	P	J			
ENROLLMENT FOR B.E. / B.TECH. (HONOURS) / MINOR DEGREE (OPTIONAL)										
1		Minor/Honour/remedial class **	L	3	0	0	0	3	3**	PEC**
PRACTICAL COURSES - EMPLOYABILITY ENHANCEMENT COURSE										
2	22RAJ801	Project Work - Phase	J	0	0	0	16	16	08	EEC
			TOTAL	**00**	**00**	**00**	**16**	**19**	**08**	

L- Lecture T- Tutorial P- Practical J- Project TCP- Total Contact Periods
C- Credits CAT- Category

**** Common to all branches, selection from one minor vertical/approved honors subjects**

CREDIT DISTRIBUTION

Semester	HSMC	BSC	ESC	PCC	PEC	OEC	EEC	MC	TOTAL	Total PER %
I	06	12	05	-	-	-	03	-	**26**	**16**
II	05	04	09	03	-	-	02	-	**23**	**14**
III	02	04	03	11	-	-	01	-	**21**	**13**
IV	-	02	-	20	-	-	01	-	**23**	**14**
V	03	-	-	14	03	-	01	-	**21**	**13**
VI	-	-	-	10	06	03	02	-	**21**	**13**
VII	-	-	-	08	06	03	03	-	**20**	**12**
VIII	-	-	-	-		-	08	-	**8**	**5**
TOTAL	**16**	**22**	**17**	**66**	**15**	**06**	**21**	**-**	**163**	**100**

CATEGORY		Breakup of Credits	PER % in Total
HSMC	Humanities & Social Science Including Management	**16**	**9**
BSC	Basic Science Courses	**22**	**14**
ESC	Engineering Science Courses	**17**	**10**
PCC	Professional Core Courses	**66**	**41**
PEC	Professional Elective Courses	**15**	**9**
OEC	Open Elective Courses	**06**	**4**
EEC	Employment Enhancement Courses	**21**	**13**
MCC	Mandatory Courses	**-**	**-**
	Total Credits	**163**	**100**

PROFESSIONAL ELECTIVES COURSES: VERTICALS

VERTICAL 1	VERTICAL 2	VERTICAL 3	VERTICAL 4	VERTICAL 5	VERTICAL 6
APPLIED ROBOTICS	**AUTOMATION AND NETWORKING**	**INTELLIGENCE SYSTEMS**	**SMART MOBILITY SYSTEM**	**DESIGN AND MANUFACTURING**	**DIVERSIFIED COURSES GROUP 1**
Medical Robotics	Virtual Instrumentation Systems	Machine Learning for Robotics	Automobile Engineering	Robot and Machine Elements Design	Micro Electro Mechanical Systems
Industrial Robotics	Industrial Networking	Condition Monitoring and Fault Diagnostics	Automotive Mechatronics	Computer Integrated Manufacturing	Process Planning and Cost Estimation
Agricultural Robotics and Automation	Computer Architecture and Organization	Internet of Things (IOT)	Electric and Hybrid Vehicles	Additive Manufacturing	Medical Mechatronics
Drones and Autonomous Systems	Farm Automation	Industry 4.0	Smart Mobility and Intelligent Vehicles	Lean Manufacturing	Reliability and Maintenance Engineering
Robotic Welding Technology	Automation in Manufacturing	Industry 5.0	Advanced Driver Assistance Systems	-	Integrated Product Development
Humanoid Robotics	-	AI in Robotics	-	-	Design of Jigs and Fixtures

Registration of Professional Elective Courses from Verticals:

Professional Elective Courses will be registered in Semesters V and VI. These courses are listed in groups called verticals that represent a Particular area of specialisation / diversified group. Students

are permitted to choose all the Professional Electives from a particular vertical or from different verticals. Further, only one Professional Elective course shall be chosen in a semester horizontally (row-wise). However, two courses are permitted from the same row, provided one course is enrolled in Semester V and another in semester VI.

The registration of courses for B.E./B.Tech (Honours) or Minor degree shall be done from Semester V to VIII. The procedure for

registration of courses explained above shall be followed for the courses of B.E/B.Tech (Honours) or Minor degree also. For more details on B.E./B.Tech (Honours) or Minor degree refer to the Regulations 2022

PROFESSIONALS ELECTIVES COURSES: VERTICALS

VERTICALS -I Applied Robotics								
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22RAP501	Medical Robotics	3	0	0	0	3	3
2	22RAP502	Industrial Robotics	3	0	0	0	3	3
3	22RAP503	Agricultural Robotics and Automation	3	0	0	0	3	3
4	22RAP504	Drones and Autonomous Systems	3	0	0	0	3	3
5	22RAP505	Robotic Welding Technology	3	0	0	0	3	3
6	22RAP506	Humanoid Robotics	3	0	0	0	3	3

VERTICALS -II Automation and Networking								
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22RAP601	Virtual Instrumentation Systems	3	0	0	0	3	3
2	22RAP602	Industrial Networking	3	0	0	0	3	3
3	22RAP603	Computer Architecture and Organization	3	0	0	0	3	3
4	22RAP604	Farm Automation	3	0	0	0	3	3
5	22RAP605	Automation in Manufacturing	3	0	0	0	3	3

VERTICALS -III Intelligence Systems								
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**
1	22RAP606	Machine Learning for Robotics	3	0	0	0	3	3
2	22RAP607	Condition Monitoring and Fault Diagnostics	3	0	0	0	3	3
3	22RAP608	Applied Image Processing	3	0	0	0	3	3
4	22RAP609	Advance Optimization Techniques	3	0	0	0	3	3
5	22RAP610	Digital Twin and VR	3	0	0	0	3	3
6	22RAP611	Computer Vision and Image Processing	3	0	0	0	3	3

VERTICALS -IV Smart Mobility System								
S.No	**Course Code**	**Course Name**	**L**	**T**	**P**	**J**	**Contact Hours**	**Credits**

1	22RAP701	Automobile Engineering	3	0	0	0	3	3
2	22RAP702	Automotive Mechatronics	3	0	0	0	3	3
3	22RAP703	Electric and Hybrid Vehicles	3	0	0	0	3	3
4	22RAP704	Smart Mobility and Intelligent Vehicles	3	0	0	0	3	3
5	22RAP705	Advanced Driver Assistance Systems	3	0	0	0	3	3

VERTICALS -V
Design and Manufacturing

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22RAP706	Robot and Machine Elements Design	3	0	0	0	3	3
2	22RAP707	Computer Integrated Manufacturing	3	0	0	0	3	3
3	22RAP708	Additive Manufacturing	3	0	0	0	3	3
4	22RAP709	Lean Manufacturing	3	0	0	0	3	3

MANDATORY COURSES I (Non Credit Course)
(Semester V)

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22MCT001	Introduction to Women and Gender Studies	3	0	0	0	3	0
2	22 MCT002	Elements of Literature	3	0	0	0	3	0
3	22 MCT003	Film Appreciation	3	0	0	0	3	0
4	22MCT004	Well Being with Traditional Practices (Yoga, Ayurveda and Siddha)	3	0	0	0	3	0
5	22MCT006	Indian Constitution	3	0	0	0	3	0
6	22MCT007	Industrial Safety	3	0	0	0	3	0

MANDATORY COURSES II (NonCredit Course)
(Semester VI)

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22 MCT008	Essential of Indian Traditional Values	3	0	0	0	3	0
2	22 MCT009	History of Science and Technology in India	3	0	0	0	3	0
3	22MCT010	Political and Economic Thought for a Humane Society	3	0	0	0	3	0
4	22MCT011	State, Nation Building and Politics in India	3	0	0	0	3	0
5	22MCT012	Disaster Management	3	0	0	0	3	0

LANGUAGE ELECTIVE COURSES
(Semester II)

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22LET201	Technical English	3	0	2	0	5	4
2	22LET202	French Language	3	0	2	0	5	4
3	22LET203	German Language	3	0	2	0	5	4
4	22LET204	Japanese Language	3	0	2	0	5	4

OPEN ELECTIVES
(Students shall choose the open elective courses, such that the course contents are not similar to any other course contents/title under other course categories).

OPEN ELECTIVE I

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22RAO001	Robotics	3	0	0	0	3	3
2	22RAO002	Selection of Materials	3	0	0	0	3	3
3	22RAO003	Testing of Materials	3	0	0	0	3	3
4	22RAO004	Marine Vehicles	3	0	0	0	3	3
5	22RAO005	Introduction To Nanotechnology	3	0	0	0	3	3
6	22RAO006	Lean Manufacturing	3	0	0	0	3	3

OPEN ELECTIVE II

S.No	Course Code	Course Name	L	T	P	J	Contact Hours	Credits
1	22RAO007	Fundamentals of Combustion	3	0	0	0	3	3
2	22RAO008	Basics in Manufacturing and Metal Cutting Process	3	0	0	0	3	3
3	22RAO009	Fundamentals of Planetary Remote Sensing	3	0	0	0	3	3
4	22RAO010	Lean Six Sigma	3	0	0	0	3	3
5	22RAO011	Low Cost Automation	3	0	0	0	3	3
6	22RAO012	Production of Automotive Components	3	0	0	0	3	3

SEMESTER I

Course Code	Course Title	L	T	P	J	C
22HST101	PROFESSIONAL ENGLISH	2	0	4	0	4
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to

1. Provide learners with basic vocabulary and grammar to recognise and use in real time contexts
2. Improve communicative competence
3. Help use the language effectively in academic /work contexts
4. Build language skills by engaging in listening, speaking, vocabulary and grammar learning activities relevant to authentic contexts
5. Develop the ability to read and write complex texts, summaries, articles, blogs, definitions, essays, and user manuals

COURSE OUTCOME:

After the completion of this course, the students should be able to

1. Become accustomed to the basic vocabulary and grammar
2. Listen and comprehend complex academic texts
3. Read and infer the denotative and connotative meanings of technical texts
4. Write definitions, descriptions, narrations, and essays on various topics
5. Speak fluently and accurately in formal and informal communicative contexts

UNIT-1	INTRODUCTION TO FUNDAMENTALS OF COMMUNICATION	6 HOURS

Reading – Newspaper- sports/health; technical Brochures
Writing – Professional emails; Formal letters - Requisition & Business letters
Grammar – Word formation, Parts of speech, Framing questions
Vocabulary – Synonyms and Antonyms, One word substitution, Abbreviations and Acronyms

UNIT-2	NARRATION AND SUMMATION	6 HOURS

Reading – Biographies/ Travelogues
Writing - Guided writing- Paragraph; Short Report on an event (field trip etc.)
Grammar – Tenses; Subject-Verb Agreement; Prepositions
Vocabulary – Narrative vocabulary; Phrasal verbs

UNIT-3	DESCRIPTION OF A PROCESS / PRODUCT	6 HOURS

Reading – Gadget reviews; Advertisements **Writing -** Product description, Process description; Instruction writing **Gramma**r – Imperatives; Degrees of comparison **Vocabulary** – Compound words; Homonyms, homophones; discourse markers-Connectives and Sequence words		
UNIT-4	**CLASSIFICATION ND RECOMMENDATIONS**	**6 HOURS**
Reading – Newspaper articles; journal reports **Writing** – Note-making; Interpretation of charts; Recommendations **Gramma**r – Articles; Modal verbs **Vocabulary** - Collocations; Fixed / Semi fixed expressions.		
UNIT-5	**EXPRESSION**	**6 HOURS**
Reading – Editorials; opinion blogs **Writing** – Reports – Accident & Survey; Business letters **Grammar** – Punctuation; Negations; Simple, Complex and Compound sentences **Vocabulary** - Cause & Effect Expressions; Content vs Function words		
	TOTAL HOURS:	**30 HOURS**

TEXT BOOK(S):

1.	Hewings, Martin Advanced Grammar In Use. New Delhi: CUP,2008 MLA Handbook for Writers of Research Papers, 7th Edition
2.	English for Science & Technology Cambridge University Press, 2021. Authored by Dr. Veena Selvam, Dr. Sujatha Priyadarshini, Dr. Deepa Mary Francis, Dr. KN. Shoba, and Dr. Lourdes Joevani, Department of English, Anna University.

REFERENCE BOOKS:

1	Ian wood, Anne Williams with Anna Cowper, “Pass Cambridge BEC Preliminary”, 2nd edition, Cengage Learning, 2015.
2	Technical Communication – Principles And Practices, Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.
3	A Course Book On Technical English By Lakshminarayanan, Scitech Publications (India) Pvt. Ltd.
4	Effective Communication Skill, Kulbhusan Kumar, RS Salaria, Khanna Publishing House.

LIST OF EXPERIMENTS :

1. Listening to introductions of successful people
2. Self-Introduction and introducing a friend

3. Listening and filling out a form
4. Narrating a story using hints
5. Listening to telephone conversation
6. Telephonic Interview- Role play
7. Listening to podcasts, anecdotes/event narration
8. Narrating personal experiences/ events
9. Listening to celebrity interviews
10. Conversation Skills- Politeness strategies
11. Listening to process descriptions
12. Describing a process
13. Listening to travelogues
14. Narrating travel experiences
15. Listening to educational videos
16. Group discussion
17. Listening to TED Talks
18. Mini Presentations
19. Listening to description of art work
20. Picture description
21. Listening to scientific lectures
22. Summarizing a lecture
23. Listening to definitions/ descriptions of objects
24. One minute speech - Describing an object
25. Listening to Tv shows
26. Anchoring a reality show
27. Listening to advertisements
28. Adzap
29. Listening to autobiography

30. Visume
TOTAL HOURS: 60 HOURS

Course Code	Course Title	L	T	P	J	C
22BST101	BASIC MATHEMATICS FOR ENGINEERS	3	1	0	0	4
		Syllabus version		v. 1.0		

COURSE OBJECTIVES:

After studying this course, you should be able to:

1. To develop the use of matrix algebra techniques that are needed by engineers for practical applications.
2. To acquaint the students with differential calculus.
3. To explain the student with functions of several variables.
4. To make the students understand various techniques of integration and its applications.
5. To acquaint the student with mathematical tools needed in evaluating multiple integrals and their applications.

COURSE OUTCOME:

After completion of this course, the students should be able to

1. Use the matrix algebra methods for solving practical problems.
2. Apply differential calculus tools in solving various application problems.
3. Able to use differential calculus ideas on several variable functions.
4. Apply different methods of integration in solving practical problems.
5. Apply multiple integral ideas in solving areas, volumes and other practical problems.

UNIT-1	MATRICES	9+3 HOURS

Characteristic equation – Properties of Eigenvalues and Eigenvectors – Cayley - Hamilton theorem – Diagonalization of matrices by orthogonal transformation – Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT-2	DIFFERENTIAL CALCULUS	9+3 HOURS

Representation of functions - Limit of a function- Derivatives - Differentiation rules (sum, product, quotient, chain rules) - Logarithmic differentiation - Maxima and Minima of functions of one variable.

UNIT-3	FUNCTIONS OF SEVERAL VARIABLES	9+3 HOURS

Partial differentiation – Homogeneous functions and Euler's theorem – Total derivative – Change of variables – Jacobians – Taylor's series for functions of two variables – Maxima and minima of functions of two variables and Lagrange's method of undetermined multipliers.		
UNIT-4	**INTEGRAL CALCULUS**	**9+3 HOURS**
Definite and Indefinite integrals - Substitution rule - Integration by parts, Trigonometric integrals, Trigonometric substitutions, Integration of rational functions by partial fraction		
UNIT-5	**MULTIPLE INTEGRALS**	**9+3 HOURS**
Double integrals – Change of order of integration – Double integrals in polar coordinates – Area enclosed by plane curves – Triple integrals – Volume of solids		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S):

1.	Kreyszig.E, "Advanced Engineering Mathematics", John Wiley and Sons, 10th Edition, New Delhi, 2016.
2.	Grewal.B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 44th Edition , 2018.
3.	James Stewart, " Calculus : Early Transcendentals ", Cengage Learning, 8th Edition, New Delhi, 2015. [For Units II & IV - Sections 1.1, 2.2, 2.3, 2.5, 2.7 (Tangents problems only), 2.8, 3.1 to 3.6, 3.11, 4.1, 4.3, 5.1 (Area problems only), 5.2, 5.3, 5.4 (excluding net change theorem), 5.5, 7.1 - 7.4 and 7.8].

REFERENCE BOOKS:

1.	Anton. H, Bivens. I and Davis. S, " Calculus ", Wiley, 10th Edition, 2016
2.	Bali. N., Goyal. M. and Watkins. C., " Advanced Engineering Mathematics ", Firewall Media (An imprint of Lakshmi Publications Pvt., Ltd.,), New Delhi, 7th Edition, 2009.
3.	Jain . R.K. and Iyengar. S.R.K., " Advanced Engineering Mathematics ", Narosa Publications, New Delhi, 5th Edition, 2016.
4.	Narayanan. S. and Manicavachagom Pillai. T. K., "Calculus" Volume I and II, S. Viswanathan Publishers Pvt. Ltd., Chennai, 2009.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2016.
6.	Srimantha Pal and Bhunia. S.C, "Engineering Mathematics" Oxford University Press, 2015.
7.	Thomas. G. B., Hass. J, and Weir. M.D, " Thomas Calculus ", 14th Edition, Pearson India, 2018.

Course Code	Course Title	L	T	P	J	C
22BST102	ENGINEERING PHYSICS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To make the students effectively achieve an understanding of mechanics.
2. To enable the students to gain knowledge of electromagnetic waves and its applications.
3. To introduce the basics of oscillations, optics and lasers.
4. Equipping the students to successfully understand the importance of quantum physics.
5. To motivate the students towards the applications of quantum mechanics.

COURSE OUTCOME:

After completion of this course, the students should be able to

CO1: Understand the importance of mechanics.

CO2: Express their knowledge in electromagnetic waves.

CO3: Demonstrate a strong foundational knowledge in oscillations, optics and lasers.

CO4: Understand the importance of quantum physics.

CO5: Comprehend and apply quantum mechanical principles towards the formation of energy bands

UNIT I	MECHANICS	9 HOURS

Multi-particle dynamics: Center of mass (CM) – CM of continuous bodies – motion of the CM – kinetic energy of the system of particles. Rotation of rigid bodies: Rotational kinematics – rotational kinetic energy and moment of inertia - MI of a diatomic molecule - theorems of MI – moment of inertia of continuous bodies –- torque – rotational dynamics of rigid bodies – conservation of angular momentum – rotational energy state of a rigid diatomic molecule.

UNIT II	ELECTROMAGNETIC WAVES	9 HOURS

The Maxwell's equations - wave equation; Plane electromagnetic waves in vacuum, Conditions on the wave field - properties of electromagnetic waves: speed, amplitude, phase, orientation and waves in matter - polarization - Producing electromagnetic waves - Energy and momentum in EM waves: Intensity, waves from localized sources, momentum and radiation pressure – basic introduction to Satellite Communication (qualitative treatment)

UNIT III	OSCILLATIONS, OPTICS AND LASERS	9 HOURS

Simple harmonic motion - resonance –analogy between electrical and mechanical oscillating systems - waves on a string - standing waves - traveling waves - Energy transfer of a wave –– interference–Michelson interferometer – Theory of laser – characteristics - Spontaneous and stimulated emission - Einstein's coefficients - population inversion - Nd-YAG laser, CO2 laser, semiconductor laser –Basic applications of lasers in industry.		
UNIT IV	**BASIC QUANTUM MECHANICS**	**9 HOURS**
Photons and light waves - Electrons and matter waves – Photoelectric effect - The Schrodinger equation (Time dependent and time independent forms) - interpretation of wave function_–Free particle - particle in an infinite potential well: 1D,2D and 3D Boxes- Normalization and probabilities – Bohr's correspondence principle (concept only).		
UNIT V	**APPLIED QUANTUM MECHANICS**	**9 HOURS**
The harmonic oscillator(qualitative)- Barrier penetration and quantum tunnelling (qualitative)- Tunnelling microscope - Resonant diode – Principle of quantum superposition – concept of quantum entanglement – concepts of quantum communication and quantum teleportation		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S)

1.	D.Kleppner and R.Kolenkow. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
2.	E.M.Purcell and D.J.Morin, Electricity and Magnetism, Cambridge Univ.Press, 2013.
3.	Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury, Concepts of Modern Physics, McGraw- Hill (Indian Edition), 2017.

REFERENCE BOOKS

1.	R. Wolfson. Essential University Physics. Volume 1 & 2. Pearson Education (Indian Edition), 2009.
2.	2. Paul A. Tipler, Physic – Volume 1 & 2, CBS, (Indian Edition), 2004.
3.	K. Thyagarajan and A.Ghatak. Lasers: Fundamentals and Applications, Laxmi Publications, (Indian Edition), 2019.
4.	D.Halliday, R.Resnick and J.Walker. Principles of Physics, Wiley (Indian Edition), 2015.
5.	N.Garcia, A.Damask and S.Schwarz. Physics for Computer Science Students. Springer Verlag, 2012.

Course Code	Course Title	L	T	P	J	C
22BST103	ENGINEERING CHEMISTRY	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To inculcate a sound understanding of water quality parameters and water treatment techniques.
2. To impart knowledge on the basic principles and preparatory methods of nanomaterials.
3. To introduce the different polymers and composites for engineering applications.
4. To facilitate the understanding of different types of fuels, their preparation, properties and combustion characteristics.
5. To familiarize the students with the operating principles, working processes and applications of energy conversion and storage devices.

COURSE OUTCOME:

1. To infer the quality of water from quality parameter data and propose suitable treatment methodologies to treat water.
2. To identify and apply basic concepts of nanoscience and nanotechnology in designing the synthesis of nanomaterials for engineering and technology applications.
3. To analyze the properties of different polymers and distinguish the polymers which can be degraded and demonstrate their usefulness and composites for material selection requirements.
4. To recommend suitable fuels for engineering processes and applications.
5. To recognize different forms of energy resources and apply them for suitable applications in energy sectors.

UNIT-1	WATER AND ITS TREATMENT	9 HOURS

Water: Sources and impurities, Requirements of water for municipal use, Municipal water treatment: primary treatment and disinfection (UV, Ozonation, break-point chlorination). Desalination of brackish water: Reverse Osmosis. Requirements of water for industrial use, Boiler troubles: Scale and sludge, Boiler corrosion, Caustic embrittlement, Priming &foaming. Treatment of boiler feed water: Internal treatment (phosphate, colloidal, sodium aluminate and Calgon conditioning) and External treatment -Ion exchange demineralization and zeolite process.

UNIT-2	NANOCHEMISTRY	9 HOURS

Basics: Distinction between molecules, nanomaterials and bulk materials; Size-dependent properties (optical, electrical, mechanical and magnetic); Types of nanomaterials: Definition, properties and uses of – nanoparticle, nanocluster, nanorod, nanowire and nanotube. Preparation of nanomaterials: sol-gel, solvothermal, laser ablation, chemical vapour deposition, electrochemical deposition and electro spinning. Applications of nanomaterials in medicine,

agriculture, energy, electronics and catalysis.		
UNIT-3	**POLYMERS AND COMPOSITES**	**9 HOURS**
Definition of biodegradable polymers- Classification of biodegradable Polymers – Advantages, conducting polymers- examples - Mechanism of conduction – applications, recycling of e-plastic waste (waste to wealth). Composites: Introduction: Definition & Need for composites; Constitution: Matrix materials (Polymer, matrix, metal matrix and ceramic matrix) and Reinforcement (fibre, particulates, flakes and whiskers). Properties and applications of Metal matrix composites (MMC), Ceramic matrix composites and Polymer matrix composites. Hybrid composites - definition and examples.		
UNIT-4	**FUELS AND COMBUSTION**	**9 HOURS**
Fuels: Introduction: Classification of fuels; Coal and coke: Analysis of coal (proximate and ultimate), Carbonization, Manufacture of metallurgical coke (Otto Hoffmann method). Petroleum and Diesel: Manufacture of synthetic petrol (Bergius process), Knocking - octane number, diesel oil-cetane number; Power alcohol and biodiesel. Combustion of fuels: Calorific value - higher and lower calorific values, Flue gas analysis - ORSAT Method. CO2 emission and carbon footprint.		
UNIT-5	**COMPUTATIONAL CHEMISTRY AND STORAGE DEVICES**	**9 HOURS**
Computational chemistry-molecular dynamics and chemical reactivity. Cheminformatics and Green IOT in biomedical applications, Artificial intelligence and machine learning methods to predict physicochemical properties. Batteries: a brief introduction to electrochemical cell (Daniel cell), Types of batteries, Primary battery - dry cell, Secondary battery - lead acid battery and lithium-ion- battery; battery used in Electric vehicles; Fuel cells: H2-O2 fuel cell, microbial fuel cell; Supercapacitors: Storage principle, types and examples.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S)		
1.	P. C. Jain and Monica Jain, “Engineering Chemistry”, 17th Edition, Dhanpat Rai Publishing Company (P) Ltd, New Delhi, 2018.	
2.	Sivasankar B., “Engineering Chemistry”, Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2008.	
3.	S.S. Dara, “A Text book of Engineering Chemistry”, S. Chand Publishing, 12th Edition.	
REFERENCE BOOKS		
1.	B. S. Murty, P. Shankar, Baldev Raj, B. B. Rath and James Murday, “Textbook of nanoscience and nanotechnology”, Universities Press-IIM Series in Metallurgy and Materials Science, 2018.	
2.	O.G. Palanna, “Engineering Chemistry” McGraw Hill Education (India) Private Limited, 2nd Edition, 2017.	

3.	Friedrich Emich, "Engineering Chemistry", Scientific International PVT, LTD, New Delhi, 2014.
4.	ShikhaAgarwal, "Engineering Chemistry-Fundamentals and Applications", Cambridge University Press, Delhi, Second Edition, 2019.
5.	O.V. Roussak and H.D. Gesser, Applied Chemistry-A Text Book for Engineers and Technologists, Springer Science Business Media, New York, 2nd Edition, 2013.

Course Code	Course Title	L	T	P	J	C
22EST101	PROBLEM SOLVING AND PYTHON PROGRAMMING	3	0	0	0	3
		Syllabus version				v. 1.0

COURSE OBJECTIVES: After studying this course, you should be able to:

1. To understand the basics of algorithmic problem solving.
2. To learn to solve problems using Python conditionals and loops.
3. To define Python functions and use function calls to solve problems.
4. To use Python data structures - lists, tuples, dictionaries to represent complex data.
5. To do input/output with files in Python.

COURSE OUTCOME:

After completion of this course, the students should be able to

1. Develop algorithmic solutions to simple computational problems.
2. Develop and execute simple Python programs.
3. Write simple Python programs using conditionals and loops for solving problems.
4. Decompose a Python program into functions.
5. Represent compound data using Python lists, tuples, dictionaries etc.
6. Read and write data from/to files in Python programs.

UNIT-1	COMPUTATIONAL THINKING AND PROBLEM SOLVING	9 HOURS

Fundamentals of Computing – Identification of Computational Problems -Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems: find minimum in a list, insert a card in a list of sorted cards, guess an integer number in a range, Towers of Hanoi.

UNIT-2	DATA TYPES, EXPRESSIONS, STATEMENTS	9 HOURS

Python interpreter and interactive mode,debugging; values and types: int, float, boolean, string and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Illustrative programs: exchange the values of two variables, circulate the values of n variables, distance between two points.		
UNIT-3	**CONTROL FLOW, FUNCTIONS, STRINGS**	**9 HOURS**
Conditionals:Boolean values and operators, conditional (if), alternative (if-else),chained conditional (if-elif-else);Iteration: state, while, for, break, continue, pass; Fruitful functions: return values,parameters, local and global scope, function composition, recursion; Strings: string slices,immutability, string functions and methods, string module; Lists as arrays. Illustrative programs: square root, gcd, exponentiation, sum an array of numbers, linear search, binary search.		
UNIT-4	**LISTS, TUPLES, DICTIONARIES**	**9 HOURS**
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: simple sorting, histogram, Students marks statement, Retail bill preparation.		
UNIT-5	**FILES, MODULES, PACKAGES**	**9 HOURS**
Files and exceptions: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs: word count, copy file, Voter's age validation, Marks range validation (0-100).		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):		
1.	Allen B. Downey, "Think Python: How to Think like a Computer Scientist", 2nd Edition, O'Reilly Publishers, 2016.	
2.	Karl Beecher, "Computational Thinking: A Beginner's Guide to Problem Solving and Programming", 1st Edition, BCS Learning & Development Limited, 2017	
REFERENCE BOOKS:		
1.	Paul Deitel and Harvey Deitel, "Python for Programmers", Pearson Education, 1st Edition,2021.	
2.	G Venkatesh and Madhavan Mukund, "Computational Thinking: A Primer for Programmers and Data Scientists", 1st Edition, Notion Press, 2021.	
3.	John V Guttag, "Introduction to Computation and Programming Using Python: With	

	Applications to Computational Modeling and Understanding Data", Third Edition, MIT Press, 2021
4.	Eric Matthes, "Python Crash Course, A Hands - on Project Based Introduction to Programming", 2nd Edition, No Starch Press, 2019.
5.	Martin C. Brown, "Python: The Complete Reference", 4th Edition, Mc-Graw Hill, 2018.

Course Code	Course Title	L	T	P	J	C
22EET101	ENGINEERING AND PROFESSIONAL SKILLS	1	0	2	0	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES: After studying this course, you should be able to:

1. Understand the characteristics of 'engineering' and the quality engineers have played in shaping engineering up to the present and into the future
2. Understand a range of principles in science, mathematics, and engineering in order to make well-founded decisions as part of a design process
3. To be proficient in using MS WORD to create quality technical documents, by using standard templates, widely acceptable styles and formats, variety of features to enhance the present ability and overall utility value of content
4. To be proficient in using MS EXCEL for all data manipulation tasks including the common statistical, logical, mathematical etc., operations, conversion, analytics, search and explore, visualize, interlink, and utilizing many more critical features offered
5. To be able to create and share quality presentations by using the features of MS PowerPoint, including: organization of content, present ability, aesthetics, using media elements and enhance the overall quality of presentations

COURSE OUTCOME:

- Understand the basic knowledge in evolution of engineering
- Understand the basic knowledge in Engineering approach
- Use the MS Word to create quality documents, by structuring and organizing content for their day to day technical and academic requirements
- Use MS EXCEL to perform data operations and analytics, record, retrieve data as per requirements and visualize data for ease of understanding
- Use MS PowerPoint to create high quality academic presentations by including common tables, charts, graphs, interlinking other elements, and using media objects.

UNIT-1	EVOLUTION OF ENGINEERING	6 HOURS
Evolution of Engineering: Description of Engineering, Early stages of Engineering, Outline of Ancient Engineering, Case studies of historic engineers. Introduction to Engineering Career: Engineering as a career and common qualities of employable engineers History of Engineering Domains Impact of engineering on society. Roles of Engineers and Career Paths.		
UNIT-2	**ENGINEERING APPROACH**	**6 HOURS**
Introduction, problem statement: Detailing Customer Requirements, Setting Objectives, Identifying Constraints, Establishing Functions, generating solution Alternatives and Choosing a solution. Steps in problem-solving: Problem Solving Techniques, Six Thinking Hats, Mind Mapping, Forced Connections. Analytical Thinking, Numeric, symbolic, and graphic reasoning. seven steps in solving engineering problems, reverse engineering, forward engineering, concurrent engineering, and Value Engineering.		
UNIT-3	**MS WORD**	**6 HOURS**
Create and format a document, Working with tables, Working with Bullets and Lists, Working with styles, shapes, smart art, charts Inserting objects, charts and importing objects from other office tools, Creating and Using document templates, Inserting equations, symbols and special characters, Working with Table of contents and References, citations Insert and review comments, Create bookmarks, hyperlinks, endnotes footnote, Viewing document in different modes, Working with document protection and security, Inspect document for accessibility.		
UNIT-4	**MS EXCEL**	**6 HOURS**
Create worksheets, insert and format data, Work with different types of data: text, currency, date, numeric etc. Split, validate, consolidate, Convert data Sort and filter data Perform calculations and use functions: (Statistical, Logical, Mathematical, date, Time etc.,) Work with Lookup and reference formulae, Create and Work with different types of charts, Use pivot tables to summarize and analyse data, Perform data analysis using own formulae and functions, Combine data from multiple worksheets using own formulae and built-in functions to generate results, Export data and sheets to other file formats, Working with macros, Protecting data and Securing the workbook		
UNIT-5	**MS POWERPOINT**	**6 HOURS**

Hours Select slide templates, layout and themes, Formatting slide content and using bullets and numbering, Insert and format images, smart art, tables, charts Using Slide master, notes and handout master, Working with animation and transitions, Organize and Group slides Import or create and use media objects: audio, video, animation, Perform slideshow recording and Record narration and create presentable videos.	
TOTAL LECTURE HOURS:	**30 HOURS**
TEXT BOOK(S):	
1.	Remesh S., Vishnu R. G., Life Skills for Engineers, Ridhima Publications, 1 stEdition,2016.
2.	Barun K. Mitra, Personality Development & Soft Skills, Oxford Publishers, Third impression, 2017.
3.	Dorothy House, Microsoft Word, Excel, and PowerPoint: Just for Beginners, Import, 29 January 2015
REFERENCE BOOKS:	
1.	Paul H .Wright, Introduction to Engineering, School of Civil and Environmental Engineering, 3rd Edition, John Wiley & Sons, Inc,

Course Code	Course Title	L	T	P	J	C
22HSM101	**HERITAGE OF TAMILS**	**1**	**0**	**0**	**0**	**1**
Pre-requisite		Syllabus version			v. 1.0	

Unit-1	**LANGUAGE AND LITERATURE**	**03 hours**
Language Families in India - Dravidian Languages – Tamil as a Classical Language - Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature - Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land - Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modern literature in Tamil - Contribution of Bharathiyar and Bharathidhasan.		
Unit-2	**HERITAGE - ROCK ART PAINTINGS TO MODERN ART – SCULPTURE**	**03 hours**
Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple car making - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils.		
Unit-3	**FOLK AND MARTIAL ARTS**	**03 hours**
Therukoothu, Karagattam, Villu Pattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam, Valari, Tiger dance - Sports and Games of Tamils.		

Unit-4	**THINAI CONCEPT OF TAMILS**	**03 hours**
Flora and Fauna of Tamils & Aham and Puram Concept from Tholkappiyam and Sangam Literature - Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports of Sangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas.		
Unit-5	**CONTRIBUTION OF TAMILS TO INDIAN NATIONAL MOVEMENT AND INDIAN CULTURE**	**03 hours**
Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the other parts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems of Medicine – Inscriptions & Manuscripts – Print History of Tamil Books		
	Total Lecture hours:	15 hours

TEXT BOOK(S)

1.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
2.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,
3.	Tamilaga Varalaru, Makalum Panpadum- Dr. K.K. Pillai
4.	Kanini Tamil- Munaivar L. Sundaram

REFERENCE BOOKS

1.	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
5.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)

Course Code	Course Title	L	T	P	J	C
22ESP101	PROBLEM SOLVING AND PYTHON PROGRAMMING LABORATORY	0	0	4	0	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To understand the problem solving approaches.
2. To learn the basic programming constructs in Python.
3. To practice various computing strategies for Python-based solutions to real world

problems.

4. To use Python data structures - lists, tuples, dictionaries.
5. To do input/output with files in Python.

COURSE OUTCOME:

On completion of the course, students will be able to:

1. Develop algorithmic solutions to simple computational problems
2. Develop and execute simple Python programs.
3. Implement programs in Python using conditionals and loops for solving problems. Deploy functions to decompose a Python program.
4. Process compound data using Python data structures.
5. Utilize Python packages in developing software applications.

LIST OF EXPERIMENTS:

Note: The examples suggested in each experiment are only indicative. The lab instructor is expected to design other problems on similar lines. The Examination shall not be restricted to the sample experiments listed here.

1. Identification and solving of simple real life or scientific or technical problems, and developing flow charts for the same. (Electricity Billing, Retail shop billing, Sin series, weight of a motorbike, Weight of a steel bar, compute Electrical Current in Three Phase AC Circuit, etc.)
2. Python programming using simple statements and expressions (exchange the values of two variables, circulate the values of n variables, distance between two points).
3. Scientific problems using Conditionals and Iterative loops. (Number series, Number Patterns, pyramid pattern) Implementing real-time/technical applications using Lists, Tuples. (Items present in a library/Components of a car/ Materials required for construction of a building –operations of list & tuples)
5. Implementing real-time/technical applications using Sets, Dictionaries. (Language, components of an automobile, Elements of a civil structure, etc.- operations of Sets & Dictionaries)
6. Implementing programs using Functions. (Factorial, largest number in a list, area of shape)
7. Implementing programs using Strings. (reverse, palindrome, character count, replacing characters)
8. Implementing programs using written modules and Python Standard Libraries (pandas, numpy. Matplotlib, scipy)
9. Implementing real-time/technical applications using File handling. (copy from one file to another, word count, longest word)
10. Implementing real-time/technical applications using Exception handling. (divide by

zero error, voter's age validity, student mark range validation)

11. Exploring Pygame tool.
12. Developing a game activity using Pygame like bouncing ball, car race etc.

TOTAL LECTURE HOURS:	**60 HOURS**

Course Code	Course Title	L	T	P	J	C
22BSP101	**PHYSICS CHEMISTRY LABORATORY (CHEMISTRY)**	**0**	**0**	**4**	**0**	**2**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To impart practical skills in the estimation of water quality parameters by volumetry and gravimetry.
2. To familiarize the students with the estimation of impurities in aqueous solutions through electro-analytical techniques such as pH metre, potentiometry and conductometry.
3. To demonstrate the analysis of metals by UV-Visible spectroscopy.

COURSE OUTCOME:

1. To independently estimate the water quality parameters, such as acidity, alkalinity, hardness, DO, TDS, chloride and copper contents by appropriate wet chemical analyses.
2. To quantitatively analyze the impurities in aqueous solution by electroanalytical techniques.
3. To determine the amount of metal ions in aqueous samples by spectroscopic techniques.

LIST OF EXPERIMENTS: ANY SEVEN

1. Preparation of Na_2CO_3 as a primary standard and estimation of acidity of a water sample using the primary standard
2. Determination of types and amount of alkalinity in water sample.
3. Determination of total, temporary & permanent hardness of water by EDTA method.
4. Determination of DO content of water sample by Winkler's method.
5. Determination of chloride content of water sample by Argentometric method.
6. Estimation of TDS of a water sample by gravimetry.
7. Determination of strength of given hydrochloric acid using pH meter.
8. Determination of strength of acids in a mixture of acids using conductivity meter.
9. Conductometric titration of barium chloride against sodium sulphate (precipitation titration)

10. Estimation of iron content of the given solution using potentiometer.

11. Estimation of iron content of the water sample using spectrophotometer (1,10-Phenanthroline / thiocyanate method).

Total Laboratory hours:	**30hours**

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22BSP101	**ENGINEERING PHYSICS LABORATORY**	**0**	**0**	**4**	**0**	**2**
		Syllabus version			v. 1.0	

Course Objectives:

To learn the proper use of various kinds of physics laboratory equipment.

To learn how data can be collected, presented and interpreted in a clear and concise manner.

To learn problem solving skills related to physics principles and interpretation of experimental data.

To determine error in experimental measurements and techniques used to minimize such error.

To make the student an active participant in each part of all lab exercises.

Course Outcome:

Understand the functioning of various physics laboratory equipment.

Use graphical models to analyze laboratory data.

Use mathematical models as a medium for quantitative reasoning and describing physical reality.

Access, process and analyze scientific information.

Solve problems individually and collaboratively.

LIST OF EXPERIMENTS (Any Seven Experiments)

1. Torsional pendulum - Determination of rigidity modulus of wire and moment of inertia of regular and irregular objects.

2. Simple harmonic oscillations of cantilever.

3. non-uniform bending - Determination of Young's modulus

4. Uniform bending – Determination of Young's modulus

5. Laser- Determination of the wavelength of the laser using grating

6. Air wedge - Determination of thickness of a thin sheet/wire

7. a) Optical fibre -Determination of Numerical Aperture and acceptance angle b) Compact disc- Determination of width of the groove using laser. 8. Acoustic grating- Determination of velocity of ultrasonic waves in liquids. 9. Ultrasonic interferometer – determination of the velocity of sound and compressibility of liquids 10. Post office box -Determination of Band gap of a semiconductor. 11. Photoelectric effect 12. Michelson Interferometer. 13. Melde's string experiment 14. Experiment with lattice dynamics kit.

Total Laboratory hours:	**30hours**

Course Code	Course Title	L	T	P	J	C
22EEP101	**PRODUCT TINKERING LABORATORY**	**0**	**0**	**2**	**0**	**1**
		Syllabus version			v. 2.0	

COURSE OBJECTIVES:

1. Hands on practical training, maintenance and troubleshooting on mechanical and electrical appliances in day-to-day life.
2. Analyse single phase and three phase residential building wiring (Energy meter, fuse, earthing)
3. Understand the internal structure and layout of the computer system.
4. Learn to diagnose minor problems with the computer functioning.
5. Know the proper usage and threats of the world wide web.

COURSE OUTCOME:

1. Students will able to understand domestic wiring procedures practically.
2. Students are capable of assembling a personal computer, and can perform installation of system software like MS Windows and required device drivers.
3. Students can detect and perform minor hardware and software level troubleshooting.
4. Capacity to work on Internet & World Wide Web and make effective usage of the internet for academics.

LIST OF EXPERIMENTS:

1. **MECHANICAL EQUIPMENT STUDY**

(a) Hand drilling machine, Screw Jack and centrifugal pump

(b) Two wheeler, Refrigeration and Air Conditioning system.

2. **ELECTRICAL EQUIPMENT STUDY**

Light fittings, LED, Stabilizer, UPS, Iron box, calling bell, Fan regulator

3. ELECTRONIC EQUIPMENT STUDY

a) Study the elements of a smart phone.

b) Assembly and dismantle of LED TV.

c) Assembly and dismantle of computer/ laptop

4. COMPUTER PERIPHERALS STUDY

PC HARDWARE Identification of the peripherals of a computer, components in a CPU and its functions. Block diagram of the CPU along with the configuration of each peripheral. Functions of Motherboard. Assembling and Disassembling of PC. System Software and application software installation.

5. BIOMEDICAL EQUIPMENT

a) Assembly and dismantle of Electrocardiogram (ECG)

b) Assembly and dismantle of ventilator.

c) Assembly and dismantle of Doppler Ultra sound Scanner.

TROUBLESHOOTING

Hardware Troubleshooting: Students are to be given a PC which does not boot due to proper assembly or defective peripherals and the students should be taught to identify and correct the problem.

Software Troubleshooting: Students have to be given a malfunctioning CPU due to system software problems. They should identify the problem and fix it to get the computer back to working condition.

Internet: Web Browsers, Access of websites, Surfing the Web, Search Engines, Customization of web browsers, proxy settings, bookmarks, search toolbars, pop-up blockers. Antivirus downloads, Protection from various threats.

TOTAL LECTURE HOURS:	**30 HOURS**

SEMESTER II

Course Code	Course Title	L	T	P	J	C
22LET201	FUNCTIONAL ENGLISH	2	0	4	0	4
		Syllabus version			v. 1.1	

COURSE OBJECTIVES:

The course enables the learner to:

1. Gain confidence to respond in English in both academic and professional contexts
2. Improve presentation skills to make effective presentations
3. Foster the ability to write effectively in all contexts
4. Strengthen the skills related to teamwork and leadership roles in society as well as in the workplace

COURSE OUTCOME:

After the completion of this course, the students should be able to

1. Communicate fluently in professional situations
2. Express flexibility and appropriacy in Technical Events
3. Demonstrate complex forms and sentence structures with adequate vocabulary
4. Report events and the processes of technological & Industrial firms.
5. Present effective Profile in the context of job search

UNIT-1	COMMUNICATIVE COMPETENCE	9 HOURS

Speaking: Interactive skills- Initiation & turn taking; relevance to the topic, puzzles & riddles

Reading – Skimming, Scanning, Churning & Assimilation

Writing – Paragraphs; Free writing & opinion paragraphs

Grammar – Order of Adjectives, Primary Auxiliary Verbs

Vocabulary – Phonetics – sounds and symbols; Vocabulary used in letters and emails

UNIT-2	SITUATIONAL CONVERSATIONS	9 HOURS

Speaking – Practicing fluency- cohesion, coherence, and speed of delivery

Reading – Reading social media messages

Writing – Checklist; Letter to the editor

Grammar – Infinitives, Gerunds and Participles, Interrogative and Reflexive Pronoun

Vocabulary – Verbal Analogies, Same words used as different parts of speech

Unit-3	REPORT ON TECHNICAL EVENTS	9 hours

Speaking –Mock TV news Reading/ anchoring

Reading – Motivational essays on famous Engineers and Technologists

Writing – Dialogue writing; Minutes of Meeting

Grammar – Reported Speech, Modal Verbs

Vocabulary – Technical Vocabulary, Jargon		
Unit-4	**DEVELOPING DISCUSSION SKILLS**	**9 hours**
Speaking – Giving short talks on technical topics **Reading** - Descriptive passages – magazines/ articles **Writing** – Recommendations; Job application **Grammar** – If conditional sentences, Articles **Vocabulary** - Purpose statements		
Unit-5	**PRESENTATION SKILLS**	**9 hours**
Speaking – Presentations using visual aids-Visume using appropriate body language and gestures; stating and asking for opinions and clarifications **Reading** – Predicting the content, speed reading techniques **Writing** – Precis Writing, Profile Writing **Grammar** – Mixed Tenses, Embedded Clause **Vocabulary** – Error Spotting, Sentence Completion		
	TOTAL LECTURE HOURS:	**45 HOURS**
List of Experiments :		
1. Initiation and turn taking		
2. Writing opinion paragraph		
3. Situational conversations		
4. Writing Checklists		
5. Mock TV news reading		
6. Writing the project proposal or Project report		
7. Short talk on technical topics		
8. Writing recommendations		
9. PPT Presentation		
10. Profile writing		
	TOTAL PRACTICAL HOURS:	**30 HOURS**
Text Book(s)		
1.	English for Engineers & Technologists (2020 edition) Orient Blackswan Private Ltd. Department of English, Anna University	
2.	Functional English for Communication (2022 edition) Ujjwala Kakarla, Guru Nanak Institutions Technical Campus (Autonomous), Hyderabad.	
Reference Books		

1.	Raman. Meenakshi, Sharma. Sangeeta (2019). Professional English. Oxford university press. New Delhi.
2.	Hewings, Martin. Advanced Grammar In Use. New Delhi: CUP,2008 MLA Handbook for Writers of Research Papers, 7th Edition
3.	Klaus Bruhn Jensen. A handbook of Media and Communication Research. Routledge, 2003

Course Code	Course Title	L	T	P	J	C
22LET202	FRENCH LANGUAGE LEVEL 1	2	0	4	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To acquire an understanding of basic French language parts of speech
2. To facilitate learner's ability to learn the French language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

COURSE OUTCOME:

1. Read and write technical basic French language parts of speech
2. Speak appropriately learner's ability to learn the French language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses and numbers
5. Prepare self-introduction comprehend various lectures and talks

UNIT-1	PARTS OF SPEECH	12 HOURS

1. inviter et répondre à une invitation, Pronoms sujets 2. L'article définis, l'article indéfinis 3. Conjugation : présent, adjectifs possessifs 4. interrogation, décrire les personnes 5. La vie de quatre parisiens de professions différentes

UNIT-2	ELEMENTS OF GRAMMAR:	12 HOURS

1. Exprimer l'ordre et l'obligation demander et commander 51 2. l'adjectif possessifs, l‟article partitif, l'article démonstratif, négation ne 3. pas, l'article contracté 4. verbe pronominaux 5. prepositions		
UNIT-3	**SENTENCE STRUCTURE:**	**12 HOURS**
1. Raconter et reporter-donner son avis 2. Futur simple, pronom complètement d'objet direct, passé composé 3. plusieurs région de France, imparfait, pronom y/en, imparfait		
UNIT-4	**TENSES AND NUMBERS**	**12 HOURS**
1. Demander l'autorisation-passé récent, futur proche 2. La vie administrative et régionale, Pluriel des noms, moyens de transport		
UNIT-5	**DISCOURSE**	**12 HOURS**
1. le discours rapporté, décrire un lieu, exprimer ses préférences 2. décrire la carrière, discuter d‟système éducation de France 3. parler de la technologie de l‟information		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S)	
1.	Christine Andant étal "À propos (livre de l'élève", LANGER., NEW DELHI,2012
2.	Myrna Bell Rochester "Easy French Step By Step", MCGraw Hill Companies., USA, 2008
REFERENCE BOOKS	
1.	Michael D. Oates "Entre Amis: An Interactive Approach", 5 th Edition, Houghton Mifflin., 2005
2.	Bette Hirsch, Chantal Thompson "Moments Literaries : An Anthology for intermediate French"
3.	Simone Renaud, Dominique van Hooff "En bonne forme

Course Code	Course Title	L	T	P	J	C
22LET203	GERMAN- LEVEL A1.1	2	0	4	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To acquire an understanding of basic German language parts of speech
2. To facilitate learner's ability to learn the German language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

COURSE OUTCOME:

1. Read and write technical basic German language parts of speech
2. Speak appropriately learner's ability to learn the German language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses and numbers
5. Prepare self-introduction comprehend various lectures and talks

UNIT-1	GUTEN TAG!	10 HOURS

1. To greet, learn numbers till 20, practice telephone numbers & e mail address, learn alphabet, speak about countries & languages
2. Vocabulary: related to the topic
3. 3. Grammar: W – Questions, Verbs & Personal pronouns I

UNIT-2	FREUNDE, KOLLEGEN UND ICH	10 HOURS

1. To speak about hobbies, jobs, learn numbers from 20; build dialogues and frame simple questions & answers
2. Vocabulary: related to the topic
3. Grammar: Articles, Verbs & Personal pronouns II, sein & haben verbs, ja/nein Frage, singular/plural

UNIT-3	IN DER STADT	12 HOURS

1. To know places, buildings, question, know transport systems, understand international words; build dialogues and write short sentences 2. Vocabulary: related to the topic 3. Grammar: Definite & indefinite articles, Negotiation, Imperative with Sien verbs		
UNIT-4	**GUTEN APPETIT!**	**13 HOURS**
1. To speak about food, shop, converse; Vocabulary: related to the topic; build dialogues and write short sentences 2. Grammar: Sentence position, Accusative, Accusative with verbs, personal pronouns & prepositions, Past tense of haben & sein verbs		
UNIT-5	**TAG FŸR TAG/ZEIT MIT FREUNDEN**	**15 HOURS**
1. To learn time related expressions, speak about family, about birthdays, understand & write invitations, converse in the restaurant; ask excuse, fix appointments on phone 2. Vocabulary: related to the topic 3. Grammar: Time related prepositions, Possessive articles, Modalverbs		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S)	
1.	Dengler Stefanie "Netzwerk A1.1", Klett-Langenscheidt Gmbh., München,2013
2.	Sandra Evans, Angela Pude "Menschen A1", Hueber Verlag., Germany, 2012

REFERENCE BOOKS	
1.	Stefanie Dengler "Netzwerk A1", Klett-Langenscheidt Gmbh., München, 2013
2.	Hermann Funk, Christina Kuhn "Studio d A1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2009
3.	Rosa-Maria Dallapiazza "Tangram Aktuell 1 (Deutsch als Fremdsprache)", Max Hueber Verlag., Munchen, 2004
4.	Christiane Lemcke und Lutz Rohrmann "“Grammatik Intensivtrainer A 1", Goyal Publishers & Distributors Pvt. Ltd., New Delhi, 2012

Course Code	Course Title	L	T	P	J	C
22LET204	BASIC JAPANESE	2	0	4	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To acquire an understanding of basic Japanese language parts of speech
2. To facilitate learner's ability to learn the Japanese language grammar.
3. To nurture learner's ability to understand the sentence structure
4. To foster technical writing skills through tenses and numbers
5. To comprehend various lectures and talks

COURSE OUTCOME:

1. Read and write technical basic Japanese language parts of speech
2. Speak appropriately learner's ability to learn the Japanese language grammar.
3. Listen and comprehend lectures learner's ability to understand the sentence structure
4. Write correctly, clearly and concisely technical writing skills through tenses and numbers
5. Prepare self-introduction comprehend various lectures and talks

UNIT-1	JAPANESE PEOPLE AND CULTURE	12 HOURS

1. Basic greetings and responses

2. Basic script–Method of writing hiragana and katakana –Combination sounds and simple words

3. Self-introductions:"Hajimemashite" -Demonstratives "Kore", "Sore", "Are"– Demonstrative "Kono","Sono","Ano"

4. Possessive noun particle "no" –Japanese apartments: Greeting your neighbor

UNIT-2	PATICLE "NI (AT)" FOR TIME	12 HOURS

: 1. kara (from) ~ made(until) – Particle "to (and)"

2. Time periods: Days of the week, months, time of day –Verbs (Present / future and pasttense)

3. Telephone enquiry: Asking for a phone no. And business hours- Destination particle “e”.		
UNIT-3	**LIKES AND DISLIKES**	**12 HOURS**
1. Potential verbs (wakarimasu and dekimasu) – “Kara (~ because)” 2. Adverbs –Asking some one out over the phone-Verbs denoting presence 3. Introduction to Adjectives (na and ii type) -Verb groups – I, II and III – Exercises to group verbs- Please do (te kudasai) 4. Present continuous tenses (te imasu) – Shall I? (~ mashou ka) – Describing a natural phenomenon (It is raining) (12)		
UNIT-4	**DIFFERENT USAGES OF ADJECTIVES**	**12 HOURS**
1. Comparison –Likes and dislikes –Going to a trip- Need and desire (ga hoshii) –Wanting to…(Tabeti desu)- Going for a certain purpose (mi –ni ikimasu) 2. Choosing from a menu-Adjectives (“i” and “na” type) – Adjectives (Positive and negative useage)		
UNIT-5	**ROLE PLAYS IN JAPANESE**	**12 HOURS**
1. Framing simple questions & answers 2. Writing Short paragraphs & Dialogues 3. A demonstration on usage of chopsticks and Japanese tea party (12)		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S)

1.	Minna no Nihongo, Honsatsu Roma "ji ban (Main Textbook Romanized Version)", International publisher – 3A Corporation., Tokyo, 2012

REFERENCE BOOKS

1.	Eri Banno et.al "Genki I: An Integrated Course in Elementary Japanese I - Workbook", ., 1999
2.	Tae Kim "A Guide to Japanese Grammar: A Japanese Approach to Learning Japanese Grammar", 2014
3.	Minna No Nihongo "Translation & Grammatical Notes In English Elementary",

Course Code	Course Title	L	T	P	J	C
22BST202	STATISTICS AND NUMERICAL METHODS	3	1	0	0	4
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. This course aims at providing the necessary basic concepts of a few statistical and numerical methods and give procedures for solving numerically different kinds of problems occurring in engineering and technology.
2. To acquaint the knowledge of testing of hypothesis for small and large samples which plays an important role in real life problems.
3. To introduce the basic concepts of solving algebraic and transcendental equations.
4. To introduce the numerical techniques of interpolation in various intervals and numerical techniques of differentiation and integration which plays an important role in engineering and technology disciplines.
5. To acquaint the knowledge of various techniques and methods of solving ordinary differential equations.

COURSE OUTCOME:

1. Apply the concept of testing of hypothesis for small and large samples in real life problems.
2. Apply the basic concepts of classifications of design of experiments in the field of agriculture.
3. Appreciate the numerical techniques of interpolation in various intervals and apply the numerical techniques of differentiation and integration for engineering problems.
4. Understand the knowledge of various techniques and methods for solving first and second order ordinary differential equations.
5. Solve the partial and ordinary differential equations with initial and boundary conditions by using certain techniques with engineering applications.

UNIT-1	TESTING OF HYPOTHESIS	9+3 HOURS

Sampling distributions - Tests for single mean, proportion and difference of means (Large and small samples) – Tests for single variance and equality of variances – Chi square test for goodness of fit

UNIT-2	DESIGN OF EXPERIMENTS	9+3 HOURS

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

UNIT-3	SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS	9+3 HOURS

Newton Raphson method- Solution of linear system of equations - Gauss elimination method – Pivoting - Gauss Jordan method – Iterative methods of Gauss Jacobi and Gauss Seidel- Eigenvalues of a matrix by Power method.		
UNIT-4	**INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION**	**9+3 HOURS**
Lagrange's and Newton's divided difference interpolations – Newton's forward and backward difference interpolation – Numerical single and double integrations using Trapezoidal and Simpson's 1/3 rules.		
UNIT-5	**NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS**	**9+3 HOURS**
Taylor's series method - Modified Euler's method - Fourth order Runge-Kutta method for solving first order differential equations - Milne's forth predictor corrector methods for solving first order differential equations.		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S)

1.	Grewal, B.S., and Grewal, J.S., "Numerical Methods in Engineering and Science", Khanna Publishers, 10th Edition, New Delhi, 2015.
2.	Johnson, R.A., Miller, I and Freund J., "Miller and Freund's Probability and Statistics for Engineers", Pearson Education, Asia, 8th Edition, 2015.

REFERENCE BOOKS

1.	Burden, R.L and Faires, J.D, "Numerical Analysis", 9th Edition, Cengage Learning, 2016.
2.	Devore. J.L., "Probability and Statistics for Engineering and the Sciences", Cengage Learning, New Delhi, 8th Edition, 2014
3.	Gerald. C.F. and Wheatley. P.O. "Applied Numerical Analysis" Pearson Education, Asia, New Delhi, 7th Edition, 2007.
4.	Gupta S.C. and Kapoor V. K., "Fundamentals of Mathematical Statistics", Sultan Chand & Sons, New Delhi, 12th Edition, 2020.
5.	Spiegel. M.R., Schiller. J. and Srinivasan. R.A., "Schaum's Outlines on Probability and Statistics ", Tata McGraw Hill Edition, 4th Edition, 2012.
6.	Walpole. R.E., Myers. R.H., Myers. S.L. and Ye. K., "Probability and Statistics for Engineers and Scientists", 9th Edition, Pearson Education, Asia, 2010.

Course Code	Course Title	L	T	P	J	C
22RAT201	FUNDAMENTALS OF ROBOTICS	3	0	0	0	3
		Syllabus version			v. 2.0	

COURSE OBJECTIVES:

1. To summarize and analyze the fundamentals of robotics.
2. To introduce students the kinematics and dynamics of robots.
3. To elucidate students the types of motion control.
4. To familiarize students with the basic techniques of designing the robots

COURSE OUTCOME:

After the completion of the course, student will be able to:

1. Comprehend, classify and analyze the fundamentals of robotics.
2. Analyze the kinematics in robots.
3. Gain the knowledge about the dynamics of robots.
4. Elucidate the motion control in robotics.
5. Gain the knowledge about the force control and hybrid control.

UNIT-1	FUNDAMENTALS OF ROBOTS	9 HOURS

Introduction – Components, Degrees of Freedom, Joints, Coordinates, Mechanisms, Controller

UNIT-2	INTODCUTION TO KINEMATICS	9 HOURS

Position and Orientation of Objects, Coordinate Transformation, Joint Variables and Position of End Effector, Inverse Kinematics Problem, Jacobian Matrix, Statics and Jacobian Matrices.

UNIT-3	ROBOT DRIVE SYSTEMS	9 HOURS

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors-Salient Features, Applications and Comparison of all these Drives.

UNIT-4	END EFFECTORS FOR ROBOTS	9 HOURS

End Effectors-Grippers-Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations.

UNIT-5	**FORCE CONTROL AND HYBRID CONTROL**	**9 HOURS**
Impedance Control - Passive-Impedance Method, Active-Impedance Method-One- Degree-of-Freedom Case, Active-Impedance Method-General Case. Hybrid Control - Hybrid Control via Feedback Compensation, Dynamic Hybrid Control.		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S):	
1.	Tsuneo Yoshikawa, "Foundations of Robotics Analysis and Control", The MIT Press Cambridge, 1990.
2.	Saeed B Niku, “Introduction to Robotics Analysis, Control, Applications”, 3rd Edition, Wiley, 2020.
REFERENCE BOOKS:	
1.	1. Robert J. Schilling, “Fundamentals of Robotics, Analysis and Control”, Prentice Hall India, 2003.
2.	John J. Craig, “Introduction to Robotics, Mechanics and Control”, 3rd Edition, Pearson Prentice Hall, 2005.

Course Code	Course Title	L	T	P	J	C
22EST201	**BASIC ELECTRICAL, ELECTRONICS ENGINEERING AND MEASUREMENTS**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To introduce the basics of electric circuits and analysis
2. To impart knowledge in the basics of working principles and application of electrical machines
3. To introduce analog devices and their characteristics
4. To educate on the fundamental concepts of linear integrated circuits
5. To introduce the functional elements and working of measuring instruments.

COURSE OUTCOME:

1. Compute the electric circuit parameters for simple problems
2. Explain the working principle and applications of electrical machines
3. Analyze the characteristics of analog electronic devices
4. Explain the basic concepts of linear integrated circuits
5. Explain the operating principles of measuring instruments.

UNIT-1	**ELECTRICAL CIRCUITS**	**9 HOURS**
DC Circuits: Circuit Components: Conductor, Resistor, Inductor, Capacitor – Ohm's Law - Kirchhoff's Laws –Independent and Dependent Sources – Simple problems- Nodal Analysis, Mesh analysis with Independent sources only (Steady state) Introduction to AC Circuits and Parameters: Waveforms, Average value, RMS Value, Instantaneous power, real power, reactive power and apparent power, power factor – Steady state analysis of RLC circuits (Simple problems only)		
UNIT-2	**ELECTRICAL MACHINES**	**9 HOURS**
Construction and Working principle- DC Separately and Self excited Generators, EMF equation, Types and Applications. Working Principle of DC motors, Torque Equation, Types and Applications. Construction, Working principle and Applications of Transformer, Three phase Alternator, Synchronous motor and Three Phase Induction Motor.		
UNIT-3	**ANALOG ELECTRONICS**	**9 HOURS**
Resistor, Inductor and Capacitor in Electronic Circuits- Semiconductor Materials: Silicon &Germanium – PN Junction Diodes, Zener Diode –Characteristics Applications – Bipolar Junction Transistor-Biasing, JFET, SCR, MOSFET,IGBT – Types, I-V Characteristics and Applications, Rectifier and Inverters		
UNIT-4	**LINEAR INTEGRATED CIRCUITS**	**9 HOURS**
Ideal OP-AMP characteristics, Basic applications of op-amp – Inverting and Non-inverting Amplifiers, summer, differentiator and integrator-S/H circuit, D/A converter (R- 2R ladder), A/D converters- Flash type ADC using OP-AMPS . Functional block, characteristics of 555 timer– Astable multi-vibrator mode.		
UNIT-5	**MEASUREMENTS AND INSTRUMENTATION**	**9 HOURS**
Functional elements of an instrument, Standards and calibration, Operating Principle , types - Moving Coil and Moving Iron meters, Measurement of three phase power, Energy Meter, Instrument Transformers-CT and PT,DSO- Block diagram- Data acquisition		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S):

1.	D P Kothari and I.J Nagrath, "Basic Electrical and Electronics Engineering", McGraw Hill Education, Second Edition, 2020.
2.	Allan S Moris, "Measurement and Instrumentation Principles", Third Edition, Butterworth Heinemann, 2001
3.	S.K. Bhattacharya, Basic Electrical Engineering, Pearson Education, 2019

4.	James A .Svoboda, Richard C. Dorf, "Dorf's Introduction to Electric Circuits", Wiley, 2018.
REFERENCE BOOKS:	
1.	Thomas L. Floyd, 'Electronic Devices', 10th Edition, Pearson Education, 2018
2.	A.K. Sawhney, Puneet Sawhney 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, New Delhi,January 2015.
3.	Albert Malvino, David Bates, 'Electronic Principles, McGraw Hill Education; 7th edition, 2017

Course Code	Course Title	L	T	P	J	C
22EST202	ENGINEERING GRAPHICS	1	0	4	0	3
		Syllabus version			v. 2.0	

COURSE OBJECTIVES:

1. To develop students, graphic skills for communication of concepts, ideas and design of engineering products.
2. To expose them to existing National standards related to technical drawings.
3. To Familiarize with basic geometrical constructions and orthographic projections.
4. To make the students to draw the different projections of the solids.
5. To view the true shape and apparent shape of the sectioned solids and their developments.
6. To get an idea about 3D views through isometric projections.

COURSE OUTCOME:

1. Perform basic geometrical constructions and principles of orthographic projections.
2. Project orthographic projections of lines and plane surfaces.
3. Draw projections of solids and development of surfaces.
4. Visualize and to project isometric views and conversion of Isometric views to Orthographic views.
5. Understand the basics of AUTO CAD and fundamentals of perspective projections.

UNIT-0	**CONCEPTS AND CONVENTIONS (Not for Examination)**	**3+9 HOURS**

Importance of graphics in engineering applications — Use of drafting instruments - BIS conventions and specifications — Size, layout and folding of drawing sheets — Lettering and dimensioning.

UNIT-1	**PLANE CURVES, PROJECTIONOF POINTS AND LINES**	**3+9 HOURS**

Conic Sections - Construction of Ellipse, Parabola & hyperbola by eccentricity method – Construction of cycloid. Introduction of Orthographic projection. First angle projection - projection of points and Projection of Lines (only for understanding)		
UNIT-2	**PROJECTION OF PLANES AND SOLIDS**	**3+9 HOURS**
Projection of simple planes (Square, circular, Hexagon, Pentagon) inclined to both the principal planes by rotating object method. Projection of simple solids like Prism, Pyramid, Cylinder& Cone when the axis is inclined to one of the principal planes by rotating object method.		
UNIT-3	**SECTION AND DEVELOPMENT SURFACES OF SOLIDS**	**3+9 HOURS**
Sectioning of simple solids (Prism, Pyramid, Cylinder& Cone) in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development of surfaces of right regular sectioned solids		
UNIT-4	**ISOMETRIC AND ORTHOGRAPHIC PROJECTIONS**	**3+9 HOURS**
Principles of Isometric Projections-Isometric scale- Isometric Views of simple and truncated solids. Conversion of Isometric views of the objects to Orthographic views Exercises using free hand sketching.		
UNIT-5	**COMPUTER AIDED DRAFTING (Only for Internal Evaluation)**	**3+9 HOURS**
Introduction to engineering graphics CAD tools, Drawing Orthographic views from Isometric views using CAD tools--Floor plans of simple buildings- Exercise of circuit diagram (2D Orthographic Views) and 3D modeling (Isometric Views) using AutoCAD Software.		
Special points applicable to University Examinations on Engineering Graphics: 1. There will be five questions, each of either or type covering all units of the syllabus. 2. All questions will carry equal marks of 20 each making a total of 100. 3. The answer paper shall consist of drawing sheets of A3 size only. The students will be permitted to use appropriate scale to fit solution within A3 size 4. The examination will be conducted in appropriate sessions on the same day		
	TOTAL LECTURE HOURS:	**60 HOURS**
TEXT BOOK(S):		
1.	Bhatt N.D. and Panchal V.M., “Engineering Drawing”, Charotar Publishing House, 53rd Edition, 2019.	
2.	Natrajan K.V., “A Text Book of Engineering Graphics”, Dhanalakshmi Publishers, Chennai, 2018.	

3.	Parthasarathy, N. S. and Vela Murali, “Engineering Drawing”, Oxford University Press, 2015
REFERENCE BOOKS:	
1.	Basant Agarwal and Agarwal C.M., “Engineering Drawing”, McGraw Hill, 2nd Edit ion, 2019.
2.	Gopalakrishna K.R., “Engineering Drawing” (Vol. I&II combined), Subhas Publications, Bangalore, 27th Edition, 2017.
3.	Luzzader, Warren.J. and Duff,John M., “Fundamentals of Engineering Drawing with an introduction to Interactive Computer Graphics for Design and Production, Eastern Economy Edition, Prentice Hall of India Pvt. Ltd, New Delhi, 2005.
4.	Parthasarathy N. S. and Vela Murali, “Engineering Graphics”, Oxford University, Press, New Delhi, 2015.
5.	Shah M.B., and Rana B.C., “Engineering Drawing”, Pearson Education India, 2nd Edition, 2009.
6.	Venugopal K. and Prabhu Raja V., “Engineering Graphics", New Age International (P) Limited, 2008.

LIST OF EQUIPMENTS

S. NO	DESCRIPTION OF EQUIPMENT	QUANTITY
1.	Computer nodes or systems with suitable graphics facility	30 Nos
2.	Software for Drafting and Modelling	30 Nos
3.	Laser Printer or Plotter to print / plot drawings	1 No

LIST OF EXPERIMETS:

1. Drawing of a title block with necessary text, projection symbol and lettering using drafting software.
2. Drafting of Conic curves - Ellipse, Parabola and Hyperbola
3. Drawing orthographic view of simple solids like Prism, Pyramids, Cylinder, Cone, etc, and dimensioning.
4. Drawing of simple solids like prism and pyramids when the axis is inclined to HP.
5. Drawing of simple solids like cylinder and cone when the axis is inclined to HP.
6. Drawing isometric projection of simple solids.
7. Drawing of star –delta starter circuit
8. Drawing an electrical circuit of three-point starter.
9. Drawing of an electrical power supply circuit.
10. Drawing of Hartley oscillator.

Course Code	Course Title	L	T	P	J	C
22EET201	INNOVATIONS AND DESIGN THINKING	2	0	0	0	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Learn design thinking concepts and principles
2. Use design thinking methods in every stage of the problem
3. Learn the different phases of design thinking
4. Apply various methods in design thinking to different problems
5. Apply the various the testing and implementation

COURSE OUTCOME:

1. Innovation of the new environmental conditions
2. Define key concepts of design thinking
3. Practice design thinking in all stages of problem-solving
4. Apply design thinking approach to real-world problems
5. Understand the testing and implementation

UNIT-1	INNOVATIONS	6 HOURS

Introduction, innovation in current environment, types of innovation, schools of innovation, analyzing the current business scenario, challenges of innovation, steps of innovation management, experimentation in innovation management, participation for innovation, co-creation for innovation, prototyping to incubation. blue ocean strategy –I, blue ocean strategy-II. marketing of innovation, technology innovation process.

UNIT-2	**DESIGN THINKING**	**6 HOURS**
Design Thinking Approach:-Introduction to Design Thinking, Iterative Design Thinking Process Stages. Design Thinking as Divergent-Convergent Questioning. Design Thinking in a Team Environment, System Thinking, Product Thinking.		
UNIT-3	**UNDERSTAND, OBSERVE AND DEFINE THE PROBLEM**	**6 HOURS**
Search field determination - Problem clarification - Understanding of the problem - Problem analysis - Reformulation of the problem - Observation Phase - Empathetic design - Tips for observing - Methods for Empathetic Design - Point-of-View Phase - Characterization of the target group - Description of customer needs.		
UNIT-4	**IDEATION AND PROTOTYPING**	**6 HOURS**
Ideate Phase - The creative process and creative principles - Creativity techniques - Evaluation of ideas - Prototype Phase - Lean Startup Method for Prototype Development - Visualization and presentation techniques.		
UNIT-5	**TESTING AND IMPLEMENTATION**	**6 HOURS**
Test Phase - Tips for interviews - Tips for surveys - Kano Model - Desirability Testing - How to conduct workshops - Requirements for the space - Material requirements - Agility for Design Thinking. Design Thinking meets the corporation – The New Social Contract – Design Activism – Designing tomorrow.		
	TOTAL LECTURE HOURS:	**30 HOURS**
TEXT BOOK(S):		
1.	Christian Mueller-Rotenberg, Handbook of Design Thinking - Tips & Tools for how to design thinking.	
2.	Designing for Growth: a design thinking tool kit for managers by Jeanne Liedtka and Tim Ogilvie.	
3.	Change by Design: How Design Thinking Transforms Organizations and Inspires Innovation by Tim Brown.	
4.	John. R. Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design", Cengage Learning (International edition) Second Edition, 2013	
REFERENCE BOOKS:		

1.	Johnny Schneider, “Understanding Design Thinking, Lean and Agile”, O'Reilly Media, 2017.
2.	Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage", Harvard Business Press, 2009.
3.	Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 201 4. http://ajjuliani.com/design-thinking-activities/ 5. https://venturewell.org/class-exercises
4.	Yousef Haik and Tamer M.Shahin, “Engineering Design Process”, Cengage Learning, Second Edition, 2011.

Course Code	Course Title	L	T	P	J	C
22HSM201	**TAMILS AND TECHNOLOGY**	**1**	**0**	**0**	**0**	**1**
Pre-requisite		Syllabus version			v. 1.0	

Unit-1	**WEAVING AND CERAMIC TECHNOLOGY**	**03 hours**

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

Unit-2	**DESIGN AND CONSTRUCTION TECHNOLOGY**	**03 hours**

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

Unit-3	**MANUFACTURING TECHNOLOGY**	**03 hours**

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

Unit-4	**AGRICULTURE AND IRRIGATION TECHNOLOGY**	**03 hours**

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

Unit-5	**SCIENTIFIC TAMIL & TAMIL COMPUTING**	**03 hours**

Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books – Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries – Sorkuvai Project.	
Total Lecture hours:	15 hours
TEXT BOOK(S)	
1.	The Contributions of the Tamils to Indian Culture (Dr. M. Valarmathi) (Published by: International Institute of Tamil Studies.)
2.	Keeladi - 'Sangam City Civilization on the banks of river Vaigai' (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation,
3.	Tamilaga Varalaru, Makalum Panpadum- Dr. K.K. Pillai
4.	Kanini Tamil- Munaivar L. Sundaram
5.	Porunai- Attrangarai Nagarigam
REFERENCE BOOKS	
1.	Social Life of Tamils (Dr. K. K. Pillay) A joint publication of TNTB & ESC and RMRL – (in print)
2.	Social Life of the Tamils - The Classical Period (Dr. S. Singaravelu) (Published by: International Institute of Tamil Studies.
3.	Historical Heritage of the Tamils (Dr. S. V. Subatamanian, Dr. K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
4.	Studies in the History of India with Special Reference to Tamil Nadu (Dr. K.K. Pillay) (Published by: The Author)
5.	Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
6.	Journey of Civilization Indus to Vaigai (R. Balakrishnan) (Published by: RMRL) – Reference Book

Course Code	Course Title	L	T	P	J	C
22ESP201	ENGINEERING PRODUCT LABORATORY	0	0	3	0	1.5
		Syllabus version			v. 2.0	

COURSE OBJECTIVES: The main learning objective of this course is to provide hands on training to the students in:

1. Drawing pipe line plan; laying and connecting various pipe fittings used in common household plumbing work; Sawing; planning; making joints in wood materials used in common household wood work.
2. Wiring various electrical joints in common household electrical wire work.
3. Welding various joints in steel plates using arc welding work; Machining various simple processes like turning, drilling, tapping in parts; Assembling simple mechanical

assembly of common household equipments; Making a tray out of metal sheet using sheet metal work.

4. Soldering and testing simple electronic circuits; Assembling and testing simple electronic components on PCB

COURSE OUTCOME: At the end of the course, the student will be able to

1. Draw pipe line plan; lay and connect various pipe fittings used in common household plumbing work; Saw; plan; make joints in wood materials used in common household wood work.
2. Wire various electrical joints in common household electrical wire work.
3. Weld various joints in steel plates using arc welding work; Machine various simple processes like turning, drilling, tapping in parts; Assemble simple mechanical assembly of common household equipments; Make a tray out of metal sheet using sheet metal work.
4. Solder and test simple electronic circuits; Assemble and test simple electronic components on PCB.

LIST OF EXPERIMENTS:

GROUP – A (CIVIL & ELECTRICAL)

PART I CIVIL ENGINEERING PRACTICES PLUMBING WORK 15

a) Connecting various basic pipe fittings like valves, taps, coupling, unions, reducers, elbows and other components which are commonly used in household.

b) Preparing plumbing line sketches.

c) Laying pipe connection to the suction side of a pump

d) Laying pipe connection to the delivery side of a pump.

e) Connecting pipes of different materials: Metal, plastic and flexible pipes used in household appliances.

PART II ELECTRICAL ENGINEERING PRACTICES 15

1. Residential house wiring using switches, fuse, indicator, lamp and energy meter.
2. Fluorescent lamp wiring with introduction to CFL and LED types.
3. Stair case wiring
4. Residential house wiring using fuse, switch, indicator, lamp and energy meter.
5. Measurement of energy using single phase energy meter.

GROUP – B (MECHANICAL AND ELECTRONICS)

PART III MECHANICAL ENGINEERING PRACTICES 15

WELDING WORK:

Demonstrating welding of Butt Joints, Lap Joints, and Tee Joints using arc welding.

BASIC MACHINING WORK:

Demonstrating of a) (simple)Turning. b) (simple)Drilling. c) (simple)Tapping.

3D PRINITNG:

Demonstrating of working principle of 3D Printer machine.

FOUNDRY WORK:

a) Demonstrating basic foundry operations

SHEET METAL WORK:

b) Making of a square tray

c) Making of a cone

FITTING EXERCISE:

Make a model by using fitting exercise

PART IV ELECTRONIC ENGINEERING PRACTICES 15

1. Study of Electronic components and equipments – Resistor, colour coding measurement of AC signal parameter (peak-peak, rms period, frequency) using CR.

2.Study of logic gates AND, OR, EOR and NOT.

3.Generation of Clock Signal.

4. Soldering practice – Components Devices and Circuits – Using general purpose PCB.

5. Measurement of ripple factor of HWR and FWR.

TOTAL LABORATORY HOURS:	**60 HOURS**

Course Code	Course Title	L	T	P	J	C
22ESP202	**BASIC ELECTRICAL, ELECTRONICS ENGINEERING AND MEASUREMENTS LABORATORY**	**0**	**0**	**3**	**0**	**1.5**
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To train the students in conducting load tests on electrical machines
2.To gain practical experience in characterizing electronic devices
3.To train the students to use DSO for measurements

COURSE OUTCOME:

After completing this course, the students will be able to

1. Use experimental methods to verify the Ohm's and Kirchhoff's Laws.
2. Analyze experimentally the load characteristics of electrical machines
3. Analyze the characteristics of basic electronic devices
4. Use DSO to measure the various parameters

LIST OF EXPERIMENTS:

ELECTRICAL 1. Verification of ohms and Kirchhoff's Laws. 2. Load test on DC Shunt Motor. 3. Load test on Self Excited DC Generator 4. Load test on Single phase Transformer 5. Load Test on Induction Motor **ELECTRONICS** 6. Experiment on Transistor based application circuits (Inverting and non-inverting amplifier or switching circuits) (Or) Experiments on Operational Amplifier based Inverting and non-inverting amplifier. 7. Experiments on ADC. 8. Experiments on 555 timer **MEASUREMENTS** 9. Study on function of DSO. 10. Measurement of Amplitude, Frequency, Time, Phase Measurement using DSO.
TOTAL LECTURE HOURS: 60 HOURS

COURSE CODE	COURSE TITLE	L	T	P	J	C
22NXP201	NCC Credit Course Level 1* (ARMY WING)	1	0	0	0	1
		Syllabus version			v. 1.0	

UNIT-1	NCC GENERAL	3 HOURS
NCC 1 Aims, Objectives & Organization of NCC NCC 2 Incentives NCC 3 Duties of NCC Cadet NCC 4 NCC Camps: Types & Conduct		

UNIT-2	NATIONAL INTEGRATION AND AWARENESS	3 HOURS
NI 1 National Integration: Importance & Necessity NI 2 Factors Affecting National Integration NI 3 Unity in Diversity & Role of NCC in Nation Building NI 4 Threats to National Security		

UNIT-3	PERSONALITY DEVELOPMENT	3 HOURS
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving PD 2 Communication Skills PD 3 Group Discussion: Stress & Emotions		

UNIT-4	LEADERSHIP	2 HOURS
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code L 2 Case Studies: Shivaji, Jhasi Ki Rani		
UNIT-5	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**	**4 HOURS**
SS 1 Basics, Rural Development Programmes, NGOs, Contribution o Youth SS 2 Protection of Children and Women Safety SS 3 Road / Rail Travel Safety SS 4 New Initiatives SS 5 Cyber and Mobile Security Awareness		
	TOTAL LECTURE HOURS	**15 HOURS**

COURSE CODE	COURSE TITLE	L	T	P	J	C
22NXP201	NCC Credit Course Level 1* (NAVAL WING)	1	0	0	0	1
		Syllabus version			v. 1.0	

UNIT-1	NCC GENERAL	3 HOURS
NCC 1 Aims, Objectives & Organization of NCC NCC 2 Incentives NCC 3 Duties of NCC Cadet NCC 4 NCC Camps: Types & Conduct		
UNIT-2	**NATIONAL INTEGRATION AND AWARENESS**	**3 HOURS**
NI 1 National Integration: Importance & Necessity NI 2 Factors Affecting National Integration NI 3 Unity in Diversity & Role of NCC in Nation Building NI 4 Threats to National Security		
UNIT-3	**PERSONALITY DEVELOPMENT**	**3 HOURS**
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving PD 2 Communication Skills PD 3 Group Discussion: Stress & Emotions		
UNIT-4	**LEADERSHIP**	**2 HOURS**
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code L 2 Case Studies: Shivaji, Jhasi Ki Rani		

UNIT-5	SOCIAL SERVICE AND COMMUNITY DEVELOPMENT	4 HOURS
SS 1 Basics, Rural Development Programmes, NGOs, Contribution o Youth SS 2 Protection of Children and Women Safety SS 3 Road / Rail Travel Safety SS 4 New Initiatives SS 5 Cyber and Mobile Security Awareness		
	TOTAL LECTURE HOURS	**15 HOURS**

COURSE CODE	COURSE TITLE	L	T	P	J	C
22NXP201	NCC Credit Course Level 1* (AIR FORCE WING)	1	0	0	0	1
		Syllabus version			v. 1.0	

UNIT-1	NCC GENERAL	3 HOURS
NCC 1 Aims, Objectives & Organization of NCC NCC 2 Incentives NCC 3 Duties of NCC Cadet NCC 4 NCC Camps: Types & Conduct		
UNIT-2	**NATIONAL INTEGRATION AND AWARENESS**	**3 HOURS**
NI 1 National Integration: Importance & Necessity NI 2 Factors Affecting National Integration NI 3 Unity in Diversity & Role of NCC in Nation Building NI 4 Threats to National Security		
UNIT-3	**PERSONALITY DEVELOPMENT**	**3 HOURS**
PD 1 Self-Awareness, Empathy, Critical & Creative Thinking, Decision Making and Problem Solving PD 2 Communication Skills PD 3 Group Discussion: Stress & Emotions		
UNIT-4	**LEADERSHIP**	**2 HOURS**
L 1 Leadership Capsule: Traits, Indicators, Motivation, Moral Values, Honour Code L 2 Case Studies: Shivaji, Jhasi Ki Rani		
UNIT-5	**SOCIAL SERVICE AND COMMUNITY DEVELOPMENT**	**4 HOURS**
SS 1 Basics, Rural Development Programmes, NGOs, Contribution o Youth SS 2 Protection of Children and Women Safety SS 3 Road / Rail Travel Safety SS 4 New Initiatives SS 5 Cyber and Mobile Security Awareness		
	TOTAL LECTURE HOURS	**15 HOURS**

SEMESTER III

Course Code	Course Title	L	T	P	J	C
22BST304	TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS	3	1	0		4
		Syllabus version				v. 1.0

COURSE OBJECTIVES:

1. To introduce the basic concepts of PDE for solving standard partial differential equations.
2. To introduce Fourier series analysis which is central to many applications in engineering apart from its use in solving boundary value problems.
3. To acquaint the student with Fourier series techniques in solving heat flow problems used in various situations.
4. To acquaint the student with Fourier transform techniques used in wide variety of situations.
5. To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes and to develop Z transform techniques for discrete time systems.

COURSE OUTCOME:

1. Understand how to solve the given standard partial differential equations.
2. Solve differential equations using Fourier series analysis which plays a vital role in engineering applications
3. Appreciate the physical significance of Fourier series techniques in solving one- and two-dimensional heat flow problems and one-dimensional wave equations.
4. Understand the mathematical principles on transforms and partial differential equations would provide them the ability to formulate and solve some of the physical problems of engineering.
5. Use the effective mathematical tools for the solutions of partial differential equations by using Z transform techniques for discrete time systems.

UNIT-1	PARTIAL DIFFERENTIAL EQUATIONS	9+3 HOURS

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations – Lagrange's linear equation – Linear partial differential equations of second and higher order with constant coefficients of both homogeneous and non-homogeneous types.

UNIT-2	FOURIER SERIES	9+3 HOURS

Dirichlet's conditions – General Fourier series – Odd and even functions – Half range sine series –Half range cosine series – Complex form of Fourier series – Parseval's identity – Harmonic analysis.

UNIT-3	APPLICATIONS OF PARTIAL DIFFERENTIAL	9+3 HOURS

	EQUATIONS	
Classification of PDE – Method of separation of variables – Fourier Series Solutions of one-dimensional wave equation – One dimensional equation of heat conduction – Steady state solution of two-dimensional equation of heat conduction.		
UNIT-4	**FOURIER TRANSFORMS**	**9+3 HOURS**
Statement of Fourier integral theorem – Fourier transform pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity.		
UNIT-5	**Z – TRANSFORMS AND DIFFERENCE EQUATIONS**	**9+3 HOURS**
Z-transforms – Elementary properties – Inverse Z-transform (using partial fraction and residues) –Initial and final value theorems – Convolution theorem – Formation of difference equations – Solution of difference equations using Z – transform.		
	TOTAL LECTURE HOURS:	**60 HOURS**

TEXT BOOK(S)

1.	Grewal B.S.,"Higher Engineering Mathematics" 44thEdition, Khanna Publishers,New Delhi, 2018.
2.	Kreyszig E, "Advanced Engineering Mathematics ", 10th Edition, John Wiley, New Delhi, India, 2016.

REFERENCE BOOKS

1.	Andrews. L.C and Shivamoggi. B, "Integral Transforms for Engineers" SPIE Press, 1999.
2.	Bali. N.P and Manish Goyal, "A Textbook of Engineering Mathematics", 10th Edition, Laxmi Publications Pvt. Ltd, 2015.
3.	James. G., "Advanced Modern Engineering Mathematics", 4thEdition, Pearson Education, New Delhi, 2016.
4.	Narayanan. S., Manicavachagom Pillay.T.K and Ramanaiah.G "Advanced Mathematics for Engineering Students", Vol. II & III, S.Viswanathan Publishers Pvt. Ltd, Chennai, 1998.
5.	Ramana. B.V., "Higher Engineering Mathematics", McGraw Hill Education Pvt. Ltd, New Delhi, 2018.
6.	Wylie. R.C. and Barrett . L.C., "Advanced Engineering Mathematics "Tata McGraw Hill Education Pvt. Ltd, 6th Edition, New Delhi, 2012.

Course Code	Course Title	L	T	P	J	C
22EST301	FLUID MECHANICS AND THERMODYNAMICS	3	0	0	0	3
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To knowledge in Fluid Properties and Statics
2. To understand the concept of fluid kinematics and Dynamics.
3. To learn about the flows in fluid, Viscous flows and flow through pipes
4. To understand the basics laws of thermodynamics
5. To understand the second law of thermodynamics and entropy

COURSE OUTCOME: At the end of the course, the student able to:

- CO1: Recognize the fluid properties, fluid statics and laws of thermodynamics
- CO2: Interpret the problems related to kinematics and dynamics of fluids and thermal systems
- CO3: Review the energy losses in flow through pipes and steady flow equation in thermal systems.
- CO4: Analyse the fluid flow and thermal process
- CO5: Solve the problems related to fluid and thermal systems.

UNIT I	FLUID PROPERTIES AND FLUID STATICS	09 HOURS

Fluid Definition and Classification – Properties of fluids: Density, Specific Weight, Specific Volume, Specific Gravity, Viscosity, Compressibility, Bulk Modulus, Capillary and Surface Tension – Fluid statics: Concept of fluid static pressure – Pascal‘s law –Absolute and Gauge pressures – Manometers: Types and Pressure measurement – Concept of Buoyancy and Floatation.

UNIT II	FLUID KINEMATICS AND FLUID DYNAMICS	09 HOURS

Fluid Kinematics: Types of fluid flow – Continuity equation in two and three dimensions – Velocity and Acceleration of fluid particle – Velocity potential function and Stream function. Fluid dynamics: Euler's equation along a streamline –Bernoulli's equation and applications – Venturi meter, Orifice meter and Pitot tube.

UNIT III	VISCOUS FLOW, FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS	09 HOURS

Viscous flow: Shear stress, pressure gradient relationship – Flow of viscous fluid through circular pipe – Flow through pipes: Loss of head due to friction – Minor head losses – Hydraulic gradient and Total energy lines – Flow through pipes in series and in parallel – Power transmission through pipes. Dimensional analysis: Buckingham's theorem.

UNIT IV	BASICS OF THERMODYNAMICS AND FIRST LAW	09 HOURS

	OF THERMODYNAMICS	
Thermodynamics – Microscopic and macroscopic point of view – Systems, properties, process, path, cycle. Thermodynamic equilibrium – Zeroth law of Thermodynamics – internal energy, enthalpy, specific heat capacities CV and CP, Relationship between CV and CP. First law of Thermodynamics – Application to closed and open systems – Steady Flow Energy Equation (SFEE) – Simple problems.		
UNIT V	**SECOND LAW OF THERMODYNAMICS AND ENTROPY**	**09 HOURS**
Second Law of thermodynamics – Kelvin Planck and Clausius Statements – Equivalents of Kelvin Planck and Clausius statements. Reversibility – Irreversibility, reversible cycle – Heat engine, heat pump and refrigerator. Carnot cycle and Clausius theorem, the property of entropy, the inequality of Clausius – Entropy principle – General expression for entropy – Simple problems in entropy.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):		
1.	Bansal R.K., ―Fluid Mechanics and Hydraulic Machines‖, 9th Edition, Laxmi Publications, New Delhi, 2015.	
REFERENCE BOOKS:		
1.	Nag P.K., ―Engineering Thermodynamics‖, 5th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2013.	
2.	Cengel Yunus A. and Boles Michael A., ―Thermodynamics: An Engineering Approach‖, 7th Edition, McGraw-Hill, New York, 2011.	
3.	Frank M. White., ―Fluid Mechanics‖, 7th Edition, Tata McGraw Hill Publishing Company, New Delhi, 2009.	

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22RAT301	**ELECTRICAL CONTROL DRIVES AND DIGITAL ELECTRONICS**	**3**	**0**	**0**	**0**	**3**
		Syllabus version			**v. 2.0**	

COURSE OBJECTIVES:

1. To get a knowledge on drive characteristics
2. To obtain the knowledge on AC and DC motors and drives.
3. To obtain the knowledge on Stepper and Servo motor.
4. To present the Digital fundamentals, Boolean algebra and its applications in digital systems

5. To explain the various semiconductor memories and related technology
COURSE OUTCOME: At the end of the course, the student able to:
• CO1: Recognize the principles and working of relays, drives and motors. • CO2: Apply the solid state switching circuits to operate various types of Motors and • Drivers • CO3: Suggest the Motors and Drivers for given applications. • CO4: State the fundamental operating concepts behind digital logic circuits and microprocessors. • CO5: Recognize the use of various digital logic circuits and sub units in microprocessors.

UNIT I	**RELAY AND POWER SEMI-CONDUCTOR DEVICES**	**9 HOURS**
Study of Switching Devices – Relay and Types, Switching characteristics -BJT, SCR, TRIAC, GTO, MOSFET, IGBT and IGCT-: SCR, MOSFET and IGBT - Triggering and commutation circuit - Introduction to Driver and snubber circuits		
UNIT II	**AC AND DC MOTORS AND DRIVES**	**9 HOURS**
DC Servomotor - Types of PMDC & BLDC motors - principle of operation- emf and torque equations - characteristics and control – Drives- H bridge - Single and Three Phases – 4 quadrant operation – Applications. Introduction – Induction motor drives – Speed control of 3-phase induction motor – Stator voltage control – Stator frequency control – Stator voltage and frequency control – Stator current control – Static rotor resistance control – Slip power recovery control.		
UNIT III	**STEPPER AND SERVO MOTOR**	**9 HOURS**
Stepper Motor: Classifications- Construction and Principle of Operation – Modes of Excitation Drive System-Logic Sequencer - Applications. Servo Mechanism – DC Servo motor-AC Servo motor – Applications.		
UNIT IV	**DIGITAL FUNDAMENTALS**	**9 HOURS**
Number Systems – Decimal, Binary, Octal, Hexadecimal, 1‘s and 2‘s complements, Codes – Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems, Logic gates, Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization, Multiplexer, Demultiplexer, Decoder, Priority Encoder.		
UNIT V	**8085 PROCESSOR AND PROGRAMMING PROCESSOR**	**9 HOURS**

Hardware Architecture, pin diagram – Functional Building Blocks of Processor – Memory organization – I/O ports and data transfer concepts– Interrupts.Instruction - format and addressing modes – Assembly language format – Data transfer, datamanipulation& control instructions – Programming: Loop structure with counting & Indexing – Look up table - Subroutine instructions.	
TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):	
1.	M. Morris Mano and Michael D. Ciletti, "Digital Design", 5th Edition, Pearson, 2014.
2.	Krishna Kant, "Microprocessor and Microcontrollers", Eastern Company Edition, Prentice Hall of India, New Delhi, 2007.
REFERENCE BOOKS:	
1.	Charles H.Roth. "Fundamentals of Logic Design", 6th Edition, Thomson Learning, 2013.
2.	Thomas L. Floyd, "Digital Fundamentals", 10th Edition, Pearson Education Inc, 2011
3.	Muhammad Ali Mazidi & Janice Gilli Mazidi, R.D.Kinely 'The 8051 Micro Controller and Embedded Systems', PHI Pearson Education, 5th Indian reprint, 2003.
4.	R.S. Gaonkar, 'Microprocessor Architecture Programming and Application', with 8085, Wiley Eastern Ltd., New Delhi, 2013

Course Code	Course Title	L	T	P	J	C
22RAT302	**DESIGN OF ROBOT ELEMENTS-I**	**3**	**0**	**2**	**0**	**4**
Pre-requisite	**Fundamentals of Robotics**	**Syllabus version**			**v. 1.0**	
COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:						
1. To understand the concepts of stress, strain, principal stresses and principal planes. 2. To study the concept of shearing force and bending moment due to external loads in determinate beams and their effect on stresses. 3. To understand the basic knowledge about kinematics of machines. 4. To understand the motion resulting from a specified set of linkages, design few linkage mechanisms and cam mechanisms for specified output motions. 5. To understand the basic concepts of toothed gearing and kinematics of gear trains and the effects of friction in motion transmission and in machine components.						
COURSE OUTCOME: Upon completion of this course, the students will be able to:						

- CO1: Understand the concepts of stress and strain in simple and compound bars, the importance of principal stresses and principal planes.
- CO2: Understand the load transferring mechanism in beams and stress distribution due to shearing force and bending moment.
- CO3: The students be able to understand the basic knowledge of kinematics of machines
- CO4: Impart knowledge about the gears and gear trains.
- CO5: Ability to analyse them for optimum design.

UNIT I	**STRESS, STRAIN AND DEFORMATION OF SOLIDS**	**9+3 HOURS**
Rigid bodies and deformable solids – Tension, Compression and Shear Stresses – Deformation of simple and compound bars – Thermal stresses – Elastic constants – Volumetric strains –Stresses on inclined planes – principal stresses and principal planes – Mohr's circle of stress.		
UNIT II	**TRANSVERSE LOADING ON BEAMS AND STRESSES IN BEAM**	**9+3 HOURS**
Beams – types transverse loading on beams – Shear force and bending moment in beams – Cantilevers – Simply supported beams and over – hanging beams. Theory of simple bending– bending stress distribution – Load carrying capacity – Proportioning of sections – Flitched beams – Shear stress distribution.		
UNIT III	**KINEMATIC OF MACHINES**	**9+3 HOURS**
Mechanisms – Terminology and definitions – kinematics inversions of 4 bar and slide crank chain – kinematics analysis in simple mechanisms – velocity and acceleration polygons – Analytical methods – computer approach – cams – classifications – displacement diagrams - layout of plate cam profiles – derivatives of followers motion – circular arc and tangent cams.		
UNIT IV	**GEARS AND GEAR TRAINS**	**9+3 HOURS**
Spur gear – law of toothed gearing – involute gearing – Interchangeable gears – Gear tooth action interference and undercutting – nonstandard teeth – gear trains – parallel axis gears trains – epicyclic gear trains – automotive transmission gear trains.		
UNIT V	**FRICTION**	**9+3 HOURS**
Sliding and Rolling Friction angle – friction in threads – Friction Drives –Belt and rope drives .		
	TOTAL LECTURE AND PRACTICAL HOURS:	**60 HOURS**

TEXT BOOK(S):

1. Bansal, R.K., "Strength of Materials", Laxmi Publications (P) Ltd., 2016

2.	Jindal U.C., "Strength of Materials", Asian Books Pvt. Ltd., New Delhi, 2009
3.	Ambekar A.G., “Mechanism and Machine Theory” Prentice Hall of India, New Delhi, 2007
4.	Shigley J.E., Pennock G.R and Uicker J.J., “Theory of Machines and Mechanisms”, Oxford University Press, 2003
REFERENCE BOOKS:	
1.	Egor. P.Popov “Engineering Mechanics of Solids” Prentice Hall of India, New Delhi, 2002
2.	Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole "Mechanics of Materials", Tata McGraw Hill Publishing ‘co. Ltd., New Delhi, 2005.
3.	Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 1984.
4.	Thomas Bevan, “Theory of Machines”, CBS Publishers and Distributors, 1984.
LIST OF EXPERIMENTS:	
1.	Tension test on steel rod
2.	Compression test on wood
3.	Double shear test on metal
4.	Deflection test on metal beam
5.	Deflection test on carriage spring

Course Code	**Course Title**	**L**	**T**	**P**	**J**	**C**
22HST301	**ENTREPRENEURSHIP AND STARTUPS**	**3**	**0**	**0**	**0**	**2**
Pre-requisite		**Syllabus version**			**v. 1.0**	

COURSE OBJECTIVES:

1. To provide practical, proven tools for transforming an idea into a product or service that creates value for others
2. To build a winning strategy, how to shape a unique value proposition, prepare a business plan
3. To impart practical knowledge on business opportunities
4. To inculcate the habit of becoming an entrepreneur
5. To know the financing, growth, and new venture & its problems

COURSE OUTCOME: At the end of the course, the students will be able to

- CO1: Transform ideas into real products, services, and processes by validating the idea, testing it, and turning it into a growing, profitable, and sustainable Business.
- CO2: Identify the major steps and requirements to estimate the potential of an innovative idea as the basis of an innovative project.
- CO3: Reach creative solutions via an iteration of a virtually endless stream of world-changing ideas and strategies, integrating feedback and learning from failures along the way.
- CO4: Apply the ten entrepreneurial tools in creating a business plan for a new innovative venture.
- CO5: Apply methods and strategies learned from interviews with start-up entrepreneurs and innovators

UNIT I	**ENTREPRENEURIAL COMPETENCE**	**9 HOURS**

Introduction to Entrepreneurship & Entrepreneur Meaning and concept of Entrepreneurship, the history of Entrepreneurship development, Myths of Entrepreneurship, the role of Entrepreneurship in Economic Development, Agencies in Entrepreneurship Management, and the Future of Entrepreneurship. The Entrepreneur: Means the skills required to be an entrepreneur, the entrepreneurial decision process, Role models, Mentors and Support system.

UNIT II	**BUSINESS PLAN PREPARATION AND PROTOTYPING**	**9 HOURS**

Business Opportunity Identification and Preparing a Business Plan Business ideas, methods of generating ideas, and opportunity recognition, Idea Generation Process, Feasibility study, preparing a Business Plan: Meaning and significance of a business plan, components of a business plan. Experimentation and incubation, Participation in Innovation & Co-creation, and Prototyping

UNIT III	**ENTREPRENEURIAL ENVIRONMENT**	**9 HOURS**

Business Environment - Role of Family and Society - Entrepreneurship Development Training and Other Support Organisational Services - Central and State Government Industrial Policies and Regulations

UNIT IV	**LAUNCHING OF SMALL BUSINESS**	**9 HOURS**

Financing & Launching the New Venture Importance of new venture financing, types of ownership, venture capital, types of debt securities, determining ideal debt-equity mix, and financial institutions and banks. Launching the New Venture: Choosing the legal form of the new venture, protection of intellectual property, and formation of the new venture.

UNIT V	**MANAGEMENT OF SMALL BUSINESS**	**9 HOURS**

Managing Growth & Rewards in New Venture Characteristics of high growth new ventures, strategies for growth, and building the new ventures. Managing Rewards: Exit Strategies for Entrepreneurs, Mergers and acquisitions, Succession and exit strategy, managing failures – bankruptcy - Business Sickness - Effective Management of Small Business - Case Studies.	
TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):	
1.	Stephen Key, "One Simple Idea for Start-ups and Entrepreneurs: Live Your Dreams and Create Your Own Profitable Company", 1st Edition, Tata Mc Graw hill Company, New Delhi, 2013.
2.	Charles Bamford and Garry Bruton, "ENTREPRENEURSHIP: The Art, Science, and Process for Success", 2nd Edition, Tata Mc Graw hill Company, New Delhi, 2016.
REFERENCE BOOKS:	
1.	Philip Auerswald, "The Coming Prosperity: How Entrepreneurs Are Transforming the Global Economy", Oxford University Press, 2012.
2.	Janet Kiholm Smith; Richard L. Smith; Richard T. Bliss, "Entrepreneurial Finance: Strategy, Valuation, and Deal Structure, Stanford Economics and Finance", 2011.
3.	Edward D. Hess, "Growing an Entrepreneurial Business: Concepts and Cases", Stanford Business Books, 2011.
4.	Howard Love, "The Start-Up J Curve: The Six Steps to Entrepreneurial Success", Book Group Press, 2011.

Course Code	Course Title	L	T	P	J	C
22RAP304	**FLUID MECHANICS AND THERMAL LABORATORY**	**0**	**0**	**4**	**0**	**2**
Pre-requisite		**Syllabus version**			**v. 1.0**	

COURSE OBJECTIVES:

1. To verify the principles studied in Fluid Mechanics theory by performing experiments in lab.
2. To study the value timing-V diagram and performance of IC Engines
3. To Study the characteristics of fuels/Lubricates used in IC Engines
4. To study the heat transfer phenomena predict the relevant coefficient using implementation
5. To study the performance of refrigeration cycle / components

COURSE OUTCOME:

After completing this course, the students will be able to

- CO1: Perform Tension, Torsion, Hardness, Compression, and Deformation test on Solid materials.
- CO2: Use the measurement equipment's for flow measurement.
- CO3: Perform test on different fluid machinery.
- CO4: Conduct tests on heat conduction apparatus and evaluate thermal conductivity of materials.
- CO5: Conduct tests on natural and forced convective heat transfer apparatus and evaluate heat transfer coefficient.

LIST OF EXPERIMENTS:

1. Determination of the Coefficient of discharge of given Orifice meter.
2. Determination of the Coefficient of discharge of given Venturi meter.
3. Calculation of the rate of flow using Rota meter
4. Determination of friction factor for a given set of pipes. 5. Conducting experiments and drawing the characteristic curves of centrifugal pump/ submergible pump
5. Conducting experiments and drawing the characteristic curves of Gear pump.
6. Conducting experiments and drawing the characteristic curves of Pelton wheel
7. Conducting experiments and drawing the characteristics curves of Francis turbine.
8. Conducting experiments and drawing the characteristic curves of Kaplan turbine.
9. I.C. ENGINE LAB- Valve Timing and Port Timing diagrams.
10. STEAM LAB- Study on Steam Generators and Turbines.
11. HEAT TRANSFER LAB- Thermal conductivity measurement using guarded plate apparatus.
12. REFRIGERATION AND AIR CONDITIONING LAB- Determination of COP of a refrigeration system

TOTAL LECTURE HOURS:	**60 HOURS**

Course Code	Course Title	L	T	P	J	C
22RAP303	DRIVES AND CONTROL ACTUATORS LABORATORY	0	0	4	0	2
Pre-requisite		Syllabus version			v. 2.0	

COURSE OBJECTIVES:

1. To impart knowledge on Performance of the fundamental control practices associated with AC and DC machines (starting, reversing, braking, plugging, etc.) using power electronics To impart industry oriented learning
2. To evaluate the use of computer-based analysis tools to review the major classes of machines and their physical basis for operation

COURSE OUTCOME:

After completing this course, the students will be able to

- CO1: Practice the basic working of AC, DC motor, stepper motor, servo motor and synchronous motor using power electronic drive
- CO2: Demonstrate the control of AC, DC motor, stepper motor, servo motor and synchronous motor using power electronic drive
- CO3: :Analyze the performance of AC, DC motor, stepper motor, servo motor and synchronous motor using power electronic drive

LIST OF EXPERIMENTS:

1. Load test on DC Shunt Motor
2. Load test on 3 Phase Induction Motor
3. Rheostat based Speed control of DC motor.
4. Switching circuits of MOSFET, IGBT, SCR and TRAIC.
5. Gate pulsation generation using PWM signals.
6. Position and direction control DC servomotor using Power Electronic Drive.
7. Position, direction and speed control of BLDC and PMDC motors using PowerElectronic Drive.
8. Position, Direction and speed control of stepper Motor.
9. Four quadrant operation of three-phase Induction Motor using Power ElectronicDrive.
10. AC servomotor position, direction and speed control using Power Electronic Drive.

TOTAL LECTURE HOURS:	60 HOURS

Course Code	Course Title	L	T	P	J	C
22EEP301	SOFT SKILLS	0	0	2	0	1
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Do self-introspection and develop right attitude
2. Understand the self-motivation and mange his abilities with time
3. Understand the inter personal skills
4. Know the leader's qualities and develop as a leader
5. Undersating the conflict at work and make right decisions

COURSE OUTCOME:

After completing this course, the students will be able to

- CO1: Able to develop self-confidence through right attitude
- CO2: Use self-motivation and to manage his abilities
- CO3: Effectively use inter personal skills
- CO4: Develop leadership qualities
- CO5: Able to make right decisions and solving conflicts

UNIT-1	SELF ANALYSIS	6 HOURS

Introduction, SWOT analysis, self-introspection, self confidence and self-esteem, Creativity - Out of the box thinking, Creative thinking and Lateral thinking, Factors influencing attitude, Influence of attitude on behaviour, Synergy between knowledge, skill and attitude,

UNIT-2	GROWTH FACTORS	6 HOURS

Motivation, Motivational factors, Self-motivation, Intrinsic and extrinsic motivators, Goal setting, SMART goals, Short, long, life time goals, Time management, Value of time, Test your Time management skill, Prioritizing work, Time management matrix

UNIT-3	INTERPERSONAL SKILLS	6 HOURS

Gratitude, Secret of happiness, Understanding the integration of leadership, networking and teamwork, situation analysis, Importance of teamwork, Teamwork activity, Stress Management-Causes of stress and its impact, how to manage and de-stress

UNIT-4	LEADERSHIP	6 HOURS

Skills needed for a good leader, Types of leadership style, Assessment of leadership skills, Wheel of leadership, Personal, social and professional etiquette Emotional intelligence, Emotional quotient and intelligence quotient, Emotion scale, Managing emotions		
UNIT-5	**CONFLICT RESOLUTION AND DECISION MAKING**	**6 HOURS**
Conflicts in human relations, Self-assessment test for conflict management, Approaches to conflict resolution, Case study Decision making- Importance of decision making, Impact of decision in life, Process and practical way of decision making.		
	TOTAL LECTURE HOURS:	**30 HOURS**

TEXT BOOK(S):	
1.	SOFT SKILLS, 2015, Career Development Centre, Green Pearl Publications.
REFERENCE BOOKS:	
1.	Covey Sean, Seven Habits of Highly Effective Teens, New York, Fireside Publishers, 1998.
2.	Carnegie Dale, How to Win Friends and Influence People, New York: Simon & Schuster, 1998.
3.	Thomas A Harris, I am ok, You are ok, New York-Harper and Row, 1972.
4.	Daniel Coleman, Emotional Intelligence, Bantam Book, 2006.
5.	Carnegie Dale, How to stop worrying and start living, New York: Simon & Schuster, 1985.
6.	http://empower.srmuniv.ac.in (online LMS)

SEMESTER IV

Course Code	Course Title	L	T	P	J	C
22RAT401	CNC MACHINING AND METROLOGY	3	0	0	2	4
Pre-requisite		Syllabus version			v. 2.0	

COURSE OBJECTIVES:

1. Understand evolution and principle of CNC machine tools
2. Write simple programs for CNC turning and machining centres
3. Generate CNC programs for popular CNC controllers
4. Describe about linear and angular measurements in metrology
5. Study about the advancement in metrology

COURSE OUTCOME: Upon completion of this course the students can able to understand

- CO1: Ability to know about the basic in CNC machineries
- CO2:. Evolution and principle of CNC machine tools and different measurement technologies
- CO3: Able to write simple programs for CNC machinery
- CO4: To impart knowledge about linear and angular measurements in metrology
- CO5: Ability to know about the advancement in metrology

UNIT I	INTRODUCTION TO CNC MACHINE TOOLS	09 HOURS

Evolution of CNC Technology, principles, features, advantages, applications, CNC and DNC concept, classification of CNC Machines – turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators– Computer Aided Inspection, CNCMachine building, structural details, configuration and design, guide ways – Friction, Anti friction and other types of guide ways

UNIT II	DRIVES AND WORK HOLDING DEVICES	09 HOURS

Spindle drives – DC shunt motor, 3 phase AC induction motor, feed drives –stepper motor, servo principle, DC and AC servomotors, Axis measuring system – synchro, synchro-resolver, gratings, moiré fringe gratings, encoders, inductosysn, work holding devices for rotating and fixed work parts, economics of CNC, maintenance of CNC machines

UNIT III	CNC PROGRAMMING	09 HOURS

Structure of a part program, G & M Codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming, machining cycles, programming for machining centre and turning centre for well-known controllers such as Fanuc, Heidenhain, Sinumerik etc., generation of CNC codes from CAMpackages.

UNIT IV	LINEAR AND ANGULAR MEASUREMENTS	09 HOURS
Linear Measuring Instruments – Evolution – Types – Classification – Limit gauges – gauge design – terminology – procedure – concepts of interchange ability and selective assembly – Angular measuring instruments – Types – Bevel protractor clinometers angle gauges, spirit levels sine bar – Angle alignment telescope – Autocollimator – Applications.		
UNIT V	**ADVANCES IN METROLOGY**	**09 HOURS**
Basic concept of lasers Advantages of lasers – laser Interferometers – types – DC and AC Lasers interferometer – Applications – Straightness – Alignment. Basic concept of CMM – Types of CMM– Constructional features – Probes – Accessories – Software – Applications – Basic concepts of Machine Vision System – Element – Applications		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S):	
1.	"Mechatronics", HMT, Tata McGraw-Hill Publishing Company Limited, New Delhi, 2005.
2.	Warren S.Seamers, "Computer Numeric Control", Fourth Edition, Thomson Delmar, 2002
3.	Jain R.K. "Engineering Metrology", Khanna Publishers, 2005.
4.	Gupta. I.C., "Engineering Metrology", Dhanpatrai Publications, 2005.
REFERENCE BOOKS:	
1.	Charles Reginald Shotbolt, "Metrology for Engineers", 5th edition, Cengage Learning EMEA,1990.
2.	Backwith, Marangoni, Lienhard, "Mechanical Measurements", Pearson Education , 2006.
3.	Peter Smid, "CNC Programming Hand book", Industrial Press Inc., 2000
4.	Radhakrishnan P "Computer Numerical Control Machines", New Central Book Agency, 2002.

Course Code	Course Title	L	T	P	J	C
22RAT402	MATERIAL HANDLING AUTOMATION	3	0	0	0	3
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. Understand evolution and principle of materials handling
2. To learn the fundamentals of conveyors
3. To learn about the uses of chain and ropes
4. Describe about Industrial trucks
5. Study about the advancement in materials handling

COURSE OUTCOME:

- CO1: Ability to know about the basic in materials handling and automation
- CO2:. Evolution and principle of Computer controlled conveyor system.
- CO3: Able to write simple programs for Automated guided vehicles
- CO4: To impart knowledge about linear and Hoppers and Gates
- CO5: Ability to know about the chain and uses of ropes

UNIT I	INTRODUCTION TO MATERIAL HANDLING	09 HOURS

Types of industrial transport – classification and characteristics of materials – classification and selection of materials handling.

UNIT II	CONVEYOR EQUIPMENT	09 HOURS

Classification of conveyors, description and uses of belt, Conveyors, Apron conveyors, Roller conveyors, Pneumatic and Hydraulic conveyors, Computer controlled conveyor system.

UNIT III	INDUSTRIAL TRUCKS	09 HOURS

Industrial trucks introduction and types, Purpose of hand trucks, Tractors and trailers, Self-propelled trucks and fork trucks, Automated guided vehicles Theory.

UNIT IV	AUXILIARY EQUIPMENT	09 HOURS

Hoppers and Gates, Auxiliary Equipment, Feeders – Chutes, Applications and Advancements.

UNIT V	HOISTING APPLIANCES	09 HOURS

Types- Description and uses of chain- Description and uses of ropes- Types and description and purpose of crane hooks- Grab buckets, lifts, Excavators

TOTAL LECTURE HOURS:	45 HOURS

TEXT BOOK(S):	
1.	Bolz, H. A and Hagemann, G. E (ed.), ‘‘Materials Handling Handbook’’, Ronald Press.
2.	IS 8005:1976, Classification of Unit Loads, Bureau of Indian Standards.
3.	Apple, J.A., ‘‘Material Handling System Design’’, John Wiley & Sons
REFERENCE BOOKS:	
1.	Allegri, T.H., ‘‘Materials Handling: Principles and Practice’’, CBS Publishers Distributors, N. Delhi.

Course Code	Course Title	L	T	P	J	C
22RAT403	SENSORS AND INSTRUMENTATION	3	0	0	0	3
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To understand the concepts of measurement technology.
2. To learn the various sensors used to measure various physical parameters.
3. To learn the fundamentals of signal conditioning, data acquisition and communication systems used in mechatronics system development
4. To learn about the optical, pressure and temperature sensor
5. To understand the signal conditioning and DAQ systems

COURSE OUTCOME: Upon successful completion of the course, students should be able to:

- CO1: Recognize with various calibration techniques and signal types for sensors.
- CO2: Describe the working principle and characteristics of force, magnetic, heading, pressure and temperature, smart and other sensors and transducers.
- CO3: Apply the various sensors and transducers in various applications
- CO4: Select the appropriate sensor for different applications.
- CO5: Acquire the signals from different sensors using Data acquisition systems.

UNIT I	INTRODUCTION	09 HOURS

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

UNIT II	MOTION, PROXIMITY AND RANGING SENSORS	09 HOURS

Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Reflective beacons, Laser Range Sensor (LIDAR).

UNIT III	FORCE, MAGNETIC AND HEADING SENSORS	09 HOURS

Strain Gage, Load Cell, Magnetic Sensors –types, principle, requirement and advantages: Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.

UNIT IV	OPTICAL, PRESSURE AND TEMPERATURE SENSORS	09 HOURS

Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure

– Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC, Thermistor, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensors.		
UNIT V	**SIGNAL CONDITIONING AND DAQ SYSTEMS**	**09 HOURS**
Amplification – Filtering – Sample and Hold circuits – Data Acquisition: Single channel and multi-channel data acquisition – Data logging - applications - Automobile, Aerospace, Home appliances, Manufacturing, Environmental monitoring.		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):		
1.	Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGrawHill, 2009.	
2.	Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", Dhanpat Rai & Co, 12th edition New Delhi, 2013.	
REFERENCE BOOKS:		
1.	C. Sujatha ... Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2001.	
2.	Hans Kurt Tönshoff (Editor), Ichiro, "Sensors in Manufacturing" Volume 1, Wiley-VCH April 2001.	
3.	John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 1999.	
4.	Patranabis D, "Sensors and Transducers", 2nd Edition, PHI, New Delhi, 2011.	
5.	Richard Zurawski, "Industrial Communication Technology Handbook" 2nd edition, CRC Press, 2015.	

Course Code	Course Title	L	T	P	J	C
22RAT404	ADVANCE CONTROL SYSTEM	3	0	0	0	3
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To introduce the components and their representation of control systems
2. To learn various methods for analysing the time response, frequency response and stability of the systems.
3. To learn the various approach for the system frequency analysis
4. To understand the concept of stability analysis
5. To know about the state variable methods of control system analysis

COURSE OUTCOME: Upon successful completion of the course, students should be able to:

CO1: State the various control terminologies and concepts.
CO2: Know the procedures in developing the transfer function, state space models and time and frequency domain analysis methods.
CO3: Apply the procedures on developing the systems in transfer function and state space approach and apply to evaluate the performance of system in time and frequency domain techniques.
CO4: Illustrate the time and frequency response characteristics of system response.
CO5: Analyze the performance of system using various time and frequency domain techniques.

UNIT I	SYSTEMS COMPONENTS AND THEIR REPRESENTATION	09 HOURS

Control System: Terminology and Basic Structure-Feed forward and Feedback control theory-
Electrical and Mechanical Transfer Function Models-Block diagram Models-Signal flow graphs

UNIT II	TIME RESPONSE ANALYSIS	09 HOURS

Transient response-steady state response-Measures of performance of the standard first order and second order system-effect on an additional zero and an additional pole-steady error constant and system- type number-PID control-Analytical design for PD, PI,PID control
systems

UNIT III	FREQUENCY RESPONSE AND SYSTEM ANALYSIS	09 HOURS

Closed loop frequency response-Performance specification in frequency domain-Frequency response of standard second order system- Bode Plot - Polar Plot-Design of compensators using Bode plots- Cascade lead, lag and lag-lead compensation.		
UNIT IV	**CONCEPTS OF STABILITY ANALYSIS**	**09 HOURS**
Concept of stability-Bounded - Input Bounded - Output stability-Routh stability criterion-Relative stability-Root locus concept-Guidelines for sketching root locus-Nyquist stability criterion.		
UNIT V	**CONTROL SYSTEM ANALYSIS USING STATE VARIABLE METHODS**	**09 HOURS**
State variable representation-Conversion of state variable models to transfer functions-Conversion of transfer functions to state variable models-Solution of state equations-Concepts of Controllability and Observability		
	TOTAL LECTURE HOURS:	**45 HOURS**
TEXT BOOK(S):		
1.	M.Gopal,"Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.	
2.	K.Ogata, "Modern Control Engineering", PHI, 5 th Edition, 2012.	
REFERENCE BOOKS:		
1.	J.Nagrath and M.Gopal, "Control System Engineering", New Age International Publishers, 5th Edition, 2007.	
2.	S.K.Bhattacharya, "Control System Engineering", Pearson, 3 rd Edition, 2013.	
3.	Benjamin.C.Kuo, "Automatic Control Systems", Prentice Hall of India, 7th Edition,1995.	

Course Code	Course Title	L	T	P	J	C
22RAT405	Design of Robot Elements-II	3	0	0	2	4
Pre-requisite	Design of Robot Elements-I	Syllabus version			v. 1.0	

COURSE OBJECTIVES: The main learning objective of this course is to prepare the students for:

1. To introduce the students to the fundamentals of machine design, material selection and to solve the basic design problems.
2. To learn to derive various parameters for modelling links and joints in a robot.
3. To learn about Fundamentals of Computer Graphics
4. To learn and understand curves and surfaces in robot modelling.
5. To learn to derive various parameters for modelling end-effectors of a robot

COURSE OUTCOME: Upon completion of this course, the students will be able to:

- CO1: State the design parameters for designing the components of a robot.
- CO2: Apply the CAD modelling techniques in designing a Robot
- CO3: Analyse the design parameters for designing the components of a robot.
- CO4: Formulate the methods for designing the entire robot assembly
- CO5: Create a Robot CAD Model.

UNIT I	FUNDAMENTALS OF MECHANICAL DESIGN	9 HOURS

Fundamentals of Machine Design-Engineering Design, Phases of Design, Design Consideration - Standards and Codes - Design against Static and Dynamic Load –Modes of Failure, Factor of Safety, Principal Stresses, Theories of Failure-Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life, Soderberg and Goodman Criteria.

UNIT II	DESIGN OF LINKS AND JOINTS	9 HOURS

Loads and Forces on Links and Joints - Design of solid and hollow shafts - Rigid and flexible couplings -Threaded fasteners - rolling contact bearings-– Links Design: Path and Motion Synthesis – Cognate Linkages – Design of Spherical Joints.

UNIT III	FUNDAMENTALS OF COMPUTER GRAPHICS	9 HOURS

Product cycle- Design process - Computer Aided Design – Computer graphics – co-ordinate systems- 2D and 3D transformations- homogeneous coordinates - graphic primitives (point, line, circle drawing algorithms) - Clipping- viewing transformation.

UNIT IV	CURVES AND MODELLING	9 HOURS

Representation of curves - Hermite cubic spline curve, Bezier curve, B-spline curves, Fundamentals of solid modeling, Different solid representation schemes, Half -spaces, Boundary representation (B-rep), Constructive solid geometry (CSG), Sweep representation,

Analytic solid modeling, Perspective, Parallel projection, Hidden line removal algorithms.		
UNIT V	**DESIGN OF GRIPPERS**	**9 HOURS**
Grippers – Types of Grippers Mechanisms – Gripping Methods – Gripping Force analysis – Gripper Design – Two Finger gripper – Three Finger Gripper – Magnetic Gripper Design – Vacuum Gripper Design – Hooks – Scoops – Spools – Miscellaneous Grippers		
	TOTAL LECTURE HOURS:	**45 HOURS**

TEXT BOOK(S):	
1.	Joseph Edward Shigley, Charles R. Mischke “Mechanical Engineering Design”, McGraw Hill, International Edition, 1992
2.	Sharma. C.S. and Kamlesh Purohit, “Design of Machine Elements”, Prentice Hall of India Private Limited, 2003
3.	Ibrahim Zeid, “CAD/CAM theory and Practice”, Tata McGraw Hill, 2nd edition, 2008
4.	Ashby. M.F., “Materials Selection in Mechanical Design”, Third edition, ButterworthHeineman, New York, 16th edition, 2012
REFERENCE BOOKS:	
1.	Bhandari. V.B., “Design of Machine Elements”, Tata McGraw-Hill Publishing Company Limited, 2003.
2.	Robert L. Norton, “Machine Design – An Integrated Approach”, Prentice Hall International Edition, 2000.
3.	Charles. J. A. and Crane. F. A. A, “Selection and Use of Engineering Materials”, second edition, Butterworth-Heinemann Ltd., 3rd edition 2005.
4.	Kevin Otto, Kristin Wood, “Product Design”, Pearson Education, 7th Reprint, 2011.
5.	Mikell P. Groover, "Industrial Robotics", McGraw Hill, 2nd edition, 2012.
6.	Zeid, I., CAD/CAM, McGraw Hil , 2008.

LIST OF EXPERIMENT:		
1.	Create a Robot CAD Model	30 HOURS

Course Code	Course Title	L	T	P	J	C
22EST301	ENVIRONMENTAL SCIENCES AND SUSTAINABILITY	2	0	0	0	2
		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To study the nature and facts about environment.
2. To finding and implementing scientific, technological, economic and political solutions to environmental problems.
3. To study the interrelationship between living organism and environment.
4. To appreciate the importance of environment by assessing its impact on the human world; envision the surrounding environment, its functions and its value.
5. To study the dynamic processes and understand the features of the earth‟s interior and surface.
6. To study the integrated themes and biodiversity, natural resources, pollution control and waste management

COURSE OUTCOME:

1. Environmental Pollution or problems cannot be solved by mere laws. Public participation is an important aspect which serves the environmental Protection. One will obtain knowledge on the following after completing the course.
2. Public awareness of environmental is at infant stage.
3. Ignorance and incomplete knowledge has lead to misconceptions
4. Development and improvement in std. of living has lead to serious environmental disasters

UNIT-1	ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY	6 HOURS

Definition, scope and importance of environment – need for public awareness. Eco-system and Energy flow– ecological succession. Types of biodiversity: genetic, species and ecosystem diversity– values of biodiversity, India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ.

UNIT-2	ENVIRONMENTAL POLLUTION	6 HOURS
Causes, Effects and Preventive measures of Water, Soil, Air and Noise Pollutions. Solid, Hazardous and E-Waste management. Case studies on Occupational Health and Safety Management system (OHASMS). Environmental protection, Environmental protection acts .		
UNIT-3	**NATURAL RESOURCES**	**6 HOURS**
Energy management and conservation, New Energy Sources: Need of new sources. Different types new energy sources. Applications of- Hydrogen energy, Ocean energy resources, Tidal energy conversion. Concept, origin and power plants of geothermal energy.		
UNIT-4	**SOCIAL ISSUES AND THE ENVIRONMENT**	**6 HOURS**
Development, GDP, Sustainability- concept, needs and challenges-economic, social and aspects of sustainability-from unsustainability to sustainability-millennium development goals, and protocols- Sustainable Development Goals-targets, indicators and intervention areas Climate change- Global, Regional and local environmental issues and possible solutions-case studies. Concept of Carbon Credit, Carbon Footprint. Environmental management in industry-A case study.		
UNIT-5	**HUMAN POPULATION AND THE ENVIRONMENT**	**6 HOURS**
Population growth, variation among nations – population explosion – family welfare Programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare – role of information technology in environment and human health – Case studies.		
TOTAL LECTURE HOURS:		**30 HOURS**

TEXT BOOK(S)

1.	Anubha Kaushik and C. P. Kaushik's "Perspectives in Environmental Studies", 6th Edition, New Age International Publishers ,2018.
2	Benny Joseph, 'Environmental Science and Engineering', Tata McGraw-Hill, New Delhi, 2006
3	Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd edition, Pearson Education, 2004.

REFERENCE BOOKS

1	Dharmendra S. Sengar, 'Environmental law', Prentice hall of India PVT LTD,New Delhi,2007.
2.	Erach Bharucha, "Textbook of Environmental Studies", Universities Press(I) PVT, LTD, Hydrabad, 2015

Course Code	Course Title	L	T	P	J	C
22RAP405	MANUFACTURING TECHNOLOGY LABORATORY	0	0	4	0	2
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

6. To Selecting appropriate tools, equipment's and machines to complete a given job.
7. To Performing various welding process using GMAW and fabricating gears using gear making machines.
8. To Performing various machining process such as rolling, drawing, turning, shaping, drilling, milling and analyzing the defects in the cast and machined components.

COURSE OUTCOME:

After completing this course, the students will be able to

- Demonstrate the safety precautions exercised in the mechanical workshop and join two metals using GMAW.
- The students able to make the work piece as per given shape and size using machining process such as rolling, drawing, turning, shaping, drilling and milling.
- The students become make the gears using gear making machines and analyze the defects in the cast and machined components

LIST OF EXPERIMENTS:

1. Fabricating simple structural shapes using Gas Metal Arc Welding machine.
2. Preparing green sand moulds with cast patterns.
3. Taper Turning and Eccentric Turning on circular parts using lathe machine.
4. Knurling, external and internal thread cutting on circular parts using lathe machine.
5. Shaping – Square and Hexagonal Heads on circular parts using shaper machine.
6. Drilling and Reaming using vertical drilling machine.
7. Milling contours on plates using vertical milling machine.
8. Cutting spur and helical gear using milling machine.
9. Generating gears using gear hobbing machine.
10. Generating gears using gear shaping machine.
11. Grinding components using cylindrical and centerless grinding machine.
12. Grinding components using surface grinding machine.
13. Cutting force calculation using dynamometer in milling machine
14. Cutting force calculation using dynamometer in lathe machine

TOTAL LECTURE HOURS:	60 HOURS

Course Code	Course Title	L	T	P	J	C
22RAP406	SENSORS AND INSTRUMENTATION LABORATORY	0	0	4	0	2
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. To learn about various force, pressure and vibration measuring sensors.
2. To learn about various Temperature, light and magnetic field measuring sensors
3. To learn about various displacement and speed measuring sensors.

COURSE OUTCOME:

Upon the completion of this course, the students will be able to;

- CO1: Demonstrate the various contact and non-contact sensors.
- CO2: Analyze and Identify appropriate sensors for given applications.
- CO3: Create a sensor system for given requirements.

LIST OF EXPERIMENTS:

1. Load, Torque and Force using Strain Gauge – 3 Nos
2. Pressure Sensor and Piezoelectric Force Sensor- 1 No's
3. LVDT setup – 1 No.
4. Temperature Sensors measurement setup with RTD, Thermocouple and Thermistor -1 No.
5. Measurement setup Optical Sensors LDR, Photo transistor, photo diode – 1 each
6. Measurement setup -Ultrasonic and Laser Sensor- 1 No.
7. Gyroscope measurement setup - 1 No.
8. Accelerometer measurement setup - 1 No.
9. Magnetometer measurement setup -1 No.
10. Absolute Encoders and Incremental encoder with DSO/ single board computer- 1 no
11. DAQ with sensor or transducer -1 set
12. 3 axis force sensor – 1 No. 13. Tactile Sensor – 1No.

TOTAL LECTURE HOURS:	60 HOURS

Course Code	Course Title	L	T	P	J	C
22EEP401	QUANTITATIVE APTITUDE AND LOGICAL REASONING -1	0	0	2	0	1
Pre-requisite		Syllabus version			v. 1.0	

COURSE OBJECTIVES:

1. This module would train the students on the quick ways to solve quantitative aptitude problems

and questions applying logical reasoning, within a short time span given during the placement drives.

COURSE OUTCOME:

Upon the completion of this course, the students will be able to;

- CO1: Demonstrate the various Mock interviews on one-on-one basis.
- CO2: Analyze and Identify Quantitative aptitude.
- CO3: Analyze and Identify Logical Reasoning.

LIST OF EXPERIMENTS:

1. Mock interviews on one-on-one basis
2. Quantitative aptitude
3. Partnership
4. Simple Interest, Compound Interest
5. Profit and Loss
6. Problems on Clock, Calendar and Cubes
7. Permutation and Combination
8. Allegation and mixtures
9. Logical Reasoning
10. Letter and Symbol series
11. Number series
12. Analyzing arguments
13. Making judgments

Total Lecture hours:	**30 hours**