MUTHAYAMMAL ENGINEERING COLLEGE

(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC, NBA & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu.

B.E-Department of Robotics and Automation

Curriculum/Syllabus

Regulation-2019

MUTHAYAMMAL ENGINEERING COLLEGE

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(Approved by AICTE, Accredited by NAAC & NBA, Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dt, Tamil Nadu.

Ph. No.: 04287-220837

Email: principal@mec.edu.in.

Programme Code & Name: RA & B.E-Robotics and Automation

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(An Autonomous Institution)

(Approved by AICTE, New Delhi, Accredited by NAAC & Affiliated to Anna University)

Rasipuram - 637 408, Namakkal Dist., Tamil Nadu

Estd. 2000

DEPARTMENT OF ROBOTICS AND AUTOMATION

GROUPING OF COURSES

HUMANITIES AND SOCIAL SCIENCES COURSES (HS)

S.No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1	19HSS01	Business English	HS	3	2	0	0	2
2	19HSS02	English Communicative Skills Laboratory	HS	2	0	0	2	1
3	19HSS03	Life Skills and Workplace Psychology	HS	3	2	0	0	2
4	19HSS04	Technical English For Engineers	HS	3	2	0	0	2
5	19HSS05	Communicative English for Engineers	HS	3	2	0	0	2
6	19HSS06	Basics of Japanese Language	HS	3	2	0	0	2
7	19HSS07	Basics of French Language	HS	3	2	0	0	2

BASIC SCIENCES COURSES (BS)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	19BSS01	Engineering Physics	BS	4	3	0	0	3
2.	19BSS02	Physics and Chemistry Laboratory	BS	2	0	0	2	1
3.	19BSS03	Bio and Nanomaterials Sciences	BS	4	3	0	0	3
4.	19BSS04	Material Sciences	BS	4	3	0	0	3
5.	19BSS05	Physics for Mechanical Engineers	BS	4	3	0	0	3
6.	19BSS11	Engineering Chemistry	BS	4	3	0	0	3
7.	19BSS12	Environmental Science and Engineering	BS	4	3	0	0	3
8.	19BSS13	Organic Chemistry	BS	4	3	0	0	3
9.	19BSS14	Physical Chemistry	BS	4	3	0	0	3
10.	19BSS15	Applied Chemistry	BS	4	3	0	0	3
11.	19BSS16	Organic Chemistry Laboratory	BS	3	0	0	3	1
12.	19BSS17	Physical Chemistry Laboratory	BS	3	0	0	3	1
13.	19BSS21	Algebra and Calculus	BS	5	3	1	0	4
14.	19BSS22	Differential Equations and Vector Analysis	BS	5	3	1	0	4
15.	19BSS23	Transform and Partial Differential Equations	BS	5	3	1	0	4
16.	19BSS24	Discrete Mathematics	BS	5	3	1	0	4

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17.	19BSS25	Statistical and Queuing Model	BS	5	3	1	0	4
18.	19BSS26	Numerical Methods	BS	5	3	1	0	4
19.	19BSS27	Probability and Random Processes	BS	5	3	1	0	4
20.	19BSS28	Statistic and Numerical Methods	BS	5	3	1	0	4

GENERAL ENGINEERING SCIENCE COURSES (GES)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	19GES01	Programming for Problem Solving Using C	GES	3	3	0	0	3
2.	19GES02	Programming for Problem Solving Technique	GES	3	3	0	0	3
3.	19GES03	Programming in C Laboratory	GES	3	0	0	3	1
4.	19GES04	Programming in C and Python Laboratory	GES	3	0	0	3	1
5.	19GES05	Electrical and Electronic Sciences	GES	3	3	0	0	3
6.	19GES06	Mechanical and Building Sciences	GES	3	3	0	0	3
7.	19GES07	Computer Aided Drafting Laboratory	GES	3	0	0	3	1
8.	19GES08	Python Programming	GES	3	3	0	0	3
9.	19GES09	Programming in Python Laboratory	GES	3	0	0	3	1
10.	19GES10	Soft Skills Laboratory	GES	3	0	0	3	1
11.	19GES11	Electronic Devices	GES	3	3	0	0	3
12.	19GES12	Electronic Simulation Laboratory	GES	3	0	0	3	1
13.	19GES13	Electric Circuits	GES	3	2	1	0	3
14.	19GES14	Electric Circuits Laboratory	GES	3	0	0	3	1
15.	19GES15	Manufacturing Process	GES	3	3	0	0	3
16.	19GES16	Manufacturing Process Laboratory	GES	3	0	0	3	1
17.	19GES17	Mechanical and Building Sciences Laboratory	GES	3	0	0	3	1
18.	19GES18	Construction Materials	GES	3	3	0	0	3
19.	19GES19	Concepts in Product Design	GES	3	3	0	0	3
20.	19GES20	Renewable Energy Sources	GES	3	3	0	0	3

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21.	19GES21	Electrical Drives and Control	GES	3	3	0	0	3
22.	19GES22	Electrical Drives and Control Laboratory	GES	3	0	0	3	1
23.	19GES23	Analog and digital communication	GES	3	3	0	0	3
24.	19GES24	Digital Principles and System Design	GES	3	3	0	0	3
25.	19GES25	Digital Principles and System Design Laboratory	GES	3	0	0	3	1
26.	19GES26	Engineering Drawing	GES	4	1	0	3	3
27.	19GES27	Engineering Geology	GES	3	3	0	0	3
28.	19GES28	Engineering Mechanics	GES	4	3	1	0	3

PROFESSIONAL CORE (PC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	19RAC01	Applied hydraulics and pneumatics	PC	3	3	0	0	3
2.	19RAC02	Fluid Mechanics and Machinery	PC	4	2	2	0	3
3.	19RAC03	Manufacturing Technology	PC	3	3	0	0	3
4.	19RAC04	Digital Electronics	PC	3	3	0	0	3
5.	19RAC05	Fluid mechanics and Machinery Laboratory	PC	2	0	0	2	1
6.	19RAC06	Manufacturing Technology Laboratory	PC	2	0	0	2	1
7.	19RAC07	Digital Electronics Laboratory	PC	2	0	0	2	1
8.	19RAC08	Control System Engineering	PC	3	3	0	0	3
9.	19RAC09	Strength of Materials	PC	4	2	2	0	3
10.	19RAC10	Metrology and Measurements	PC	3	3	0	0	3
11.	19RAC11	Computer Aided Design and Manufacturing	PC	3	3	0	0	3
12.	19RAC12	Microprocessors and Applications	PC	3	3	0	0	3
13.	19RAC13	Strength of Materials Laboratory	PC	2	0	0	2	1
14.	19RAC14	Microcontroller Laboratory	PC	2	0	0	2	1
15.	19RAC15	Assembly Drawing and Modeling Laboratory	PC	2	0	0	2	1

16.	19RAC16	Dynamics of Machines	PC	4	2	2	0	3
17.	19RAC17	Power Electronics	PC	3	3	0	0	3
18.	19RAC18	Design of Machine Elements	PC	4	2	2	0	3
19.	19RAC19	Principles of Robotics	PC	3	3	0	0	3
20.	19RAC20	Robotics and Machine Vision System	PC	3	3	0	0	3
21.	19RAC21	Dynamics of Machines Laboratory	PC	2	0	0	2	1
22.	19RAC22	Power Electronics Laboratory	PC	2	0	0	2	1
23.	19RAC23	Micro Controller and PLC	PC	3	3	0	0	3
24.	19RAC24	Sensors and Signal Processing	PC	3	3	0	0	3
25.	19RAC25	Automation System Design	PC	3	3	0	0	3
26.	19RAC26	Sensors and Signal Processing Laboratory	PC	2	0	0	2	1
27.	19RAC27	Field and Service Robotics	PC	2	3	0	0	3

PROFESSIONAL ELECTIVES (PE)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	19RAE01	Advanced Machining Processes	PE	3	3	0	0	3
2.	19RAE02	Total Quality Management	PE	3	3	0	0	3
3.	19RAE02	Principles of Management	PE	3	3	0	0	3
4.	19RAE04	Automotive Electronics	PE	3	3	0	0	3
5.	19RAE05	Advanced Microprocessors and Microcontrollers	PE	3	3	0	0	3
6.	19RAE06	System Software	PE	3	3	0	0	3
7.	19RAE07	Automobile Engineering	PE	3	3	0	0	3
8.	19RAE08	Intellectual Property Rights	PE	3	3	0	0	3
9.	19RAE09	Design of Pressure Vessel and Piping	PE	3	3	0	0	3
10.	19RAE10	Lean Manufacturing	PE	3	3	0	0	3

11.	19RAE11	Industrial Design and Applied Ergonomics	PE	3	3	0	0	3
12.	19RAE12	Process Planning and Cost Estimation	PE	3	3	0	0	3
13.	19RAE13	Operations Research	PE	3	3	0	0	3
14.	19RAE14	VLSI Design	PE	3	3	0	0	3
15.	19RAE15	Virtual instrumentation	PE	3	3	0	0	3
16.	19RAE16	Artificial Intelligence for Robotics	PE	3	3	0	0	3
17.	19RAE17	Special Machines and Controllers	PE	3	3	0	0	3
18.	19RAE18	Advanced Control Systems	PE	3	3	0	0	3
19.	19RAE19	Foundation Skills in Integrated Product Development	PE	3	3	0	0	3
20.	19RAE20	Maintenance and Safety Engineering	PE	3	3	0	0	3

EMPLOYABILITY ENHANCEMENT COURSES (EEC)

S. No.	Course Code	Course Title	Category	Contact Hours	Instruction Hours/Week			C
					L	T	P	
1.	19RAS01	Project work Phase –I	EEC	6	0	0	6	3
2.	19RAS02	Project work Phase -II	EEC	20	0	0	20	10
3.	19RAS03	Value Added Course /Internship	EEC	2	0	0	2	1
4.	19RAS04	Inter Disciplinary Project	EEC	3	0	0	3	1
5.	19RAS05	Constitution of India and professional Ethics	EEC	3	3	0	0	0
6.	19RAS06	Essence of Indian Traditional Knowledge	EEC	3	3	0	0	0

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Programme Code & Name: RA & B.E-Robotics and Automation

COURSE COMPONENT SUMMARY

Sl. No.	Subject Area	Credits per Semester								Credits Total	AICTE Credits
		I	II	III	IV	V	VI	VII	VIII		
1.	HS	3	2	-	-	-	-	-	-	5	12
2.	BS	10	11	4	4	-	-	-	-	29	24
3.	GES	9	7	3	-	-	-	-	-	19	27
4.	PC	-	-	15	18	17	10	3	-	63	58
5.	PE	-	-	-	-	-	3	9	6	18	18
6.	OE	-	-	-	-	3	6	3	3	15	09
7.	EEC	-	-	-	-	-	1	3	10	14	15
Total		22	20	22	22	20	20	18	19	163	163

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Department of Mechatronics
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Programme Code & Name: RA & B.E-Robotics and Automation

	MUTHAYAMMAL ENGINEERING COLLEGE (An Autonomous Institution) (Approved by AICTE & Affiliated to Anna University), RASIPURAM – 637 408	CURRICULUM UG R - 2019

Department	Robotics and Automation	Total Credit: 163
Programme	B. E	

SEMESTER - I

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	19HSS01	Business English	2	0	0	2	2
2.	19BSS21	Algebra & Calculus	3	1	0	4	4
3.	19BSS01	Engineering Physics	3	0	0	3	3
4.	19BSS11	Engineering Chemistry	3	0	0	3	3
5.	19GES02	Programming for Problem Solving Techniques	3	0	0	3	3
6.	19GES05	Electrical and Electronics Sciences	3	0	0	3	3
PRACTICAL							
7	19GES07	Computer Aided Drafting Laboratory	0	0	4	2	4
8	19GES04	Programming in C & Python Laboratory	0	0	3	1	3
9	19HSS02	English Communicative Skills Laboratory	0	0	3	1	3
		Total Credits				**22**	**28**

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Department	Robotics and Automation
Programme	B.E.

SEMESTER - II

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
1.	19HSS03	Life Skill Psychology and Ethics	2	0	0	2	2
2.	19BSS22	Differential Equations and Vector Analysis	3	2	0	4	5
3.	19BSS03	Bio and Nano Material Sciences	3	0	0	3	3
4.	19BSS12	Environmental Science and Engineering	3	0	0	3	3
5.	19GES19	Concepts in Product Design	3	0	0	3	3
6.	19GES15	Manufacturing Processes	3	0	0	3	3
PRACTICAL							
7	19BSS02	Physics and Chemistry Laboratory	0	0	2	1	2
8	19GES16	Manufacturing Processes Laboratory	0	0	3	1	3
		Total Credits				**20**	**24**

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Department	Robotics and Automation
Programme	B.E.

SEMESTER – III

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	19BSS23	Transform and Partial Differential Equations	3	1	0	4	4
2.	19RAC01	Applied hydraulics and pneumatics	3	0	0	3	3
3.	19GES21	Electrical Drives and Control	3	0	0	3	3
4.	19RAC02	Fluid Mechanics and Machinery	2	2	0	3	4
5.	19RAC03	Manufacturing Technology	3	0	0	3	3
6.	19RAC04	Digital Electronics	3	0	0	3	3
PRACTICAL							
7	19RAC05	Fluid mechanics and Machinery Laboratory	0	0	2	1	2
8	19RAC06	Manufacturing Technology Laboratory	0	0	2	1	2
9	19RAC07	Digital Electronics Laboratory	0	0	2	1	2
		Total Credits				**22**	**26**

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Department	Robotics and Automation
Programme	B.E.

SEMESTER - IV

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
1.	19BSS28	Statistics and Numerical Methods	3	1	0	4	4
2.	19RAC08	Control System Engineering	3	0	0	3	3
3.	19RAC09	Strength of Materials	2	2	0	3	4
4.	19RAC10	Metrology and Measurements	3	0	0	3	3
5.	19RAC11	Computer Aided Design and Manufacturing	3	0	0	3	3
6.	19RAC12	Microprocessors and Applications	3	0	0	3	3
PRACTICAL							
7	19RAC13	Strength of Materials Laboratory	0	0	2	1	2
8	19RAC14	Microcontroller Laboratory	0	0	2	1	2
9	19RAC15	Assembly Drawing and Modeling Laboratory	0	0	2	1	2
		Total Credits				**22**	**26**

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SEMESTER - V

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
1.	19RAC16	Dynamics of Machines	2	2	0	3	4
2.	19RAC17	Power Electronics	3	0	0	3	3
3.	19RAC18	Design of Machine Elements	2	2	0	3	4
4.	**19RAC19**	Principles of Robotics	3	0	0	3	3
5.	**19RAC20**	Robotics and Machine Vision System	3	0	0	3	3
6.	21RAE**	OPEN ELECTIVE-I	3	0	0	3	3
PRACTICAL							
7.	19RAC21	Dynamics of Machines Laboratory	0	0	2	1	2
8.	19RAC22	Power Electronics Laboratory	0	0	2	1	2
		Total Credits				**20**	**24**

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Department	Robotics and Automation
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SEMESTER - VI

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
1.	19RAC23	Micro Controller and PLC	3	0	0	3	3
2.	19RAC24	Sensors and Signal Processing	3	0	0	3	3
3.	**19RAC25**	Automation System Design	3	0	0	3	3
4.	19RAE**	PROFESSIONAL ELECTIVE -I	3	0	0	3	3
5.	19*****	OPEN ELECTIVE-II	3	0	0	3	3
6.	19*****	OPEN ELECTIVE-III	3	0	0	3	3
PRACTICAL							
6	19RAC26	Sensors and Signal Processing Laboratory	0	0	2	1	2
7	19RAS04	Interdisciplinary Project	0	0	3	1	3
		Total Credits				**20**	**23**

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Department	Robotics and Automation
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SEMESTER - VII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
THEORY							
1.	19RAS06	Essence of Indian Traditional Knowledge	3	3	0	0	6
2.	**19RAC27**	Field and Service Robotics	3	0	0	3	3
3.	19RAE**	PROFESSIONAL ELECTIVE -II	3	0	0	3	3
4.	19RAE**	PROFESSIONAL ELECTIVE -III	3	0	0	3	3
5.	19RAE**	PROFESSIONAL ELECTIVE -IV	3	0	0	3	3
6	19*****	OPEN ELECTIVE-IV	3	0	0	3	3
PRACTICAL							
6	19RAS01	Project work Phase –I	0	0	6	3	6
					Total Credits	**18**	**27**

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Department	Robotics and Automation
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SEMESTER - VIII

Sl. No.	Course Code	Course Name	Hours/ Week			Credit	Contact Hours
			L	T	P	C	
1.	19RAS05	Constitution of India and Professional Ethics	3	0	0	0	3
2.	19RAE**	PROFESSIONAL ELECTIVE -V	3	0	0	3	3
3.	19RAE**	PROFESSIONAL ELECTIVE -VI	3	0	0	3	3
4.	19*****	OPEN ELECTIVE-V	3	0	0	3	3
PRACTICAL							
5.	19RAS02	Project work Phase -II	0	0	20	10	20
					Total Credits	**19**	**32**

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Programme Code & Name: RA & B.E-Robotics and Automation

19HSS01	BUSINESS ENGLISH	L T P C 2 0 0 2

COURSE OBJECTIVES

- To make effective communication in business situations.
- To use English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To inculcate the effective email writing skills for better business communication.
- To ensure that learners to understand the fundamentals of Business writing and interviews.
- To prepare for and participate in presentations on business topics.

COURSE OUTCOMES

- Employ strategies to be a successful employee or employer in the workplace.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Able to use electronic technology in business communication
- Understanding of lectures, talks and interviews on business topics delivered by authentic business specialists
- Use the phrases and sentences clearly in their written communication

UNIT I COMMUNICATION AND BUSINESS ENGLISH 6

Communication meaning – Objectives – Importance – Process of Communication – Barriers to communication – Effective Communication - Make up sentences- the text about business- Business Operations- conversation - giving sentences unity-arranging sentences for clarity- Accent on positive Language - Coherence- Transitional words

UNIT II GRAMMAR & VOCABULARY 6

Phrases & Clauses- Kinds of Sentences - Types of sentences and sentence patterns – GRE Vocabulary – Prefix & Suffix - Synonyms - Antonyms - Word Formation- Error Spotting- Sentence Correction- Word Analogy- Idioms and Phrases- Direct and Indirect Speech- 'If' Conditionals

UNIT III WRITING CV AND LETTER OF APPLICATION 6

Writing for communicative purposes [Letters – official and personal , Messages / Notices, Reports , Emails, Advertisements , Structure of the Sales Letter- Letter of Authorization- Letter of Recommendation.-Application for a job (covering letter and CV) - Creative Writing (Stories, Poems, Dialogues)

UNIT IV JOB INTERVIEWS AND RECRUITMENT 6

Job Interviewing- appearance and body language - Attending interviews -Public Speaking and Oral Reporting- Overcome Nervousness- Making Formal Speech-Use of Voice- Using Telephone -Use of Visual Aids- Interviewing People-Recruitment - Asking for Information- Asking for Action- Orders-Inquiries about people-claims –Refusing Request- Adjustment Refusals- Credit Refusal- Text Types - Academic Writing [Paragraphs , Essays]

UNIT V PRESENTATION AND GRAMMAR USAGE 6

Presentation – Types and Importance of Presentation – Standards of Punctuation – Apostrophe, Brackets, Colon, Comma etc…Standards for Grammar- Adjective-Adverb Confusion, Subject-Verb Agreement, Dangling Modifier, Parallelism.

TOTAL HOURS:30 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Lesikar, Bamford	Basic Business Communication"	1st Canadian Edition (IRWIN DORSEY), Von Hoffmann Press,	1993
2.	Simon Sweeney	English For Business	Cambridge University Press	2008

REFERENCE BOOKS:

SL.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mindscapes	English For Technologists and Engineers	Department of English, Anna University, Chennai,	2012
2.	Rutherford, Andrea.	J Basic Communication Skills for Technology.	Pearson New Delhi.	2001
3.	Viswamohan, Aysha.	English for Technical Communication	Tata McGraw-Hill, New Delhi.	2008
4.	Aspinall Tricia, Bethell George.	Test your Business Vocabulary in Use.	Cambridge University Press	2003
5.	Cambridge ESOL.	BEC 1, 3.	Cambridge University Press,	2001

19HSS02 ENGLISH COMMUNICATIVE SKILLS LABORATORY L T P C

0 0 2 1

COURSE OBJECTIVES

- To instill the basic communication concepts to enhance students' communication skills through various lab sessions.
- To understand the importance of listening and speaking in language acquisition process
- To speak English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To help students develop the ability to communicate effectively in spoken English and develop their soft skills and interpersonal skills.
- To increase employability by developing students' communication skills in English.

COURSE OUTCOMES

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- Listen/view and comprehend different spoken discourses/excerpts in different accents

- Communicate with others confidently

UNIT I FORMAL & INFORMAL CONVERSATION PRACTICE

Role Play conversations - with family members, neighbours, friends, relatives etc. Simple expressions - agreeing / disagreeing, persuading, wishing, consoling, advising, arguing, expressing opinions etc.- Professional dialogues with superiors - Conversation with different professionals in government and corporate Offices, Official Meetings, educational Institutions, (At the railway junction, malls, post office, bank) etc- every day usage of English

UNIT II ORAL REVIEW, RADIO SHOW & NARRATIVE TECHNIQUES

Oral review of books - Presentation of various radio programs like news, announcements, advertisements, entertainment programs etc. as a team activity. Understanding the basic narrative techniques - Narrating short stories. Narrating real life experiences, Oral interpretation of charts, tables, graphs.

UNIT III RESUME / LETTER WRITING

Preparation of resume - structure – Types of resume – writing the vision statement – Objectives – Types of Letter – Job Application – accepting / declining a Job offer.

UNIT IV PRESENTATION SKILLS & GROUP DISCUSSION

Elements of effective presentation – Structure of a presentation – Speech acts - effective use to presentation tools - Audience analysis – Preparing the PPT slides - Video samples- Importance of GD – in the selection process - Structure of a GD – Moderator – led and other GDs - Strategies in GD – Team work - Body Language - Mock GD -Video samples

UNIT V INTERVIEW SKILLS

Kinds of interviews – one to one, group interview, telephone interview, online interview, stress interview - Required Skills – Corporate culture – Mock interviews-Video samples.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sobana.S, Manivannan.R and Immanuel. G,	Communication and Soft Skills	VK Publications, Sivakasi.	2016

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Anderson, P.V.	Technical Communication	Thomson Edition, New Delhi	2007
2.	Rizvi, Ashraf. M	Effective Technical Communication	Tata McGraw-Hill, New Delhi	2005
3.	Dutt, Kiranmai P and Geetha Rajeevan	Basic Communication Skills .	Foundation Books, New Delhi.	2007

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Programme Code & Name: RA & B.E-Robotics and Automation

19HSS03	LIFE SKILLS AND WORKPLACE PSYCHOLOGY	L	T	P	C
		2	0	0	2

COURSE OBJECTIVES:

- To inculcate critical thinking process and to prepare them on problem solving skills.
- To enable learners to perform in a team.
- To learn leadership qualities and practice them.
- To make the learners to use grammar error free sentences.
- To introduce the essentials of psychology at workplace and gain insights about work place behavior

COURSE OUTCOMES:

- Able to think critically on a particular problem.
- Able to do good performance in a team.
- Able to become an effective leader.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Students will be able to classify and utilize their knowledge In Psychology in the process of employment

UNIT I CRITICAL THINKING & PROBLEM SOLVING 6

Creativity, Lateral thinking, Critical thinking, Multiple Intelligence, Problem Solving, Six thinking hats Mind Mapping & Analytical Thinking.

UNIT II TEAMWORK 6

Groups, Teams, Group Vs Teams, Team formation process, Stages of Group, Group Dynamics, Managing Team Performance & Team Conflicts.

UNIT III LEADERSHIP SKILLS 6

Leadership, Levels of Leadership, Making of a leader, Types of leadership, Professional Etiquette – Prevention of Sexual Violence and Misconduct on Campus.

UNIT IV GRAMMAR & VOCABULARY 6

Single Word substitutes – verb patterns- use of dialogue writing - tenses – voices – use of conditionals – comparative Adjectives (affirmative and negative) – expanding– nominal compounds – articles – use of prepositions - phrasal verbs – British and American vocabulary – error detection – abbreviations and acronyms - Instruction - Recommendation.

UNIT V WORKPLACE PSYCHOLOGY 6

Nature and Development of Industrial/Work Psychology - Employee Selection Techniques, Fair Employment Practices Recruitment- Biographical Information, Interviews, References & Letters of Recommendation Job Analysis- Types, Newer Developments.

TOTAL HOURS: 30 Hours

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Matthewman, L., Rose, A. & Hetherington, A	Work Psychology	Oxford University Press, India.	2009
2.	Dr.K.Ravikanth Roa , Dr. P. Dhinakar	Life skills Education	Neel Kamal	2016

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Larry James	The First Book of Life Skills	First Edition; Embassy Books	2016
2.	Shalini Verma	Development of Life Skills and Professional Practice	First Edition; Sultan Chand (G/L) & Company	2014
3.	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
4.	Landy, F. J. & Conte, J. M	Work in the 21st Century: An Introduction to Industrial and Organizational Psychology.	Wiley India: New Delhi: 2nd Edition.	2010
5.	Schultz, D. & Schultz, S. E.	Psychology and Work Today	Pearson Education : New Delhi.	2002

19HSS04 **TECHNICAL ENGLISH FOR ENGINEERS** **L T P C**
2 0 0 2

COURSE OBJECTIVES

- To enable learners of Engineering and Technology develop their basic communication skills in English.
- To emphasize specially the development of speaking skills amongst learners of Engineering and Technology.
- To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
- To inculcate the habit of reading and writing leading to effective and efficient communication.
- To make the learners to use the phrase and clauses error free.

COURSE OUTCOMES

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents

- use the phrases and sentences clearly in their written communication

UNIT I GRAMMAR & VOCABULARY 6

Word formation with prefixes and suffixes – synonyms and antonyms – verb patterns – tenses – voices – use of conditionals – comparative adjectives (affirmative and negative) – expanding– nominal compounds – articles – use of prepositions - phrasal verbs – British and American vocabulary.

UNIT II LISTENING 6

Extensive listening – listening for general content – listening to fill up gapped texts – intensive listening – listening for specific information: retrieval of factual information – listening to identify topic, context, function, speaker's opinion, attitude, etc. – global understanding skills and ability to infer, extract gist and understand main ideas

UNIT III SPEAKING 6

Verbal and non verbal communication – speech sounds – syllables – word stress (structures and content words) – sentences stress – intonation – pronunciation drills, tongue twisters –developing confidence – introducing oneself – asking for or eliciting objects — giving instructions

UNIT IV READING 6

Exposure to different reading techniques – reading for gist and global meaning – predicting the content – text – identifying the topic sentence and its role in each paragraph – scanning – inferring / identifying lexical and contextual meanings – transfer of information / guided note-making – understanding discourse coherence – sequencing of sentences – cloze reading.

UNIT V WRITING 6

Introductions to the characteristics of technical style – writing definitions and descriptions – paragraph writing (topic sentence and its role, unity, coherence and use of cohesive expressions) – process description (use of sequencing connectives) – comparison and contrast – formal letter writing (letter to the editor, letter for seeking practical training, and letter for undertaking project works in industries)

TOTAL HOURS: 30 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice. Oxford University Press,	Oxford University Press, New Delhi.	2011
2	Rizvi, Ashraf. M.	Effective Technical Communication.	Tata McGraw-Hill, New Delhi.	2005

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication

1.	Regional Institute of English	English for Engineers.	Cambridge University Press, New Delhi.	2006
2	Mindscapes	English For Technologists and Engineers	Department of English, Anna University, Chennai,	2012
3	Rutherford, Andrea.	J Basic Communication Skills for Technology	Pearson, New Delhi.	2001
4	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill, New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice. Oxford University	Press, New Delhi.	2011

19HSS05 COMMUNICATIVE ENGLISH FOR ENGINEERS L T P C
2 0 0 2

COURSE OBJECTIVES

- To understand the importance of listening and speaking in language acquisition process
- To engage in conversation intelligibly
- To use English accurately, appropriately and fluently in different situations (academic, social and professional) and familiarize themselves with all speech sounds in English
- To write academic, communicative and creative pieces of writing
- To devise different tasks / methods to enhance their learners' communication skills

COURSE OUTCOMES

- Speak clearly, confidently, comprehensibly, and communicate with one or many listeners using appropriate communicative strategies.
- Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide vocabulary range, organizing their ideas logically on a topic.
- Read different genres of texts adopting various reading strategies.
- listen/view and comprehend different spoken discourses/excerpts in different accents
- Communicate with others confidently

UNIT I GRAMMAR & VOCABULARY **6**

Phrases & Clauses- Kinds of Sentences - Types of sentences and sentence patterns – GRE Vocabulary - Word Formation- Error Spotting- Sentence Correction- Word Analogy- Idioms and Phrases- Direct and Indirect Speech- 'If' Conditionals

UNIT II LISTENING **6**

Listening processes: top-down and bottom-up skills - Listening strategies - Sounds of English: Consonants, vowels and diphthongs - Phonemic transcription, tongue twisters, words often mispronounced - Word stress and sentence stress: content words, structural words, strong forms, weak forms - Intonation patterns - Language functions : [Inviting-accepting/declining invitation - Offering /accepting/ refusing help - Thanking/ responding to thanks - Congratulating , Complimenting - Apologizing/ accepting an apology

UNIT III SPEAKING **6**

Greeting - Introducing Oneself -Invitation - Making Request - Expressing Gratitude - Complimenting and Congratulating - Expressing Sympathy - Apologizing - Asking for Information - Seeking Permission - Complaining and Expressing Regret - Using English in Real Life Situation [At the

Bank/ post office/ College office - At the Green Grocer - At the Temple - At the College Canteen or Restaurant - At the Police station - At the Railway Station/ Bus Station - At the Medical Shop - At the Library

UNIT IV READING **6**

Importance of Reading - Why develop reading habits among students and How - Reading techniques [Skimming , Scanning , Intensive reading , Extensive] Reading different text types [Menu ,Email , Letters , Cartoons , Advertisements, Recipe , Articles , Literary texts – stories, plays, poems, Biographies] – identifying lexical and Contextual meaning- Understanding Discourse Coherence – sequencing of sentences

UNIT V WRITING **6**

Developing Proficiency in Writing - Writing for communicative purposes [Letters – official and personal , Messages / Notices, Reports , Emails , Advertisements ,Application for a job (covering letter and CV) - Creative Writing (Stories, Poems , Dialogues)

TOTAL HOURS: 30

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press, New Delhi.	2011
2	Rizvi, Ashraf. M	Effective Technical Communication.	Tata McGraw-Hill New Delhi.	2005

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Regional Institute of English	English for Engineers. Cambridge University Press	New Delhi.	2006.
2	Dr.Gunasekaran, Vishu "	Technical English Work Book.	Vishnu "Print Media, Krishna Publications	2011
3	Rutherford, Andrea.	J Basic Communication Skills for Technology.	Pearson, New Delhi.	2001
4	Viswamohan, Aysha.	English for Technical Communication.	Tata McGraw-Hill. New Delhi.	2008
5	Raman, Meenakshi & Sangeetha Sharma.	Technical Communication: Principles and Practice.	Oxford University Press, New Delhi	2011

Programme Code & Name: RA & B.E-Robotics and Automation

19HSS06 **BASICS OF JAPANESE LANGUAGE** **L T P C**
2 0 0 2

COURSE OBJECTIVES:

- To develop the reading skill of the students and to familiarize them with Japanese language.
- To instill the communication concepts and enhance the students' conversational skill through various practice sessions.
- To familiarize them with a variety of words and pronunciation.
- To develop the receptive skills such as listening, writing, reading and to make the students well-versed in speaking.
- To assist them in improving their vocabulary in Japanese.

COURSE OUTCOMES:

- Learn and write Japanese alphabet.
- Develop their pronunciation skill in Japanese language.
- Enrich the vocabulary in Japanese language.
- Speak in Japanese at various occasions.
- Understand and communicate by constructing sentences.

UNIT I INTRODUCTION OF JAPANESE LANGUAGE **6**

Introduction about Japan - Japanese people - Language and their culture - Importance of Japanese Language Learning - Japanese writing system – Hiragana - Basic Hiragana syllables - Hiragana with Diacritical Marks - Hiragana words and pronunciation – Katakana - Basic Katakana syllables - Katakana with Diacritical Marks –
Katakana words and pronunciation.

UNIT II BASIC WORDS **6**

Japanese Greetings and daily expressions - Culture and Behavior of Japanese People and body language – bowing - Time of the day; calendar; counting using Japanese numerical classifiers.

UNIT III PHRASES & CLAUSES **6**

Grammar - Sentence patterns and examples - Making Sentences – Present, Past and Future, Progressive & Perfect Tense - Time- Asking question for numbers and time - Telephone number practice - Translate English into Japanese practice - Describe each person using given cues – Self-Introduction about students -Time and Age making comparisons; talking of daily activities; giving and receiving; shopping; making requests.

UNIT IV BASIC TENSES **6**

Grammar - Making Sentences – Present, Past and Future, Progressive & Perfect Tenses-verb and its forms- particles - pattern and examples -Adverbs - using frequency adverbs -Sentence making using time and verb with direct object - Translate English sentence to Japanese sentence - Making question sentence and answers.

UNIT - V KEY BELIEFS AND VALUES OF JAPANESE SOCIETY **6**

Japanese social interaction - Harmony – Order - Self-development – the three of the most important values. Basic ideas about self and the nature of human society- several religious and philosophical traditions. **TOTAL HOURS: 30**

TEXT BOOKS:

SL. No	Author(s)	Title of the Book	Publisher	Year of Publication

1.	George Trombley , Yukari Takenaka	Japanese from Zero! 1: Proven Techniques to Learn Japanese for Students and	Volume 1) 6th Edition Bay Foreign Language Books Ltd,	2015
2	Living Language Japanese, Complete Edition	Japanese reading & writing guide, and free online learning Paperback	Unabridged	2012

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Pimsleur	Japanese Level 1 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	3rd edition (Comprehensive)	2002
2	Pimsleur	Japanese Level 2 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur;	Pimsleur; 3 edition	October 1, 2002
3	Pimsleur	Japanese Level 3 CD: Learn to Speak and Understand Japanese with Pimsleur Language Programs Pimsleur	Pimsleur; 3 edition	October 1, 2002
4	Eriko Sato	Practice Makes Perfect Basic Japanese 1st Edition, McGraw-Hill Education	Pimsleur; 1 edition	April 1, 2014
5	Mr Tae K Kim,	A Guide to Japanese Grammar: A Japanese approach to learning Japanese grammar ,	Create Space Independent Publishing Platform	January23, 2014

19HSS07 **BASICS OF FRENCH LANGAUGE**

L T P C

2 0 0 2

COURSE OBJECTIVES

- To develop the reading skill of the students and to familiarize them with French language.
- To instill the communication concepts and enhance the students' conversational skill through various practice sessions.
- To familiarize them with a variety of words and pronunciation.

- To develop the receptive skills such as listening, writing, reading and to make the students well-versed in speaking.
- To assist them in improving their vocabulary in French.

COURSE OUTCOMES

- Learn and write French alphabet.
- Develop their pronunciation skill in French language.
- Enrich the vocabulary in French language.
- Speak in French at various occasions.
- Understand and communicate by constructing sentences.

UNIT I **BASIC GRAMMAR** **6**

Alphabets - Numbers 0-31 - Nouns - Definite articles - Indefinite articles - verbs - Greetings- adjectives - possessive adjectives - countries and nationality - months of the year

UNIT II **BASIC VOCABULARY** **6**

Personality- dresses - colours - interests - adjectives: masculine / feminine - singular / plural - negation - regular verbs

UNIT III **BASIC PHRASES** **6**

Time - days of the week - house - numbers 32-69 - irregular verbs : aller, faire, prendre - negation : ne.... jamais - questions - near future - pronominal verbs - pronoun : 'on'

UNIT IV **SPEAKING** **6**

Name of dishes - shopping - at the restaurant - recipe - numbers: 70 - 1000 - partitive articles: du, de la, de l', des - passé composé and negation - irregular past participles- preposition à + definite article

UNIT V **CULTURE AND SOCIETY** **6**

Town – directions - public transport - preposition à/en + transport - irregular past participles - adverbs

TOTAL HOURS: 30 Hours

TEXTBOOK:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Régine Mérieux and Yves Loiseau.	Connexions 1	Didier	2004
2.	Rosemary Schell	French for Beginners	Maanu Graphics	2013

REFERENCE BOOKS:

Programme Code & Name: RA & B.E-Robotics and Automation

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	R.de Roussy de Sales	French Verbs Drills 5th Edition	McGraw-Hill Education	2017
2.	Annie Heminway	Complete French Grammar	McGraw-Hill Education	2016
3.	David M.Srillman and Ronni L.Gordon	French Vocabulary Drills	McGraw-Hill Education	2014
4.	Frederic Bibard	Fluent in French	Talk in French	2016
5.	Gaelle Graham	Complete French	Teach Yourself	2010

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Programme Code & Name: RA & B.E-Robotics and Automation

19BSS01	ENGINEERING PHYSICS	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES

- To acquire the knowledge in acoustical engineering and ultrasonic
- To enrich the principles involved in laser technology and its applications
- To understand the concept and significance in fiber optics
- To acquire the knowledge on classification and properties of different types of crystal structures
- To understand the concepts in elasticity and transfer of heat energy through materials

COURSE OUTCOMES

- A knowledge of contemporary issues on ultrasonic studies
- An ability to apply knowledge in laser technology for engineering practice
- An ability to solve problems in fiber optics technology
- An ability to analyze the crystal structures by applying crystallographic parameters
- An ability to apply knowledge in elasticity and heat transfer

UNIT I ACOUSTICS AND ULTRASONICS 9

Introduction of acoustics – Classification of sound-Weber-Fechner law- Reverberation – Reverberation time – Factors affecting acoustics of building and its remedy - Absorption coefficient – Measurement of Absorption coefficient. Introduction to ultrasonics– properties - Detection of ultrasonic waves, Magnetostriction effect - Magnetostriction generator – piezoelectric effect - piezoelectric generator– Cavitations - SONAR - Non Destructive Testing – pulse echo system, through transmission and reflection modes.

UNIT II LASERS 9

Introduction – Principle of Spontaneous emission and stimulated emission. Population inversion - pumping methods. Einstein's A and B coefficients – derivation - Types of lasers – He-Ne, Nd-YAG, Semiconductor lasers (homojunction & heterojunction) - Industrial Applications - Lasers in welding, cutting, heat treatment – Medical applications - Holography (construction & reconstruction).

UNIT III FIBRE OPTICS AND ITS APPLICATIONS 9

Principle and propagation of light in optical fibers – Numerical aperture and Acceptance angle - Classification based on materials, refractive index profile – Double crucible technique of fiber drawing – Splicing - Loss in optical fiber – attenuation, dispersion, bending - Fibre optical communication system (Block diagram) – Fiber optic Light sources - Detectors - Endoscope.

UNIT IV - CRYSTAL PHYSICS 9

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius –Coordination number – Packing factor for SC, BCC, FCC and HCP structures –Crystal defects – point, line and surface defects- Burger vector.

UNIT V PROPERTIES OF MATTER AND THERMAL PHYSICS 9

Elasticity – Hook's law – Relationship between three modulii of elasticity (Qualitative) – stress and strain diagram – Poisson's ratio – factors affecting elasticity – bending moment – depression of a cantilever – young's modulus by uniform bending – I shaped girders. Modes of heat transfer – thermal conductivity – Newton's law of cooling – linear heat flow – lee's disc method – radial heat flow – rubber tube method – conduction through compound media (series and parallel method)

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar & S.O.Pillai,	Engineering Physics I	New Age International Publishers	2015
2	Rajagopal K	Engineering Physics	PHI, New Delhi	2011

REFERENCE BOOKS:

Sl.No	Author	Title of the Book	Publisher	Year of Publication
1.	Tamilarasan.K &Prabhu.K	Engineering Physics-I	Mc Graw Hill Education	2015
2	Palanisamy P.K	Engineering Physics	SCITECH Publications	2011
3	Senthilkumar G	Engineering Physics I	VRB Publishers	2011
4	Gaur R.K. and Gupta S.L.	Engineering Physics	Dhanpat Rai publishers	2009
5	D.K.Bhattacharya & Poonam Tandon	Engineering Physics	Oxford university Press	2017

19BSS02 PHYSICS AND CHEMISTRY LABORATORY

L	T	P	C
0	0	2	1

COURSE OBJECTIVES

- The students will understand the ultrasonic sounds in liquid medium.
- The students can demonstrate laser and its propagation through optics.
- To understand thermal conductivity of bad conductors.
- The students familiar with characteristics of water and able to estimate hardness and alkalinity of water sample.
- The students will understand the basic concepts condunctometric and pH metric titrations.

COURSE OUTCOMES

- Ability to determine the velocity of ultrasonic sound in any liquid.
- Capable of understanding the concept of laser and its propagation through Optical fiber.
- Ability to determine the thermal conductivity of the bad conductor and determine the modulus of elasticity.
- Able to analyze hardness and alkalinity of water sample.

- Able to estimate the amount of acid by conductometric, potentiometric and pH metric titrations.

LIST OF EXPERIMENTS IN PHYSICS

1. (a) Determination of Wavelength and particle size using Laser, (b) Determination of acceptance angle in an optical fiber.
2. Determination of Velocity of sound and Compressibility of liquid – Ultrasonic Interferometer
3. Determination of Thermal Conductivity of a bad conductor – Lee's Disc method.
4. Determination of Young's Modulus by uniform bending method
5. Determination of Moment of Inertia by rigidity modulus

LIST OF EXPERIMENTS IN CHEMISTRY

1. Determination of hardness of water by EDTA Method
2. Determination of alkalinity in water sample
3. Conductometric titration of HCl vs NaOH
4. Estimation of hydrochloric acid by pH meter
5. Determination of molecular weight of polymer using Oswald Viscometer

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.G.Senthilkumar	Physics Laboratory Manual	VRB Publishers	2017
2.	Dr.P.Mani	Engineering Physics Practical	Dhanm Publictions	2017
3.	R.Veeraswamy, V.Venkateswaran	Basic Principles of Practical Chemistry	Sultan Chand & Sons	2013
4.	P.Meena Sundari	Engineering Chemistry Laboratory Manual	KKS Publishers	2015

19BSS03 BIO AND NANOMATERIALS SCIENCE

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand the classification and properties of materials
- To acquire the knowledge in basics of biomaterials
- To enrich the principles involved in nanotechnology
- To understand the synthesis techniques of nanomaterials
- To educate the basic concepts of carbon nanotubes

COURSE OUTCOMES

- A knowledge on basics of materials
- A knowledge of contemporary issues on bio materials
- An ability to apply knowledge in nanomaterials and its applications
- An ability to solve problems in nanotechnology

- An ability to apply knowledge in carbon nanotubes

Unit- I Introduction to Materials 9

Postulates of Rutherford and Bhor atom model-Bhor Theory of Hydrogen atom- - Classification of atomic bonds-primary and secondary bonds - Classification of Materials: metals-ceramics-composites-types and its general properties-Significance of Phase diagram.

Unit- II Basics of Biomaterials 9

Definition of biomaterials and biocompatibility- classification of biomaterials- shape memory alloys-properties and applications-properties of NiTinol –properties and application of alumina-polymers in biomedical use-schematic diagram and working of heart lung machine-contact lenses.

Unit- III Introduction to Nanotechnology

Definition of Nanoscale system –Theory of Nanotechnology –surface to volume ratio-Classification of nano structures based on dimension: 0D, 1D, 2D, 3D materials – Applications of Nanotechnology

Unit- IV Synthesis Of Nanomaterials Bottom up and top down process, difference between bottom up and top down process, Electro deposition method - Plasma arcing method –Ball milling-Chemical vapour deposition-Pulsed laser deposition method- Lithography-Electron beam lithography -properties of nanomaterials-Applications.

Unit V Carbon Nano Materials

Bonding in carbon structures–Carbon nanotube types - Single walled and multi walled carbon nanotubes-structure and properties – Synthesis of carbon nanotube: arc discharge-chemical vapour deposition method –applications.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Pillai S.O.	Solid State Physics	New Age International(P) Ltd	2009
2	Sujata V. Bhatt	Biomaterials	Second Edition Narosa Publishing House	2005
3	T.Pradeep	TheEssentials:Understanding Nanoscience and Nanotecnology	TataMcGraw-Hill PublishingCompany Limited,NewDelhi,	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James F. Shackelford, Madanapalli K. Muralidhara	Introduction to Materials Science for Engineers	Sixth Edition, Pearson Education Inc.	2007
2	C.M.Agrawal, J.L.Ong, M.R.Appleford ,Gopinath Mani	Introduction to Biomaterials basic theory with Engineering Applications	Cambridge University Press New York	2014
3	B.D. Ratner, A.S. Hoffman F.J. Schoen, J.E. Lemons	Biomaterials Science an Introduction to Materials in Medicine	2nd Edition Elsevier Academic Press, California, USA	2004
4	C.P. Poole and F.J. Owens.	Introduction to Nanotechnology	Wiley, New Delhi	2007
5	M. Meyyappan	Carbon Nanotubes Science & Applications	CRC Pres, Boca Ranton, London, New York, Washington D.C	2005

19BSS04 MATERIAL SCIENCES **L T P C**
3 2 0 4

COURSE OBJECTIVES

- To understand the types of atomic structures in crystalline materials
- To understand the basic concepts in magnetism and superconductivity
- To impart knowledge on conducting and semiconducting materials
- To educate the concept of dielectric materials
- To understand the basic concepts in modern engineering materials

COURSE OUTCOMES

- An ability to identify the types of crystalline structure
- An ability to apply properties on magnetism and superconducting materials
- An ability to apply knowledge on superconducting materials and its applications
- An ability to apply knowledge on dielectric materials
- An ability to use the synthesis techniques in modern materials

UNIT I CRYSTAL PHYSICS **9**

Lattice – Unit cell – Bravais lattice – Lattice planes – Miller indices – d spacing in cubic lattice – Calculation of number of atoms per unit cell – Atomic radius –Coordination number – Packing factor for SC, BCC, FCC and HCP structures – Diamond and Graphite structures (Qualitative) – Crystal growth techniques – Bridgeman technique and Czochralski method.

UNIT II CONDUCTORS AND SEMICONDUCTORS **9**

Classical free electron theory of metals – Electrical and thermal conductivity – Wiedemann-Franz law – Quantum theory - Fermi distribution function – Effect of temperature on Fermi Function – Density of

energy states – carrier concentration in metals.Properties of semiconductors - classification – Elemental and Compound semiconductors – Intrinsic and Extrinsic semiconductors - carrier concentration derivation in intrinsic semiconductors - band gap determination - Hall effect – Determination of Hall coefficient – Experimental method - Applications of Hall Effect.

UNIT III MAGNETIC AND SUPERCONDUCTING MATERIALS 9

Origin of magnetic moment – Types – Dia, para, Ferro, anti ferromagnetic materials – Domain theory – Hysteresis – Soft and hard magnetic materials – Ferrites – preparation, properties and applications.Properties of superconducting materials - BCS theory of superconductivity (Qualitative) - Types of super conductors – High T_c superconductors – Applications of superconductors – SQUID, Cryotron, Magnetic levitation.

UNIT IV DIELECTRIC MATERIALS 9

Basic definitions - Electrical susceptibility – dielectric constant – Types of polarization - electronic, ionic, orientational and space charge polarization – frequency and temperature dependence of polarisation – internal field – Claussius –Mosotti relation (derivation) – dielectric loss – dielectric breakdown – uses of dielectric materials(capacitor and transformer) – ferroelectricity and applications

UNIT V ADVANCED ENGINEERING MATERIALS 9

Metallic glasses: Preparation, properties and applications – metallic glasses as transformer cores.Shape memory alloys (SMA): Types and Characteristics - properties of NiTi alloy- advantages and disadvantages of SMA - applications. Nanomaterials: Synthesis– Eleectro deposition, Plasma arcing - properties of nanoparticles and applications. Carbon nanotubes: Types - Single walled and multi walled nanotubes – Synthesis of carbon nanotube - pulsed laser deposition, chemical vapour deposition – Properties and applications

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Palanisamy P K	Materials Science	Scitech Publishers	2007
2	V Rajendran	Materials Science	Tata McGraw Hill publications	2008

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Arumugam,	Materials Science	Anuradha Publications	2010
2	William Smith	Materials science	Tata McGraw Hill publications	2015
3	Raghavan V	Materials science	Prentice Hall India Ltd.	2007
4	O.P.Kanna	Material Science and Metallurgy	Dhanpat Rai Publications	2012

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5	G.Sudarmozhi	Material Science	Bharathi Publishers	2015

19BSS05 PHYSICS FOR MECHANICAL ENGINEERS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- Define the various moduli of elasticity and explain streamline and turbulent flow of liquid and apply Poiseuille's formula to determine the coefficient of viscosity of a liquid.
- Describe experimental methods to determine thermal conductivity and state the laws of thermodynamics and their applications in the field of Engineering.
- Define and explain electrical and thermal conductivity of conducting materials.
- Explain the theory of semi-conducting materials and its applications.
- Recognize the novel properties of new engineering materials

COURSE OUTCOMES

- An ability to identify the types crystalline structure
- An ability to apply properties on magnetism and superconducting materials
- An ability to apply knowledge on superconducting materials and its applications
- An ability to apply knowledge on dielectric materials
- An ability to use the synthesis techniques in modern materials

UNIT I PROPERTIES OF MATTER AND HYDRODYNAMICS 9

Elasticity - Poisson's ratio and relation between moduli (qualitative) - Stress-strain diagram- Factors affecting elasticity - Bending of beams - Cantilever - expression for bending moment – Measurement of Young's modulus by uniform and non-uniform bending - I shaped girders - Stream line flow - Turbulent flow- Poiseuille's formula for flow of liquid through a capillary tube – Determination of coefficient of viscosity of a liquid

UNIT II HEAT AND THERMODYNAMICS 9

Thermal conductivity - Forbe's and Lee's disc methods- Radial and cylindrical flow of heat -Thermal conductivity of rubber and glass - Thermal insulation of buildings - Thermal insulating materials - Thermal equilibrium - Zeroth law of thermodynamics - Internal Energy - First law of thermodynamics - Indicator diagram - Isothermal process - Work done in an isothermal expansion - Adiabatic process - Work done in an adiabatic expansion – Reversible and irreversible processes - Second law of thermodynamics - Carnot engine - Efficiency of Canot's cycle - Carnot's cycle as heat engine and refrigerator - Carnot's theorem - Comparative study of Ideal Otto and diesel engines and their efficiency (no derivation) - Entropy - temperature diagram of Carnot's cycle.

UNIT III CONDUCTING MATERIALS 9

Conductors - classical free electron theory of metals - Electrical and thermal conductivity - Wiedemann-Franz law - Lorentz number - Drawbacks of classical theory - Quantum theory -band theory of solids(qualitative treatment only) - Fermi distribution function - Effect of temperature on Fermi Function - Density of energy states - Carrier concentration in metals - application of conducting materials in induction furnace

UNIT IV SEMICONDUCTING MATERIALS 9

Intrinsic semiconductors – Energy band diagram – direct and indirect band gap semiconductors -Carrier concentration in intrinsic semiconductors - Fermi level – Variation of Fermi level with temperature – Electrical conductivity – Band gap determination – Extrinsic semiconductors – Carrier concentration in N-type and P-type semiconductors (Qualitative Treatment only) – Variation of Fermi level with temperature and impurity concentration – Compound semiconductors – Hall effect – Determination of Hall coefficient – Hall effect applications - application of semiconductors in strain measurements

UNIT V NEW ENGINEERING MATERIALS 9

Metallic glasses: Preparation - properties - applications

Shape memory alloys: Characterisitics - properties of Ni-Ti alloy – application- advantages and disadvantages of SMA

Advanced Ceramics: Introduction – characteristics – structural ceramics

Nanoscience and Nanotechnology – significance of the nanoscale - different types of nanostructures (Confinement Dimensions 0-D, 1-D, 2-D and 3-D) - Categories of nanomaterials - Fabrication of nonomaterials - Ball milling method and Chemical vapour deposition technique - Carbon nanotubes - Types of carbon nanotubes - CNT structure – properties and applications.

Biomaterials (metals and alloys, ceramics) - classification and applications.

TOTAL: 45Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B.N.Sankar& S.O.Pillai	Engineering Physics I	New Age International Publishers	2015
2	M. Arumugam,	Materials Science	Anuradha Publications	2006

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B. K. Pandey and S. Chaturvedi	Engineering Physics	Cengage Learning India Pvt. Ltd., Delhi,	2012
2	Rajendran, V, and Marikani A	Materials science	TMH Publications	2004
3	Jayakumar, S.	Materials science	R.K. Publishers, Coimbatore	2008
4	Palanisamy P.K	Materials science	Scitech Publications (India) Pvt. Ltd	2007
5	Sudarmozhi.G.	Engineering Physics II.	Bharathi Publishers,	2015

19BSS11 **ENGINEERING CHEMISTRY** **L T P C**

3 0 0 3

COURSE OBJECTIVES

- The students familiar with characteristics of water and know the specification of boiler feed water. To understand the softening of hard water by using various purification techniques.
- To understand the principles involved in corrosion. The students able to apply these principles towards the prevention of corrosion.
- The students will understand the basic concepts of polymers chemistry and its applications. The students have sound knowledge of plastics and rubbers.
- The students understand the reaction of nuclear fission and fusion and promote the knowledge about process of nuclear reactors and understand various chemical reactions involved in the batteries.
- The students will have knowledge on industrial important abrasives and refractories.

COURSE OUTCOMES

- Acquire knowledge conversant with principles of water characterization and treatment of portable water for industrial purpose.
- An ability to apply principles of electrochemistry and corrosion towards the control of corrosion.
- Ability to familiarize different polymers, plastics, rubbers and its applications.
- Ability to apply basic knowledge on nuclear reactors and its use in electrical power generation and working of energy storage devices
- Acquire knowledge on abrasives, refractories in industrial application.

UNIT I WATER TECHNOLOGY 9

Characteristics of water – hardness of water – types of hardness – estimation of hardness by EDTA method – alkalinity – types of alkalinity – estimation of alkalinity – Boiler feed water – requirements – disadvantages of using hard water in boilers – boiler troubles – scale and sludge – priming and foaming – caustic embrittlement – boiler corrosion – internal conditioning (phosphate, calgon, colloidal and carbonate conditioning methods) – external conditioning – zeolite and demineralization process – desalination and reverse osmosis.

UNIT II CORROSION AND CORROSION CONTROL 9

Corrosion – chemical corrosion – electrochemical corrosion – mechanism of dry and wet corrosion – types of corrosion – galvanic corrosion – differential aeration corrosion – factors influencing rate of corrosion – corrosion control methods – sacrificial anodic method and impressed current cathodic protection method – corrosion inhibitors – types of inhibitors – protective coatings – paints – requirements of paints – constituents and functions of paints – failures of paints – electroplating of gold on copper – electroless plating of nickel.

UNIT III POLYMERS 9

Polymers – definition – polymerization – types of polymerization (addition, condensation and copolymerization only) – mechanism of addition polymerization (free radical mechanism only) – properties of polymers – molecular weights, stereo specific polymers and polydispersive index –Plastics and its classification – thermo plastics and thermosetting plastics – preparation, properties and uses of polyvinyl chloride (PVC), Teflon, polyamides (nylon – 11, nylon – 6 and nylon – 6,6) and polyethylene terephthalate (PET) – Rubber – vulcanization of rubber – preparation, properties, uses of butyl rubber and SBR .

UNIT IV NON CONVENTIONAL ENERGY SOURCES AND STORAGE DEVICES 9

Nuclear energy – fission and fusion reactions – nuclear chain reactions – characteristics of nuclear chain reaction – light water nuclear reactor for power generation – breeder reactor – solar energy conversion – solar cells – wind energy – Fuel cells – working of hydrogen and oxygen fuel cell – batteries – types of

batteries – construction and working of batteries – alkaline battery – lead acid battery, nickel – cadmium battery and lithium battery.

UNIT V ENGINEERING MATERIALS **9**

Refractories – classification – acidic, basics and neutral refractories – properties – manufacture of alumina, magnesite and zirconia bricks – Abrasives – natural and synthetic abrasives – hardness of abrasives – Mohs scale – manufacture, properties and uses of silicon carbide and boron carbide – application of abrasives.

TOTAL: 45 Hours

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B P.C.Jain and Monica Jain	Engineering Chemistry	Dhanpat Rai Pub, Co., New Delhi	2013
2.	Dr.A.Ravikrishnan	Engineering Chemistry I & II	Sri Krishna Hitech Publishing Company Pvt. Ltd	2016

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.P.Santhi & S.Elavarasan	Engineering Chemistry	Sri Kandhan Publications	Aug 2016
2.	S.S. Dara	A text book of engineering chemistry	S.Chand & Co.Ltd., New Delhi	2013
3.	Shradha Sinha	Advanced Engineering Chemistry	Krishna Prakasan Media (P) Ltd., Meerut	2015
4.	B.Sivasankar	Engineering Chemistry	Tata McGraw-Hill Publishing Company, Ltd., New Delhi	2008
5.	V.R.Gowariker N.V.Viswanathan and Jayadev Sreedhar	Polymer Science	New Age International Pvt. Ltd., Chennai	2006

19BSS12 ENVIRONMENTAL SCIENCE AND ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To give a comprehensive insight into ecosystem, biodiversity and natural recourses.
- To create an awareness on the various environmental pollution aspects and issues.
- To educate the ways and means to protect the environment from various types of pollution.
- To import some fundamental knowledge on human welfare measures and understands the role of

government and non-government organization in environment managements.

- Discuss the impact of human population on the environment

COURSE OUTCOMES

- Able to define and explain scope and importance of environment, ecosystem and biodiversity.
- Acquire knowledge about various natural resources and equitable use of resources for sustainable life style.
- Acquire knowledge on various environmental pollution and able to protect.
- Acquire fundamental knowledge on human welfare and Familiarizes about the roles of various government and non-government organization in environment managements.
- Acquire knowledge on impacts of human population over the environment.

UNIT I **ECOSYSTEMS AND BIODIVERSITY** **9**

Definition, scope and importance of environment – need for public awareness – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers – energy flow in the ecosystem – ecological succession – food chains, food webs and ecological pyramids – Introduction to biodiversity definition – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – 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 exsitu conservation of biodiversity.

UNIT II **NATURAL RESOURCES** **9**

Forest resources: Use and over – exploitation, deforestation, cause – effect – control measures – Water resources: Use and over – utilization of surface and ground water, floods, drought, conflicts over water, dams – benefits and problems –Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer – pesticide problems, water logging, salinity – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles.

UNIT III **ENVIRONMENTAL POLLUTION** **9**

Definition – causes, effects and control measures of: (a) Air pollution (b) Water pollution(c) Soil pollution (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards – soil waste management: causes, effects and control measures of municipal solid wastes – role of an individual in prevention of pollution – disaster management: floods, earthquake, cyclone and landslides.

UNIT IV **SOCIAL ISSUES AND THE ENVIRONMENT** **9**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people – environmental ethics: Issues and possible solutions – climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, – environment protection act – Air (Prevention and Control of Pollution) act – Water (Prevention and control of Pollution) act – Forest conservation act – role of nongovernmental organization – Public awareness.

UNIT V **HUMAN POPULATION AND THE ENVIRONMENT** **9** 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.

TOTAL: 45 Hours

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TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.A.Ravikrishnan	Environmental Science and Engineering	Sri Krishna Hitech Publishing Company Pvt. Ltd	June 2016
2.	Gilbert M. Masters	Introduction to Environmental Engineering and Science	Pearson Education Pvt., Ltd., Second Edition. ISBN 81-297-0277-0	2004

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dharmendra S. Sengar	Environmental Law	Prentice hall of India PVT LTD, New Delhi	2007
2.	R.K.Trivedi	Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol-I and II	BS Publications	2010
3.	R.Rajagopalan	Environmental Studies	From Crisis to Cure, Oxford University Press	2015
4.	Benny Joseph	Environmental Science and Engineering	Tata McGraw-Hill, New Delhi	2006
5.	T.G.Miller	Environmental Science	Wadsworth Publishing Co.	2007

19BSS13 **ORGANIC CHEMISTRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- The students familiar with different types of organic compounds and its characteristics reactions.
- The students will understand the preparation of heterocyclic compounds and organic dyes.
- To understand the mechanism for the preparation of organic compounds with help of reagents.
- The students understand the chemistry of carbohydrates and proteins.
- The students will have knowledge on identification of organic compounds with spectroscopy tools.

COURSE OUTCOMES

- Acquire knowledge on various functional groups of organic compounds.
- An ability to prepare heterocyclic compounds and dyes.
- Ability to explain mechanism of various organic reactions.
- Acquire knowledge on types, functions and reactions of carbohydrates and proteins.

- Acquire knowledge on identification of organic compounds by spectroscopy.

UNIT - I INTRODUCTION TO ORGANIC CHEMISTRY 9

Introduction – types of organic compounds (aliphatic and aromatic) – various types of functional groups – types of organic reactions (substitution and elimination only) – Aliphatic nucleophilic substitution – mechanism of SN1, SN2 and SNi reactions – Aliphatic elimination reactions – mechanisms of E1 and E2 reactions.

UNIT - II CHEMISTRY OF HETEROCYCLIC COMPOUNDS AND DYES 9

Introduction – heterocyclic compounds having not more than one heteroatoms such as oxygen, nitrogen and sulphur – synthesis and properties of furan, pyrrole and thiophene. Dyes – color and constitution – chromophore – auxochrome – classification according to application and structure – preparation and uses of methyl orange, fluorescein and malachite green dyes.

UNIT - III ORGANIC NAMING REACTIONS AND REAGENTS 9

Perkin reaction – Reimer Tiemann reaction – Kolbe Schmitt reaction – Ullmann reaction – Diels Alder reaction – Important reagents and their synthetic applications in organic chemistry – $LiAlH_4$, $NaBH_4$, Ag_2O, Lead tetra acetate and Osmium tetroxide.

UNIT - IV CHEMISTRY OF CARBOHYDRATES AND PROTEINS 9

Carbohydrate – classification – mono saccharides, structure elucidation of mono saccharides (glucose and fructose only), interconversion (aldose to ketose and ketose to aldose only). Amino acids – Zwitter ion – isoeletric point – preparation of amino acids. Peptides – Peptide linkages – proteins – classification of proteins – Structure of proteins.

UNIT - V ORGANIC SPECTROSCOPY 9

UV-Visible spectroscopy – types of electronic transitions – Instrumentation – bathochromic shift and hypsochromic shift – IR spectroscopy – number and types of fundamental vibrations – Instrumentation – position of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid, amine and amide.

TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Arun Bahl and B.S.Bahl	A Text Book of Organic Chemistry	S.Chand & Company Ltd	2012
2	V.K.Ahluwalia and R.K.Parashar	Organic Reaction Mechanism	Narosa Publishing House	2017

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Tantillo Dean J	Applied Theoretical Organic Chemistry	World Scientific	2018
2.	Tom Sorrell	Organic Chemistry	University Science Books,	2016
3.	Mehta Bhupinder & Mehta Manju	Organic Chemistry -II Edition	PHI Learning Pvt. Ltd.	2015
4.	R.T. Morrison and R.N. Boyd	Organic Chemistry	VI Edition Prentice Hall Inc.	1996

5.	K.S. Tiwari, N.K. Vishnoi and S.N. Malhotra	A text book of Organic Chemistry	Second Edition, Vikas Publishing House Pvt. Ltd, Delhi	1998

19BSS14 **PHYSICAL CHEMISTRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To acquire knowledge on electric components and their behavior.
- To demonstrate the kinetics involved in chemical reaction.
- To determine the physical properties of photochemistry.
- To verify various laws involved in physical chemistry.
- To familiarize with different types of alloys.

COURSE OUTCOMES

- Understand the fundamentals of electrochemistry.
- Illustrate the kinetics and theories involved in chemical reactions
- Demonstrate various quantum theories and reactions of photochemistry.
- Summarize the properties of colloids
- Interpret the characteristics of alloys and phase rule.

UNIT I **ELECTROCHEMISTRY** **9**

Electrical Resistance – Specific Resistance – Electrical conductance – Specific conductance – Equivalent conductance – Cell constant – Determination of cell constant – variation of conductance with dilution – Kohlrausch's law – Single electrode potential – Nernst equation – Applications of Nernst equation – Electrochemical series.

UNIT II **CHEMICAL KINETICS** **9**

Rate of a reaction – Order of a reaction – Examples and rate equations for Zero order, First order, Second order and Third order reactions – Molecularity of a reaction – Unimolecular and Bimolecular reactions – Half life period – Activation energy – Arrhenius equation – Collision theory of reaction rates.

UNIT III **PHOTOCHEMISTRY** **9**

Laws of Photochemistry, Beer–Lambert's law- Grothus & Drapper's law- Stark Einstein's law-Quantum efficiency– Reason for difference in quantum efficiency – Method of determination of quantum yield. Jabulanski diagram - Photochemical reactions, Kinetics and mechanism of Hydrogen – Chlorine reaction – Photosensitization - Photo inhibitor - Chemiluminescence.

UNIT IV **COLLOIDS** **9**

Introduction to colloids – properties of colloids – coagulation of solutions – Origin of charge on colloidal particles – Determination of size of colloidal particles – Donnan Membrane equilibrium – Emulsions – Gels – Applications of colloids – Nanoparticles (Au, Ag, Pt) – Preparation – Characterization – Properties and Application.

UNIT V **PHASE EQUILLIBRIA** **9**

Phase - Components – Degrees of freedom - The Gibbs Phase rule – Derivation of the Phase rule – One Component system – The water System – Two Component system – Simple Eutectic System – Lead-Silver System - Desilverisation of Lead – Congruent and Incongruent Melting points.

TOTAL: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	B.R.Puri, L.R.Sharma	Principals of Physical Chemistry	Vishal Publishing Co	2017
2	A. S. Negi	A Textbook of Physical Chemistry	New Age International	2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David W. Ball	Physical Chemistry	Cengage Learning	2014
2.	Arthur Adamson	A Textbook of Physical Chemistry	Elsevier	2012
3.	V.D. Athawale	Experimental Physical Chemistry	New Age International	2007
4.	Peter Atkins & Julio de Paula	Atkins' Physical Chemistry	Oxford university press	2002
5.	Kund and Jain	Physical Chemistry	S.Chand and Company	1996

19BSS15 **APPLIED CHEMISTRY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- The students familiar with characteristics of water and know the specification of boiler feed water. To understand the softening of hard water by using various purification techniques.
- To understand the concept and importance of thermodynamics.
- The students will understand the basic concepts of electrochemistry and its applications.
- The students understand about the fuels and its type and understand the combustion of fuels.
- The students will have knowledge on industrial important abrasives, cement, cement and glass.

COURSE OUTCOMES

- Acquire knowledge conversant with principles of water characterization and treatment of portable water for industrial purpose.
- An ability to apply principles of thermodynamics.
- Ability to familiarize basic concepts of electrochemistry and its applications.
- Ability to apply basic knowledge on the fuels and its uses and acquire knowledge on the combustion of fuels.
- Acquire knowledge on industrial important abrasives, cement and glass.

UNIT I **PHASE RULE AND ALLOYS** **9**

Statement and explanation of terms involved – one component system – water system – condensed phase rule – construction of phase diagram by thermal analysis – simple eutectic systems (lead-silver system only) – alloys – importance, ferrous alloys – nichrome and stainless steel – heat treatment of steel, non-ferrous alloys – brass and bronze.

UNIT II **CHEMICAL THERMODYNAMICS** **9**

Terminology of thermodynamics - Second law: Entropy - entropy change for an ideal gas, reversible and irreversible processes; entropy of phase transitions; Clausius inequality. Free energy and work function: Helmholtz and Gibbs free energy functions; Criteria of spontaneity; Gibbs-Helmholtz equation, Clausius-Clapeyron equation; Maxwell relations – Van't Hoff isotherm and isochore.

UNIT IIII **ELECTROCHEMISTRY** **9**

Electrochemical cells – reversible and irreversible cells – EMF – measurement of emf – Single electrode potential – Nernst equation (problem) – reference electrodes – Standard Hydrogen electrode - Calomel electrode – Ion selective electrode – glass electrode and measurement of pH – electrochemical series – significance – potentiometer titrations (redox - Fe^{2+} versus dichromate) and conduct metric titrations (acid-base – HCI vs, NaOH) titrations.

UNIT IV **FUELS AND COMBUSTION** **9**

Fuel: Introduction- classification of fuels- calorific value- higher and lower calorific values- coalanalysis of coal (proximate and ultimate)- carbonization- Otto Hoffmann method - petroleum- manufacture of synthetic petrol (Bergius process)- knocking, octane number - diesel oil- cetane number - natural gas-compressed natural gas(CNG)-liquefied petroleum gases(LPG) - Combustion of fuels: introduction-theoretical calculation of calorific value- ignition temperature- flue gas analysis (ORSAT Method).

UNIT V **ENGINEERING MATERIALS** **9**

Abrasives: definition, classification or types, grinding wheel, abrasive paper and cloth. Portland cement-manufacture and properties - setting and hardening of cement, special cement- waterproof and white cement–properties and uses. Glass - manufacture, types, properties and uses.

TOTAL: 45 Hours

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	B P.C. Jain and Monica Jain	Engineering Chemistry	Dhanpat Rai Pub, Co., New Delhi	2013
2.	Dr.A.Ravikrishnan	Engineering Chemistry I & II	Sri Krishna Hitech Publishing Company Pvt. Ltd	2016

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr.P.Santhi & S.Elavarasan	Engineering Chemistry	Sri Kandhan Publications	Aug 2016
2.	S.S. Dara	A text book of engineering chemistry	S.Chand & Co.Ltd., New Delhi	2013
3.	Shradha Sinha	Advanced Engineering Chemistry	Krishna Prakasan Media (P) Ltd., Meerut	2015
4.	B.Sivasankar	Engineering Chemistry	Tata McGraw-Hill Publishing Company, Ltd., New Delhi	2008
5.	V.R.Gowariker N.V.Viswanathan and Jayadev Sreedhar	Polymer Science	New Age International Pvt. Ltd., Chennai	2006

19BSS16 ORGANIC CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES

- The students familiar with different types of organic compounds and its characteristics reactions.
- The students will understand the preparation of organic compounds.
- To understand the mechanism for the preparation of organic compounds.
- The students will have skill on preparation of simple organic compounds.
- The students will understand various methods of organic preparations.

COURSE OUTCOMES

- Acquire knowledge on various functional groups of organic compounds.
- Acquire knowledge on identification of organic compounds by simple color reactions.
- An ability to identify special elements present in organic compounds.
- Ability to identify functional groups in organic compounds.
- Acquire knowledge on basics in organic compound preparation.

LIST OF EXPERIMENTS

1. Organic Qualitative Analysis

a) Detection of elements- nitrogen, sulphur and halogens.
b) Detection of aliphatic or aromatic.
c) Detection of whether saturated or unsatured compounds.
d) Preliminary tests and detection of functional groups, phenols, aromatic amines, aromatic acids, Urea, benzamide & carbohydrate (monosaccharides only).

2. Introduction to Organic Synthetic Procedures

a) Acetylation – Preparation of acetanilide from aniline.

b) Hydrolysis – Preparation of salycilic acid from methyl salyciliate.
c) Substitution – Conversion of acetone to iodoform.
d) Nitration – Preparation of m-dinitrobenzene from nitrobenzene.
e) Oxidation – Preparation of benzoic acid from benzaldehyde/ benzyl alcohol

REFERENCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	V.Venkateswaran, R.Veerasamy	Basic Principles of Practical Chemistry	Sultan Chand & Sons	2013
2	Arun Bahl and B.S.Bahl	A Text Book of Organic Chemistry	S.Chand & Company Ltd	2012

19BSS17 PHYSICAL CHEMISTRY LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

- To acquire knowledge on conductance measurements.
- To determine the rate of a chemical reaction.
- To determine the physical properties of photochemistry.
- To verify phase rule in physical chemistry.
- To familiarize with different types absorption.

COURSE OUTCOMES

- An ability to measure the conductance of a solution.
- Demonstrate phase diagram of simple system.
- Able to determine the rate of reaction of simple reaction.
- Able to estimate the amount of weak acid by conductometric measurements.
- An ability to calculate partition coefficient of two immiscible liquids.

LIST OF EXPERIMENTS

1. Determination of molecular weight of a polymer by viscosity method.
2. Determination of partition co-efficient of iodine between two immiscible solvents
3. Determination of Ka of the weak acid
4. Conductometric experiments - Verification of Oswald's Dilution Law
5. Titration of Weak Acid Vs Weak Base
6. Determination of Rate Constant (K)
7. To study the adsorption of Acetic acid on charcoal and construct the isotherm.
8. Determination of pH metric titration of Strong Acid Vs Strong Base
9. Enzyme catalytic reaction by varying pH.
10. Application of Phase Rule to Phenol-Water system
11. To study the inversion of cane sugar by polarimeter.

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

1	V.Venkateswaran, R.Veerasamy	Basic Principles of Practical Chemistry	Sultan Chand & Sons	2013
2	B.R.Puri, L.R.Sharma	Principals of Physical Chemistry	Vishal Publishing Co	2017

19BSS21 ALGEBRA AND CALCULUS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- To realize the use of matrix algebra techniques in engineering applications and to develop for future applications.
- To familiarize the student with differential calculus concepts. This is needed in almost all branches of engineering.
- To impart knowledge on the functions with several variables which finds applications in many engineering branches
- To familiarize the students with integral calculus concepts.
- To acquaint the student with mathematical tools needed in evaluating multiple integrals and their usage.

COURSE OUTCOMES

- This course equips students to have basic knowledge in matrix algebra techniques with its engineering applications.
- This course helps students in understanding the concepts of differential calculus.
- The students will have knowledge on functions with several variables.
- The students will gain understanding of the basic techniques of integration.
- The students will have the ability to solve the real time engineering problems with multiple integrals and their usage

UNIT - I MATRICES 9+3

Characteristic equation – Eigenvalues and Eigenvectors of a real matrix – Properties of eigenvalues and eigenvectors – Cayley-Hamilton Theorem (Without Proof) – Orthogonal transformation of a symmetric matrix to Diagonal form – Reduction of a quadratic form to canonical form by orthogonal transformation

UNIT – II DIFFERENTIAL CALCULUS
9+3

Representation of Functions, Limits, Continuity, Derivatives, Differentiability Rules-Maxima and Minima of functions of one variable- Mean Value Theorem.

UNIT – III FUNCTIONS OF SEVERAL VARIABLES 9+3

Functions of two variables – Taylor series - Partial derivatives – Maxima and minima – Constrained maxima and minima – Lagrange's multipliers method – Jacobians

UNIT – IV INTEGRALCALCULUS 9+3

Definite and Indefinite Integrals-Substitution Rule-Integration by parts-Trigonometric Integrals, Integration of rational functions by partial fractions -Improper Integrals.

UNIT – V MULTIPLE INTEGRALS 9+3

Double integrals in Cartesian coordinates – Change of order of integration – Area between two curves – Area of double integral - Triple integration in Cartesian coordinates – Volume as triple integrals

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	James Stewart	Calculus with Early Transcendental Functions	Cengage Learning, New Delhi	2008
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Veerarajan. T	Engineering Mathematics for first year	Tata McGraw-Hill Publishing Company Ltd., New Delhi	2015
2.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2018
3.	Jain R.K., Iyengar S.R.K.	Advanced Engineering Mathematics, 4th edition	Alpha Science International Ltd	2014
4.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
5.	Dass, H.K., Er. RajnishVerma	Higher Engineering Mathematics, 3rd Revised Edition	S. Chand Private Ltd	2014

19BSS22 DIFFERENTIAL EQUATIONS AND VECTOR ANALYSIS **L T P C**
3 1 0 4

COURSE OBJECTIVES

- To make the student acquire sound knowledge of techniques in solving ordinary differential equations that model engineering.
- To construct relatively simple quantitative models of change, and to deduce their consequences.
- To develop an understanding of the standard techniques of analytic theory.
- To enable the student to apply complex integration theory with confidence, in application areas of engineering fields.

- To have a sound knowledge of Laplace transform and learn the inverse Laplace transformations for solving real time Engineering problems.

COURSE OUTCOMES

- The knowledge gained on ordinary differential equations will provide a strong platform to solve the research problems in model engineering.
- The knowledge gained on vector calculus provides a framework for modeling systems.Use Gauss, Stokes and Greens theorems to simplify calculations of integrals and prove simple results.
- Using analytical functions for real world problems, engineer makes models of projects and then simulates its models in real world conditions.
- To enable the student to apply complex integration efficiently solving the problems that occur in various branches of engineering disciplines.
- This course equips students to have basic knowledge in inverse Laplace transforms with its engineering applications

UNIT - I ORDINARY DIFFERENTIAL EQUATIONS 9+3

Linear differential equations of second and higher order with constant coefficient when the R.H.S is e^{ax}, sin ax, cos ax, e^{ax}sinbx, e^{ax}cosbx – Cauchy's Euler's equations and Legendre's linear equations – simultaneous first order linear equations with constant co-efficients – Method of variation of parameter when the R.H.S is sec ax, cosec ax, tan ax, cot ax.

UNIT - II VECTOR CALCULUS 9+3

Gradient, divergence and curl – Line, surface and volume integrals – Green's, Gauss divergence theorem and Stokes' theorem (excluding proofs) – Verification of the above theorems and evaluation of integrals using them

UNIT – III ANALYTIC FUNCTIONS 9+3

Functions of a complex variable – Analytic function: Necessary conditions – Cauchy-Riemann equations and sufficient conditions (excluding proofs) – Properties of analytic function – Harmonic conjugate – Construction of analytic functions – Conformal mapping: w =az, 1/z and bilinear transformation.

UNIT – IV COMPLEX INTEGRATION 9+3

Cauchy's integral theorem (excluding proof) and Cauchy's integral formula(excluding proof) – Taylor's and Laurent's series expansions(excluding proof) – Singular points – Classifications – Cauchy's residue theorem – Contour integration- circle and semi-circle Contour (excluding poles on the real axis).

UNIT – V LAPLACE TRANSFORMS AND INVERSE LAPLACE TRANSFORMS 9+3

Laplace transforms – Basic properties – Initial and final value theorems - Problems - Transform of periodic functions. Inverse Laplace transforms – statement of convolution theorem - Problems – Partial fraction method – Problems – Solution of linear ODE of second order with constant coefficients.

UNIT - V ORDINARY DIFFERENTIAL EQUATIONS 9+3

Linear differential equations of second and higher order with constant coefficient when the R.H.S is e^{ax}, sin ax, cos ax, e^{ax}sinbx, e^{ax}cosbx – Cauchy's Euler's equations and Legendre's linear equations – simultaneous first order linear equations with constant co-efficients – Method of variation of parameter when the R.H.S is sec ax, cosec ax, tan ax, cot ax.

TOTAL: 45 + 15 = 60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
2.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2014
3.	Tony Croft, Anthony Croft, Robert Davison, Martin Hargreaves, James Flint	Engineering Mathematics: A Foundation for Electronic, Electrical, Communications and Systems Engineers, 4th Revised Edition	Pearson Education	2012
4.	Peter V. O.Neil	Advanced Engineering Mathematics, 7th Edition	Cengage learning	2012
5.	Dass, H.K. , Er. RajnishVerma	Higher Engineering Mathematics, 3rd Revised Edition	S. Chand Private Ltd	2014

19BSS23 TRANSFORMS AND PARTIAL DIFFERENTIAL EQUATIONS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- To acquaint the student with Fourier transform techniques used in wide variety of situations.
- To develop Z transform techniques for discrete time systems
- To introduce Fourier series analysis which is central to many applications in engineering
- To develop the basic knowledge in solving the boundary value problems
- To introduce the effective mathematical tools for the solutions of partial differential equations that model several physical processes

COURSE OUTCOMES

- This course enables the students to apply Fourier transform techniques to many engineering problems.

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- Using this course, a student develops Z transform techniques for discrete time systems for real world problems.
- Provides the students to have sound knowledge Fourier series analysis.
- The students will have the ability to solve boundary value problems.
- It equips students to find the solutions of partial differential equations that model real time processes

UNIT – I FOURIER TRANSFORMS **9+3**

Statement of Fourier integral theorem - Fourier transforms pair – Fourier sine and cosine transforms – Properties – Transforms of simple functions – Convolution theorem – Parseval's identity–Problems .

UNIT – Ii Z - TRANSFORMS AND DIFFERENCE EQUATIONS **9+3**

Z- transforms - Elementary properties – Initial and final value theorem – Inverse Z - transforms – Partial fraction method – Residue method – Convolution theorem - Formation of difference equations – Solution of difference equations using Z - transforms

UNIT - III FOURIER SERIES **9+3**

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

UNIT – IV BOUNDARY VALUE PROBLEMS **9+3**

Classification of PDE - Solutions of one dimensional wave equation – One dimensional equation of heat conduction – Fourier series solution in Cartesian coordinates – Steady state solution of two dimensional equation of heat conduction (excluding insulated edges) on finite square plates (excluding circular plates).

UNIT – V PARTIAL DIFFERENTIAL EQUATIONS **9+3**

Formation of partial differential equations – Singular integrals – Solutions of standard types of first order partial differential equations - Lagrange"s linear equation - Linear partial differential equations of second and higher order with constant coefficients of homogeneous when the R.H.S is e^{ax+by} , x^m y^n m,n>0, sin (ax+by), cos (ax+by)

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publicatio n
1.	Erwin Kreyszig	Advanced Engineering Mathematics, 9th Edition	John Wiley and Sons, New Delhi	2014
2.	Grewal. B.S	Higher Engineering Mathematics, 43rd Edition	Khanna Publications, Delhi	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publicatio

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1.	Glyn James	Advanced Modern Engineering Mathematics, 4th Edition	Pearson Education	2016
2.	Bali N. P Manish Goyal	A Text book of Engineering Mathematics, 9th edition	Laxmi Publications Pvt Ltd.	2016
3.	Datta.K.B.	Mathematical Methods of Science and Engineering	Cengage Learning India Pvt Ltd, Delhi	2013
4.	Ray Wylie. C, Barrett.L.C	Advanced Engineering Mathematics, 6th Edition	Tata Mc Graw Hill Education Pvt Ltd, New Delhi	2012
5.	Ramana.B.V.	Higher Engineering Mathematics	Tata Mc Graw Hill Publishing Company, New Delhi	2008

19BSS24 DISCRETE MATHEMATICS

L	T	P	C
3	1	0	4

COURSE OBJECTIVES

- To extend student's Logical and Mathematical maturity.
- To deal with abstraction and the counting principles.
- To identify the basic properties of graphs and model simple applications.
- To study the concepts and properties of algebraic structures.
- To learn discrete objects and their properties.

COURSE OUTCOMES

- Have knowledge of the concepts needed to test the logic of a program.
- Ability to distinguish between the notion of discrete and continuous mathematical structures
- Have an understanding in identifying structures on many levels.
- Be aware of the counting principles.
- Be exposed to concepts and properties of algebraic structures such as groups, rings and fields.

UNIT - I LOGIC AND PROOFS 9+3

Propositional Logic – Propositional equivalences-Predicates and quantifiers- Rules of inference-introduction to Proofs-Proof Methods and strategy.

UNIT – II COMBINATORICS 9+3

Mathematical inductions-Strong induction and well ordering-.The basics of counting-The pigeonhole principle –Permutations and combinations-Recurrence relations-Solving Linear recurrence relations-generating functions-inclusion and exclusion and applications.

UNIT – III GRAPHS 9+3

Graphs and graph models-Graph terminology and special types of graphs-Representing graphs and graph isomorphism - connectivity-Euler and Hamilton paths.

UNIT – IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms- Cosets and Lagrange's
Theorem - Ring & Fields (Definitions and examples)

UNIT – V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism-Some Special lattices- Boolean Algebra

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Narsingh Deo	Graph Theory with Applications to Engineering and Computer Science, Reprint edition	Dover Publications Inc.	2016
2.	Tremblay J.P, Manohar R	Discrete Mathematical Structures with application to computer science,30th Reprint	Tata Mc Graw Hill Pub.Co.Ltd,New Delhi,	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernard Kolman , Robert C.Busby, Sharan Culter Ross	Discrete Mathematical Structures, 6th Edition	Pearson Education Pvt Ltd. ,New Delhi	2015
2.	Richard Johnsonbaugh	Discrete Mathematics , 7th Edition	Pearson Education Asia, New Delhi	2014
3.	Seymour Lipschutz, Mark Lipson, Varsha H. Patil	Discrete Mathematics Schaum's Outlines , Revised 3rd Edition	Mc Graw Hil Pub.Co.Ltd.,New Delhi	2013
4.	Ralph. P.Grimaldi	Discrete and combinatorial Mathematics : An Applied Introduction, 5th Edition	Pearson Education Asia,Delhi	2012
5.	Kenneth H. Rosen	Discrete Mathematics and its Applications, 7th Edition	Tata Mc Graw Hill Pub . co.Ltd.,New Delhi,Special Indian Edition	2011

Programme Code & Name: RA & B.E-Robotics and Automation

19BSS25 **STATISTICAL AND QUEUING MODEL** **L T P C**
3 1 0 4

COURSE OBJECTIVES

- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To understand the basic concepts of Control charts for measurements.
- Identify the concept of queueing models and apply in engineering.
- To understand the significance of advanced queueing models.

COURSE OUTCOMES

- Provides knowledge to apply testing of hypothesis to real life problems.
- This course enhances the students in design of experiments model for research problems
- Apply the concept of Statistical Quality Control in engineering disciplines.
- Acquire skills in analyzing queueing models.
- Understand and characterize phenomenon which evolve with respect to time in a probabilistic manner

UNIT I TESTING OF HYPOTHESIS **9 + 3**

Sampling distributions - Estimation of parameters - Statistical hypothesis -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS **9 + 3**

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

UNIT III STATISTICAL QUALITY CONTROL **9 + 3**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

UNIT IV QUEUEING MODELS **9 + 3**

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers : Balking and reneging.

UNIT V ADVANCED QUEUEING MODELS **9 + 3**

Finite source models – M/G/1 queue – Pollaczek Khinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Devore. J.L.,	"Probability and Statistics for Engineering and the Sciences	Cengage Learning, New Delhi	2014

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2.	John F. Shortle, James M.Thompson, Carl M. Harris Donald Gross	Fundamentals of Queueing Theory, 4th Edition	Wiley	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
4.	Yates, R.D. and Goodman. D. J	"Probability and Stochastic Processes"	Wiley India Pvt. Ltd., Bangalore	2012
5.	Trivedi.K.S.,	Probability and Statistics with Reliability, Queueing and Computer Science Applications, 2nd Edition	John Wiley and Sons	2008

19BSS26 NUMERICAL METHODS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To solve a set of algebraic equations representing steady state models formed in engineering problems
- To deal with interpolation and approximation for the application of finite element analysis
- To find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- To predict the system dynamic behaviour through solution of ODEs modeling the system
- To solve PDE models representing spatial and temporal variations in physical systems through numerical methods

COURSE OUTCOMES

- The students will have a clear perception of the power of numerical techniques

- The students will have the ability to solve a set of algebraic equations representing steady state models formed in engineering problems
- The students can deal with interpolation and approximation for the application of finite element analysis
- It equips the knowledge in numerical differentiation and numerical integration
- This course makes students easy in solving initial and boundary value problems

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

Solution of algebraic and transcendental equations - Newton Raphson method – Solution of linear system of a equations - Gauss elimination method –Gauss Jordon method - Iterative methods of Gauss Jacobi and Gauss-Seidel -Eigen value of a matrix by power method

UNIT – II INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT – III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by trapezoidal and Simpsons's 1/3 rules.

UNIT – IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods – Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

UNIT – V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two Laplace's and Poisson's equations on rectangular domain – one dimensional heat equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 45 + 15 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010
2.	M.K. Jain	Numerical Methods for Scientific & Engineering Computation, 6th Edition	New Age International Publishers	2010
3.	Sankara Rao. K.	Numerical methods for Scientists and Engineers, 3rd Edition	Prentice Hall of India Private, New Delhi	2007
4.	Brian Bradie	A friendly introduction to Numerical analysis	Pearson Education, Asia, New Delhi	2007
5.	Gerald. C. F. Wheatley. P. O.	Applied Numerical Analysis,6th Edition	Pearson Education, Asia, New Delhi	2006

19BSS27 PROBABILITY & RANDOM PROCESSES

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- Analyze random or unpredictable experiments and investigate important features of random experiments.
- Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
- To acquire the knowledge the concept of convergence of random sequence and the study of random signals
- To be familiar with application of auto correlation and cross correlation functions.
- To learn the concept of spectral density

COURSE OUTCOMES

- The students will have a fundamental knowledge of the probability concepts.
- It helps to use standard distributions to the real life problems.
- Associate random variables by designing joint distributions and correlate the random variables.
- It also helps to understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.
- Gained knowledge in correlation and spectral densities

UNIT - I PROBABILITY AND RANDOM VARIABLES **9+3**

Axioms of probability–conditional probability– Baye's theorem, random variables– Discrete and continuous random variables – MGF

UNIT – II STANDARD DISTRIBUTIONS **9+3**

Discrete distributions : Binomial, Poisson, Geometric, Negative Binomial and their properties – Continuous distributions : Uniform, Exponential, Gamma, Normal distributions and their properties

UNIT – III TWO - DIMENSIONAL RANDOM VARIABLES **9+3**

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables

UNIT – IV RANDOM PROCESSES **9+3**

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations

UNIT – V CORRELATION AND SPECTRAL DENSITIES **9+3**

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oliver. C Ibe.	Fundamentals of Applied Probability and Random Processes, 2nd Edition	Academic Press	2014
2.	Stark. H., Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education, Asia	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HweiP.Hsu	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Mc Graw Hill Publishing Company, New Delhi	2014

2.	Henry Stark , John W. Woods	Probability, Statistics, and Random Processes for Engineers" , 2nd Edition	Pearson Education	2014
3.	Miller. S.L., Childers. D.G.	Probability and Random Processes with Applications to Signal Processing and Communications , 2nd Edition	Academic Press (Elsevier)	2012
4.	Yates. R.D., Goodman. D.J.	Probability and Stochastic Processes, 2nd Edition	Wiley India Pvt. Ltd., Bangalore	2012
5.	Peyton Peebles	Problems and Solutions in Probability, Random Variables and Random Signal Principles (SIE), 1st Edition	Mc Graw Hill Publishing Company, New Delhi	2012

19BSS28 STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- To predict the system dynamic behaviour through solution of ODEs modeling the system
- To introduce numerical tools for the solutions of ordinary differential equations that model several physical processes

COURSE OUTCOMES

- Provides knowledge to apply testing of hypothesis to real life problems.
- This course enhances the students in design of experiments model for research problems
- The students will have a clear perception of the power of numerical techniques
- It equips the knowledge in numerical differentiation and numerical integration
- This course makes students easy in solving ordinary differential equations

UNIT - I TESTING OF HYPOTHESIS 9+3

Sampling distributions - Tests for single mean, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT – II DESIGN OF EXPERIMENTS 9+3

Completely randomized design – Randomized block design – Latin square design – One way- Two way Classification.

UNIT – III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Newton-Raphson method- Gauss Elimination method – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Horner's Method – Eigen values of a matrix by Power method .

UNIT – IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION 9+3

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules

UNIT – V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS 9+3

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations – Adam's and Milne's predictor corrector methods for solving first order equations

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Walpole. R.E., Myers. R.H., Myers. S.L., Ye. K.	Probability and Statistics for Engineers and Scientists, 8th Edition	Pearson Education, Asia	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012
4.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
5.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010

Programme Code & Name: RA & B.E-Robotics and Automation

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Programme Code & Name: RA & B.E-Robotics and Automation

19GES01 PROGRAMMING FOR PROBLEM SOLVING USING C L T P C

3 0 0 3

COURSE OBJECTIVES

- To understand basic programming concepts
- To provide knowledge for problem solving through
- To provide hands-on experience with the concepts programming

COURSE OUTCOMES

- Understand the fundamentals of C programming
- Choose the loops and decision making statements to solve the problem
- Implement different Operations on arrays and Use functions to solve the given problem
- Understand String and structures
- Understand pointers and Implement file Operations in C programming for a given application

UNIT I INTRODUCTION TO C PROGRAMMING 9 HOURS

Introduction to computer software, Program Design Tools: Algorithms, Flowcharts, Pseudo codes, Structure of a C program, Writing the first C program, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, Input / Output Statements in C, Operators in CArithmetic, Relational, Logical, Conditional, Type conversion an Typecasting.

UNIT II CONDITIONAL AND LOOPING STATEMENTS 9 HOURS

Conditional branching statements, if, if-else, if-else-if and switch statements, Iterative statements, while, do-while and for loop statements, Nested loops, the break and continue statements.

UNIT III FUNCTIONS AND ARRAYS 9 HOURS

Functions: Function Declaration/Function Prototype, Function definition, Function call, passing parameters to functions. Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, operations on 1-d arrays – Inserting an Element of an array, Deleting an Element from an Array, searching for a Value in an Array, two-dimensional arrays, operations on twodimensional arrays – Sum, Difference.

UNIT IV STRINGS AND STRUCTURES 9 HOURS

Strings: Introduction, Operations on Strings – finding the length of a String, converting characters of a string into upper case, Converting characters of a string into lower case. Structures: Introduction to Structures, Copying and comparing structures, Nested structures.

UNIT V **POINTERS AND FILE PROCESSING** **9 HOURS**

Pointers: Introduction to Pointers, Declaring pointer variables, Passing arguments to function using pointers.

File Processing: Introduction to Files, Read Data from Files, Writing data to Files.

Total Periods:45 hours

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Computer Fundamentals and Programming in C	Oxford University Press	Second Edition.
2.	Reema Thareja	Programming in C	Oxford University Press	Second Edition.

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Programming in C	Oxford University Press	Second Edition.
2.	B S Gottfried: Schaums	Programming with C	Outline Series	2003

19GES02 **PROGRAMMING FOR PROBLEM SOLVING TECHNIQUES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand basic programming concepts
- To provide knowledge for problem solving through programming
- To provide hands-on experience with the concepts

COURSE OUTCOMES

- Understand the fundamentals of C programming
- Choose the loops and decision making statements to solve the problem
- Implement different Operations on arrays and Use functions to solve the given problem

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- Develop Simple Python Programs using Appropriate Syntax, Control Structure and Expression
- Explain the Concept of Tuples and Files in Python Programming Language

UNIT I **INTRODUCTION TO C PROGRAMMING** **9 HOURS**

Introduction to computer software, Program Design Tools: Algorithms, Flowcharts, Pseudo codes, Structure of a C program, Writing the first C program, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, Input / Output Statements in C, Operators in CArithmetic, Relational, Logical, Conditional, Type conversion and Typecasting.

UNIT II **CONDITIONAL AND LOOPING STATEMENTS** **9 HOURS**

Conditional branching statements, if, if-else, if-else-if and switch statements, Iterative statements, while, do-while and for loop statements, Nested loops, the break and continue statements.

UNIT III **FUNCTIONS AND ARRAYS** **9 HOURS**

Functions: Function Declaration/Function Prototype, Function definition, Function call, passing parameters to functions. Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, operations on 1-d arrays – Inserting an Element of an array, Deleting an Element from an Array, searching for a Value in an Array, two-dimensional arrays, operations on twodimensional arrays – Sum, Difference

UNIT IV **INTRODUCTION TO PYTHON PROGRAMMING** **9 HOURS**

Introduction- Python interpreter and interactive mode- Creating and executing Python program- Data types: Numeric, Boolean, string, List, tuple and Dictionary-Comments- Expressions- Conditional statements: if, if-else and if-elif-else- Iterative statements: while, for, continue and pass- Functions- Fruitful functions- Recursive functions- Illustrative programs: Linear search and Binary search

UNIT V **STRINGS, LISTS, TUPLES AND DICTIONARIES** **9 HOURS**

Strings: Assignment- String slices and String methods- Lists: List operations and list methods-Tuples: Tuple assignment and Tuple operations- Dictionaries: Operations and methods. Illustrative Programs: Quick sort and Merge sort.

Total Periods: 45

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Computer Fundamentals and Programming in C	Oxford University Press	Second

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				Edition
2.	John V Guttag	Introduction to Computation and Programming Using Python	Revised and expanded Edition, MIT Press	2013

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Programming in C	Oxford University Press	Second Edition
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero	Introduction to Programming in Python: An Inter-disciplinary Approach	Pearson India Education Services Pvt. Ltd.,	2016
3.	Timothy A. Budd	Exploring Python	Mc-Graw Hill Education (India) Private Ltd	2015
4.	Kenneth A. Lambert	Fundamentals of Python: First Programs	CENGAGE Learning	2012.

19GES03 PROGRAMMING IN C LAB

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

1. Develop a program to find the largest of three numbers.
2. Develop an interactive program to calculate roots of quadratic equation by accepting the coefficients.
3. Develop a program to sum the series: 1/1! + 4/2! + 27/3! +….. using functions.
4. Develop a program to insert a number at a given location in an array.
5. Implement a program to perform a binary search on 1D sorted Array.
6. Develop a program to read a two dimensional array "marks" which stores marks of 5 students in three subjects. Display the highest marks in each subject
7. Develop a program to concatenate two strings and determine the length of the concatenated string
8. Develop a program to read and display the information about a student using structures.
9. Implement a program to enter a character and then determine whether it is a vowel or not using pointers.
10. Develop a program to read data from the keyboard, write it to a file called "Input", again read the

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same data from the "Input" file and display it on the screen.

11. Mini Projects

19GES04 PROGRAMMING IN C AND PYTHON LAB

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

1. Develop a C program to find the largest of three numbers.
2. Develop an interactive C program to calculate roots of quadratic equation by accepting the coefficients.
3. Develop a C program to sum the series: 1/1! + 4/2! + 27/3! +….. using functions.
4. Develop a C program to insert a number at a given location in an array.
5. Implement a C program to perform a Fibonacci series.
6. Develop a C program to read a two dimensional array "marks" which stores marks of 5 students in three subjects. Display the highest marks in each subject.
7. Write a Python program to find GCD of two numbers.
8. Write a Python Program to find the square root of a number by Newton's Method.
9. Write a Python program to find the exponentiation of a number.
10. Write a Python Program to find the maximum from a list of numbers.
11. Write a Python Program to perform Linear Search.

19GES05 ELECTRICAL AND ELECTRONICS SCIENCES

L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on DC & AC circuits and its analysis
- To impart knowledge of measuring instruments.
- To study the operation of electrical machines.
- To impart the fundamentals of semiconductor.
- To understand the principles of micro computing.

COURSE OUTCOMES

- Able to analyze DC and AC circuits
- Able to explain the different type of measuring instruments
- Able to exhibit the operation of electrical machines
- Able to demonstrate the operation of rectifier and DAC/ADC
- Able to explain the principles of micro computing

UNIT I ELECTRICAL CIRCUITS 9

Ohm's law - Kirchhoff's laws - Resistors in series and parallel circuits (simple problem) - Introduction to ac circuits and its parameters - Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads.

UNIT II MEASUREMENTS AND INSTRUMENTATION 9

Operating principles of Moving Coil and Moving Iron instruments - Principles of Electrical Instruments, Multimeters, Oscilloscopes - Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers

UNIT III ELECTRICAL MACHINES 9

Construction, Principle of operation, Basics equation, of DC Motor and Generators - Single phase Induction motors, Construction, Types and speed control methods - Single Phase Transformer, voltage regulation and efficiency (Qualitative & Quantitative treatment only)

UNIT IV SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS 9

Operation and characteristics of PN Junction Diode - Half wave Rectifiers - Full wave Rectifiers - Bipolar Junction Transistor - Binary Number System - Logic Gates - Boolean algebra - Half and Full Adders - Registers and Counters - A/D and D/A Conversion.

UNIT V INTRODUCTION TO MICROCOMPUTING 9

Architecture of 8051 – instruction set – addressing mode – serial port programming - interrupts – ADC/DAC

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D P Kothari and I.J Nagarath	Basic Electrical and Electronics Engineering	McGraw Hill Education(India) Private Limited	2016
2.	S.K.Bhattacharya	Basic Electrical and Electronics Engineering	Pearson India	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Giorgio Rizzoni	Principles and Applications of Electrical Engineering	McGraw Hill Education(India)	2010

			Private Limited	
2.	A.E.Fitzgerald, David E Higginbotham and Arvin Grabel,	Basic Electrical Engineering	McGraw Hill Education(India) Private Limited	2009
3.	Mittle N	Basic Electrical Engineering	Tata McGraw Hill Edition	2016
4.	Rajendra Prasad	Fundamentals of Electrical engineering	Prentice Hall of India	2006
5.	Del Toro	Electrical Engineering Fundamentals	Pearson Education, New Delhi	2015

19GES06 MECHANICAL AND BUILDING SCIENCES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To get the knowledge on various type of power generation,
- To know about IC Engines and Boilers.
- To familiarize on Refrigeration and Air Conditioning.
- To posses knowledge about Surveying
- To know about the Civil Engineering materials and Building Elements

COURSE OUTCOMES

- Demonstrate the various power generation techniques.
- Outline the working principles of IC Engines and Boilers.
- Familiarize the Refrigeration and Air Conditioning systems.
- Understand the principles of field measurement in surveying.
- Gathered knowledge in civil engineering materials and Building Elements

A. MECHANICAL ENGINEERING

UNIT I: POWER PLANT ENGINEERING **8**

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps– working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT II:IC ENGINES **8**

Internal combustion engines– Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler –fire tube-water tube-Bensen boiler.

UNIT III: REFRIGERATION AND AIR CONDITIONING SYSTEM **7**

Terminology of Refrigeration and Air Conditioning. Principle of vapor compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

B. BUILDING SCIENCES

UNIT IV : FUNDAMENTALS OF SURVEYING **7**

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Surveying – objectives – divisions – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

UNIT V : MATERIALS AND FOUNDATIONS 7

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections – Foundations: Types, Bearing capacity – Requirement of good foundations.

UNIT VI : BUILDING ELEMENTS AND STRUCTURES 8

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – basics of interior design – Bridges – Dams.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shanmugam G and Palanichamy M S	Basic Civil and Mechanical Engineering	McGraw Hill Publishing Co., New	**1996**
2.	Ramamrutham S	Basic Civil Engineering	DhanpatRai Publishing Co. (P) Ltd.	2015

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Venugopal K. and Prahu Raja V	Basic Mechanical Engineering	Anuradha Publishers, Kumbakonam	2016
2.	Shantha Kumar S R J	Basic Mechanical Engineering	Hi-tech Publications, Mayiladuthurai	2014
3.	PrabhuT.J,Jai Ganesh. V and Jebaraj.S	Basic Mechanical Engineering	ScitechPublications,Chennai	2010
4.	Seetharaman S	Basic Civil Engineering	Anuradha Agencies	2015
5.	SatheeshGopi	Basic Civil Engineering	Pearson Publishers	2009

19GES07 COMPUTER AIDED DRAFTING LABORATORY **L T P C**
0 0 3 1

COURSE OBJECTIVES

- To construct various curves in engineering applications.
- To understand the principles of projection to project points, lines and planes.
- To draw the orthographic views of solids.

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- To draw the projection of solids in simple position and with their axis inclined.
- .To be able to construct the development of surfaces.

COURSE OUTCOMES

- Understand the basics of drawing instruments and standards.
- Construct various curves used in engineering applications.
- Comprehend and draw orthographic vies of various solids
- Explain and draw the projection of points, lines and planes
- Draw the projection of solids and development of surfaces using CAD software.

CONCEPTS AND CONVENTIONS 4

(Not for Examination) Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination) 6

Importance 2d Drafting, sketching, modifying, transforming and dimensioning

UNIT I: PLANE CURVES 10

Curves used in engineering practices, Conics, Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: PROJECTION OF POINTS, LINES AND PLANES 10

General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Projection of points, Projection of straight lines located in the first quadrant, Projection of polygonal surface inclined to both reference planes.

UNIT III: ISOMETRIC TO ORTHOGRAPHIC VIEWS 10

Representation of three dimensional objects, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects, Drawing orthographic views of various solids, Dimensioning.

UNIT IV: PROJECTION OF SOLIDS 10

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.

UNIT V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 10

Sectioning of simple solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.

****NOTE: Students have to give descriptive answers to the questions from first two units and need to draw the answer figures using CAD software for the questions from the last three units in end semester exam.**

TOTAL: P: 60 = 60

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	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
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House, 50th Edition	2010

19GES08 **PYTHON PROGRAMMING** **L T P C**

3 0 0 3

COURSE OBJECTIVES

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and call them.

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

COURSE OUTCOMES

1. Read, write, execute by hand simple Python programs.
2. Structure simple Python programs for solving problems.
3. Decompose a Python program into functions.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python Programs.

UNIT I INTRODUCTION **9 HOURS**

The way of programming-What is programming- debugging – formal and natural languages - Python: Features - Installing - Running – Python interpreter and interactive mode.

UNIT II VARIABLES, EXPRESSIONS, CONDITIONALS **9 HOURS**

Values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass;

UNIT III FUNCTIONS, STRINGS **9 HOURS**

Functions, function definition and use, flow of execution. 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.

UNIT IV 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.

UNIT V FILES, MODULES, PACKAGES **9 HOURS**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages.

Total: 45 Hours

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TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Allen B. Downey	Think Python: How to Think Like a Computer Scientist	O'Reilly Publishers	2016
2.	Guido van Rossum and Fred L. Drake Jr	An Introduction to Python	Network Theory Ltd	2011

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Charles Dierbach	Introduction to Computer Science using Python: A Computational Problem-Solving Focus	Wiley India Edition	2013
2.	John V Guttag	Introduction to Computation and Programming Using Python	MIT Press	2013
3.	Kenneth A. Lambert	Fundamentals of Python: First Programs	CENGAGE Learning	2012
4.	Paul Gries, Jennifer Campbell and Jason Montojo	Practical Programming: An Introduction to Computer Science using Python 3	Pragmatic Programmers,LLC	2013
5.	Timothy A. Budd	Exploring Python	Mc-Graw Hill Education (India) Private Ltd	2015

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19GES09 **PROGRAMMING IN PYTHON LAB** **L T P C**
0 0 3 1

LIST OF EXPERIMENTS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

19GES10 **SOFT SKILLS LABORATORY** **L T P C**
0 0 3 2

COURSE OBJECTIVES

- To Analyse the Strength and Weakness of an Individual
- To build an effective team in work place
- To develop effective Time Management Skills
- To describe the qualities of an Effective Presenter
- To improve Health and Social life

COURSE OUTCOMES

- Identifying the Career Path
- Developing the leadership Qualities for the betterment of the team
- Developing Effective Time Management Skill
- Understanding the importance of Effective Communication
- Handling Stress and Developing Problem Solving Skill

UNIT I Self Analysis

SWOT Analysis – Intra Personal Skill – Inter Personal Skill

UNIT II Team Work

Importance of a Team Player – Leadership Quality – Decision Making Skill

UNIT III Time management

Effective Planning – Goal Setting – Spending right time on right job

UNIT IV Presentation skill

Verbal Communiction – Non Verbal Communication

UNIT V Stress Management

Eustress -- Distress – Emotional Intelligence – Fear Management (Crowd Fear, Exam Fear, Stage Fear)

19GES11	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know about the basics of Semiconductor Diodes
- To know about the working principle and characteristics of BJT.
- To know about the operation and characteristics of FET.
- To know about the biasing techniques of BJT and FET.
- To understand the working function and applications of special diodes and optoelectronic devices.

COURSE OUTCOMES:

After the completion of the course, the students can able to

- Understand the theory, operation and characteristics of semiconductor diodes.
- Explain the basics and characteristics of BJT
- Describe the construction, working principle and characteristics of FET
- Discuss about the biasing of BJT and FET.
- Understand the working function and applications of special diodes and optoelectronics devices.

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UNIT I: SEMICONDUCTOR DIODES 9

Review of Semiconductor Physics-Drift and diffusion currents-Continuity Equation-Theory of PN Junction Diode-Diode Current Equation-Current Voltage Characteristics-Effect of Temperature on PN Junction diodes-Diffusion Capacitance-Applications: Rectifiers, Clippers, Clampers-Avalanche Breakdown Mechanism-Zener Diode as a Voltage Regulator.

UNIT II: BIPOLAR JUNCTION TRANSISTORS 9

Bipolar Junction Transistor Operations-Configurations: CC, CB, CE-Transistor Current Components-Ebermoll's Model of Transistor-Small Signal Low Frequency Hybrid-High Frequency Effects-Transistor as an Amplifier and Switch.

UNIT III: FIELD EFFECT TRANSISTORS 9

Operation and Characteristics of JFET-Configurations of JFET-JFET as Amplifier, Switch, Voltage Variable Resistor-Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-Enhancement and Depletion Mode MOSFET-Characteristics of n-MOS and p-MOS-Introduction to CMOS.

UNIT IV: BIASING OF BJT AND FET 9

DC operating point and Load line-Q point-Bias Stability-Transistor Biasing Methods: Fixed Bias-Collector to Base Bias-Self biasing, Thermal Runaway, Thermal Stability-FET biasing methods: Self bias-Source bias-Voltage divider bias-Biasing MOSFETs.

UNIT V: SPECIAL DIODES AND OPTO ELECTRONIC DEVICES 9 Theory and Characteristics of Schottky Diode-Tunnel Diode-Varactor Diode-SCR-TRIAC-LDR-UJT-Photoemissivity and Photoconductivity-Photoconductive Cell-Photo Voltaic Cell-Photodiode-Phototransistors-Construction and Characteristics of LCD and LED-LASER Diodes- Opto Couplers, FINFET.

TOTAL: 45

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Jacob Millman, Christos Halkias & Satyabrata Jit, Millman's	Electronic Devices and Circuits	McGraw Hill	2nd Edition, 2008.
2	Robert L.Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson education	11th Edition,2012

REFERNCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Allen Mottershead	Electronic Devices and Circuits	Prentice Hall of India	2008
2	Douglas.A.Pucknell, Kamran Eshraghian	Basic VLSI Design, Principles and Application	Prentice Hall of India	2009

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3	S.Salivahanan, N.Sureshkumar and A.Vallavaraj	Electronic Devices and Circuits	Tata McGraw Hill	2nd Edition, , 2008
4	Donald A. Neamen	Semiconductor Physics and Devices	Tata McGraw Hill	Third Edition
5	S. M. Sze	Semiconductor Devices: Physics and Technology	Wiley	Second Edition

19GES12 ELECTRONIC SIMULATION LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

The objectives of this laboratory course are,

- To understand the operation of semiconductor devices using laboratory equipments and simulation software.
- To design and test the electronic circuits using laboratory devices, equipments and simulation software.

COURSE OUTCOMES:

After the completion of the course, the students can able to

- Measure and interpret the parameters of diodes and transistors
- Construct and analyze the amplifier using BJT.
- Construct and analyze the voltage regulator.
- Design and measure various wave shaping circuits using diodes.
- Measure and interpret the parameters of different special diodes.

LIST OF EXPERIMENTS:

1. Analyze the Device Behaviour of Semiconductor Diodes.
2. Analyze the Characteristics of Bipolar Junction Transistors.
3. Design and Analysis of BJT as an amplifier.
4. Analyze the Device Behaviour of FETs.
5. Design and Analysis of Voltage Regulators.
6. Design and Analysis of Rectifiers.
7. Design and Analysis of Clippers and Clampers.
8. Analyze the device Behaviour of UJT.
9. Analyze the device Behaviour of SCR.
10. Analyze the characteristics of LED, LDR and Photodiode.

19GES13 ELECTRIC CIRCUITS

L	T	P	C
2	1	0	3

COURSE OBJECTIVES

- To communicate the knowledge on DC circuits and its analysis.
- To impart knowledge on AC circuits and its analysis.

- To impart knowledge on solving circuits equations using network theorems.
- To introduce the concept of resonance circuits and transient response in circuits.
- To impart knowledge on balanced and unbalanced in three phase circuits.

COURSE OUTCOMES

- Able to analyze DC circuits
- Able to give details on the AC circuits and analyze.
- Able to solve the different type of network problems
- Able to implement the resonance condition in the power circuits.
- Able to analyze the different type of load in three phase circuits.

UNIT I DC CIRCUITS **6+3**

Basic circuit elements - Ohm's law - Resistors in series and parallel circuits - Voltage division and current division - Kirchhoff's laws - Source transformation - Star-Delta conversion - Mesh and nodal analysis.

UNIT II AC CIRCUITS **6+3**

Introduction to AC circuits- Form Factor - Phase and phase difference - Sinusoidal Voltage and Current - Single phase AC circuits - Series and parallel RL, RC and RLC circuits - Power - Power factor.

UNIT III NETWORK THEOREMS FOR DC AND AC CIRCUITS **6+3**

Superposition theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem - Reciprocity theorem- Compensation theorem

UNIT IV RESONANCE CIRCUITS AND TRANSIENT RESPONSE **6+3**

Series and parallel resonance - Quality factor and bandwidth - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input.

UNIT V THREE PHASE CIRCUITS **6+3**

Three phase balanced / unbalanced voltage sources - Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads - Phasor diagram of voltages and currents - Power and Power factor measurements in three phase circuits.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles K. Alexander, Mathew N.O. Sadiku	Fundamentals of Electric Circuits	McGraw Hill	2013
2.	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin	Engineering Circuits Analysis	McGraw Hill publishers New Delhi	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jegatheesan, R	Analysis of Electric Circuits	McGraw Hill	2015
2.	Mahadevan, K., Chitra, C	Electric Circuits Analysis	Prentice-Hall of India Pvt Ltd., New Delhi	2015
3.	Sudhakar A and Shyam Mohan SP	Circuits and Network Analysis and Synthesis	McGraw Hill	2015
4.	M E Van Valkenburg	Network Analysis	Prentice-Hall of India Pvt Ltd, New Delhi	2015
5.	Chakrabarti A	Circuits Theory (Analysis and synthesis)	Dhanpath Rai & Sons, New Delhi	2011

19GES14 **ELECTRIC CIRCUITS LABORATORY** **L T P C**
0 0 3 1

COURSE OBJECTIVES

- To simulate various electric circuits using Matlab
- To gain practical experience on electric circuits and verification of theorems

COURSE OUTCOMES

- Able to simulate the electrical circuits
- Able to design the circuit and implement in hardware

LIST OF EXPERIMENTS:

1. Verification of ohm's law
2. Verification of Kirchhoff's voltage and current laws.
3. Verification of Thevenin's theorem
4. Verification of Norton 's theorem
5. Verification of Superposition theorem
6. Verification of Maximum Power Transfer Theorem.
7. Study of CRO and measurement of sinusoidal voltage and frequency.
8. Determination of time constant of series R-C electric circuits.
9. Determination of frequency response of series & parallel RLC circuits.
10. Calibration of single phase energy meter.
11. Determination of power in three phase circuits by two-watt meter method.

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TOTAL: 45 Hours

19GES15 **MANUFACTURING PROCESSES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the students to the concept of some basic production processes and fabrication techniques.
- Understand the Concept of metal castingproceses,
- To understand metal joining processes.
- Understanding metal forming Processes.
- To study the Plastic and composite materialmouldingprocesses

COURSE OUTCOMES

- Understand the concepts of casting processes..
- Study about fabrication processes to join the different metals.
- Understand the concept of bulk deformation process.
- Study about the metal forming processes.
- Understand the process of composite materials.

UNIT I **CASTING PROCESSES** **9**

Introduction–Patterns, Requirements of a good pattern, pattern materials, types of patterns, pattern allowances–Mould making, types of moulds, moulding processes, types of sand moulding–Coremaking,typesofcores,coreprints,corebox-MouldingSand Properties of mouldings and, types of moulding sand–Melting equipment, cupola furnace, crucible furnace, electric furnace–Gating system–Casting processes, Sand casting, Shell-mould casting, Investment casting, Die casting, centrifugal casting –Defects, Cleaning and Inspection of casting.

UNIT II **FABRICATION PROCESSES** **9**

Introduction–Classification of welding processes–Resistance welding, spot, seam, projection, butt welding–Gaswelding,oxy-acetylenewelding,equipments–Arcwelding,shielded arc welding, TIG, MIG, submerged arc welding, electro-slag welding, ultrasonic welding, plasma arc welding, laser beam welding, friction welding–Soldering and Brazing–Testing and Inspection of welded joints, Defects in welds.

UNIT III **BULK DEFORMATION PROCESSES** **9**

Introduction–Cold and hot working processes Rolling, classification of rolling, principle, rolling stand arrangement, defects in rolling–Forging, classification of forging, methods of forging, defects in forging–Extrusion, Classification of extrusion, Hot and cold extrusion processes, extrusion defects and equipments–Drawing, Drawing of rods, wire and tubes.

UNIT IV **METAL FORMING PROCESSES** **9**

Introduction-Metal stamping and forming, bending, deep drawing, stretch forming, metals pinning, blanking, piercing, embossing and coining, notching, punching, roll forming, rubber press forming, hydro-mechanical forming–Comparison of metal forming processes–Defects in sheet metal formed parts.

UNIT V **PLASTIC AND COMPOSITE MATERIAL PROCESSES** **9**

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Processing of plastics, compression moulding, transfer moulding, injection moulding, blow moulding, thermo forming and calendaring-advantages of plastic materials–Introduction to composite material–Classification of composite materials–advantages of composite materials.

TOTAL: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RajputR.K	ATextBookofManufacturingTechnology	Laxmipublications(P) Ltd,NewDelhi,	**2008**
2.	SharmaP.C	ATextBookofProductionTechnology	S.ChandandCompany IVEdition,	2004

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RaoP.N,	ManufacturingTechnologyVol. 1	TataMcGrawHillpublishingcompanylimited,NewDelhi,3rd edition,	2009
2.	HajraChoudhury	ElementsofWorkshopTechnologyVol.1&2.	MediapromotersPvtLtd. ,Mumbai	2007.
3.	SeropeKalpajianand Steven R.Schmid	Manufacturing Engineering and Technology	PearsonEducationInc. , SecondIndianReprint	2002
4.	JainR.K	Production Technology	KhannaPublications	2001
5.	LuqmanMidhat	Production Processes	CBS; 1ST edition	2010

19GES16 **MANUFACTURING PROCESSES LAB** **L T P C**
0 0 3 1

COURSE OBJECTIVES

- To introduce the students to the concept of some basic production processes and fabrication techniques.
- Understand the Concept of metal casting proceses,
- To understand metaljoining processes.
- Understanding metal forming Processes.
- To study the Plastic and composite material moulding processes

COURSE OUTCOMES

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- Understand the concepts of casting processes..
- Study about fabrication processes to join the different metals.
- Understand the concept of bulk deformation process.
- Study about the metal forming processes.
- Understand the process of composite materials.

List of Experiments

1. Fitting work :preparation of l joint, v-joint
2. Carpentry work :Preparation of T-Joint, Lap joint, Dovetail Joint
3. Plumbing Work : Basic pipe connections (PVC) involving the fittings like Valves, Taps, and Bends., Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends
4. Sheet metal Work: Construction of Tray, Funnel and cone
5. Foundry : Solid pattern Moulding, Split pattern Moulding , Core making
6. Welding : Vertical Welding and Horizontal Welding
7. Lathe Work : Plain Turning, Step Turning, Taper Turning, and Knurling operation.

TOTAL: 30 Hours

16GES17	MECHANICAL AND BUILDING SCIENCES LAB	L T P C 0 0 3 1

COURSE OBJECTIVES:

- At the end of course the student will plan the pipe connections in PVC, G.I pipes.
- Analyze to separate the woods with tools and made of several pieces with proper types of joints using tools and machines.
- Demonstrate and remove materials from metal components and assemble the components.
- Join two metals by melting their edges by electric arc welding.
- Demonstrate Residential house wiring and Fluorescent lamp wiring.

COURSE OUTCOMES

- The students are able to make different pipe connections using PVC, G.I pipes.
- The students demonstrate different types of joints using carpentry and power tools.
- They categories various sheet metal working tools and fitting tools.
- They are able to use welding equipments to join structures.
- Students organize household wirings.

UNIT I: CIVIL ENGINEERING PRACTICE 25

1. PLUMBING WORK

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, Elbows and household fittings.
2. Basic pipe connections (PVC) involving the fittings like Valves, Taps, and Bends.
3. Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends

2. CARPENTRY WORK

1. Study of Carpentry Tools
2. Preparation of T-Joint
3. Preparation of Lap joint
4. Preparation of Dovetail Joint

UNIT II **MECHANICAL ENGINEERING PRACTICE** **25**

FITTING WORK

1. Study of Sheet Metal Work.
2. Preparation of L joint
3. Preparation of V-joint

WELDING

1. Study of Welding Equipments and Tools
2. Preparation of Butt joint
3. Preparation of Lap joint
4. Preparation of Tee joint
5.

MACHINE ASSEMBLY PRACTICE

1. Assembly and Dismantling for gear box.
2. Assembly and Dismantling for the two wheeler wheel.

UNIT III **ELECTRICAL ENGINEERING PRACTICE** **10**

1. Residential house wiring
2. Fluorescent lamp wiring.
3. Stair-case Wiring and Door bell wiring

19GES18 **CONSTRUCTION MATERIALS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce students to various materials commonly used in civil engineering construction and their properties.
- To study about the concrete design mix.
- To know about the procedures in concreting.
- To understand special concrete and their use.
- To know about the manufacture of cement.

COURSE OUTCOMES

At the end of the course the student will be able to

- Demonstrate knowledge of construction materials and their usages in building projects.
- Learning to further research in advancement of civil engineering materials field.

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- Identify the materials including their sources and production and properties.
- Understood characteristics of conventional building materials like stone, brick, wood etc.
- Learned about new and composite materials and their value adding characteristic of being lightweight, energy efficient, speedy construction among others.

UNIT I: STONES – BRICKS – CONCRETE BLOCKS **9**

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – brick earth – composition and harmful constituents – Efflorescence – Bricks for special use –Refractory bricks – Cement, Concrete blocks – Light weight concrete blocks.

UNIT II : CEMENT – AGGREGATES – MORTAR **9**

Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Tests on cement– Industrial byproducts – Fly ash Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – abrasion Resistance – Grading – Sand Bulking.

UNIT III : CONCRETE **9**

Concrete – Ingredients – Manufacturing Process – RMC – Tests on fresh and hardened concrete – Modulus of rupture – Mix specification – Mix proportioning – BIS method –Admixtures and their functions – High Strength Concrete and HPC – Other types of Concrete – Durability of Concrete – Corrosion – Causes and effects – remedial measures – Thermal properties of concrete – Micro cracking of concrete – Quality of Water for mixing and curing – use of sea water for mixing concrete.

UNIT IV : TIMBER AND OTHER MATERIALS **9**

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates .
Ferrous metals: Iron and steel, basic metallurgy, composition and grades, market forms and heat treatment 0 Steel as reinforcement – Corrosion of metals and protection.
Non –ferrous metals: Aluminum, copper, brass and glass products – properties – applications.

UNIT V : MODERN MATERIALS **9**

Glass – Ceramics – Sealants for joints – Fiber glass reinforced plastic – Clay products – Refractory's – Composite materials – Types – Applications of laminar composites – Fiber textile – Geo membranes and Geotextiles for earth reinforcement – polymers and plastics: walls, pipes and sanitary ware, glues and mastics – acid and chemical resistant products.

TOTAL : 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Duggal.S.K	Building Materials	4th Edition, New Age International	2016
2	Edward Allen and Joseph Iano	Fundamentals of Building Construction: Materials and Methods	Wiley, 6th Edition	2013

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REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Varghese. P.C	Building construction	Prentice Hall of India Pvt. Ltd, New Delhi	2012
2	Shetty.M.S	Concrete Technology (Theory and Practice)	S. Chand and Company Ltd	2014
3	Arora S.P. and Bindra S.P	The Text Book of Building Construction	Dhanpat Rai and Sons	1999
4	G.S.Birdie, T.D.Ahuja	Building Construction and construction materials	Dhanpat Rai publishing company, New Delhi.	2007
5	Gambhir.M.L	Concrete Technology	3rd Edition, Tata McGraw Hill Education	2009

19GES19 **CONCEPTS IN PRODUCT DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To apply different ideas to manage innovation and development
- To analyze the product specification
- To know the concepts of CAD ,CAM ,CAE
- To develop product geometry, fundamental and conceptualization management
- To estimate and also to analyse the manufacturing components and assembly cost

COURSE OUTCOMES

- Apply different ideas enabling people to manage to work with innovation and development in organization.
- Examine the product specification select concept, product performance and manufacturing
- Develop product geometry, layout, fundamental and incidental interaction
- Design the integrated process robust design, conceptualization and management of industrial design.
- Estimate and Analyze the manufacturing components and assembly cost, planning for prototypes.

UNIT I: INTRODUCTION **9**

Strategic importance of Product development - integration of customer, designer, material supplier and process planner, Competitor and customer - behavior analysis. Understanding customer-promoting customer understanding-involve customer in development and managing requirements

UNIT II : CONCEPT GENERATION, SELECTION AND TESTING 9

Plan and establish product specifications. Task - Structured approaches - clarification – search externally and internally- reflect on the solutions and processes -concept selection - methodology - benefits. Implications - product performance – manufacturability.

UNIT III: PRODUCT ARCHITECTURE 9

Product development management - creation - clustering -geometric layout development - Fundamental and incidental interactions - related system level design issues - secondary systems -architecture of the chunks - creating detailed interface specifications-Portfolio Architecture.

UNIT IV: INDUSTRIAL DESIGN 9

Integrate process design - Managing costs - Robust design - Integrating CAE, CAD, CAM tools – Simulating product performance and manufacturing processes electronically - Need for industrial design-impact – design process - investigation of customer needs – conceptualization- refinement - management of the industrial design process.

UNIT V: DESIGN FOR MANUFACTURING AND PRODUCT DEVELOPMENT 9

Definition - Estimation of Manufacturing cost-reducing the component costs and assembly costs – Minimize system complexity - Prototype basics - Principles of prototyping – Planning for prototypes - Economic Analysis.

TOTAL: L: 45 Hours

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ulrich K.T. and Eppinger S.D	Product Design and Development	McGraw –Hill International Editions	1999
2	Kevin Otto	Product Design	Pearson Education,	2004

REFERENCE BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Rosenthal S	Business One Orwin	Business One	1992

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		Homewood	Orwin, Homewood	
2	Rosenthal S	Effective Product Design and Development	Business One Orwin, Homewood	1992
3	Pugh S	Total Design – Integrated Methods for successful Product Engineering	Addison Wesley Publishing	1991
4	Clive L.Dym	Engineering Design: A Project-based Introduction	John Wiley & Sons	2009
5	Yousef Haik	Engineering Design Process	Cengage Learning	2010

19GES20 **RENEWABLE ENERGY SOURCES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- At the end of the course, the students are expected to identify the new methodologies/ technologies for effective utilization of renewable energy sources.
- To understand reverse of energy recourses.
- Understand solar energy production and applications.
- To understand wind energy systems.
- Other energy recourses are studied and learned.

COURSE OUTCOMES

- Understand the fundamentals of energy scenario.
- Illustrate the techniques used in utilization and measurement of solar energy
- Demonstrate the types and performance of wind energy systems
- Comprehend and identify the bio-mass energy sources and applications.
- Outline the utilization techniques of tidal, wave, Hydro, geothermal, fuel cell systems and hybrid system energy sources.

UNIT I: **INTRODUCTION** **9**

World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario in Tamilnadu, India and around the World - Potentials - Achievements / Applications – Economics of renewable energy systems.

UNIT II: **SOLAR ENERGY** **9**

Solar Radiation – Measurements of Solar Radiation - Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT III: **WIND ENERGY** **9**

Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance - Site Selection – Details of Wind Turbine Generator – Safety and Environmental Aspects.

UNIT IV: **BIO - ENERGY** **9**

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Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration - Biomass Applications.

UNIT V: OTHER RENEWABLE ENERGY SOURCES 9

Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy Hydrogen and Storage - Fuel Cell Systems – Hybrid Systems.

TOTAL: L: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G.D. Rai	Non Conventional Energy Sources,	Khanna Publishers, New Delhi,	2011.
2.	Twidell, J.W. & Weir	A., Renewable Energy Sources	EFN Spon Ltd., UK,	2006

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David M. Mousdale	Introduction to Biofuels,	CRC Press Taylor & Francis Group, USA	2010
2.	Chetan Singh Solanki	Solar Photovoltaic, Fundamentals, Technologies and Applications,	PHI Learning Private Limited, New Delhi	2009
3.	S.P. Sukhatme	Solar Energy	Tata McGraw Hill Publishing Company Ltd., New Delhi,	1997.
4.	Sinduja S	Renewable Energy Sources	Anuradha Publications	2012
5.	Tasneem abbasi and T.A Abbasi	Renewable Energy Sources: Their Impact on Global Warming and Pollution	Prentice Hall India Learning Private Limited	2010

19GES21 ELECTRICAL DRIVES AND CONTROLS

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand the basics of electrical drives.
- To study the drive motor characteristics,
- To study the different methods of starting D.C motors and Induction Motors.
- To study the Conventional and Solid-State DC Drives.

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- To study the Speed Control of AC Drives.

COURSE OUTCOMES

1. Able to explain the basics of electrical drives.
2. Able to describe drive motor characteristics
3. Able to demonstrate the methods of starting D.C motors and Induction Motors.
4. Able to describe speed control of DC drives.
5. Able to explain the conventional and solid state speed control of AC drives.

UNIT I INTRODUCTION 9

Basic Elements - Types of Electric Drives - Factors are influencing the choice of Electrical Drives - Heating and Cooling Curves - Loading conditions and classes of duty - Selection of power rating for drive motors with regard to thermal overloading and Load variation factors.

UNIT II DRIVE MOTOR CHARACTERISTICS 9

Dynamics of Motor load system – Multiquadrant operation – DC Motor (Types, Torque Equation, Characteristics and Applications) - Single phase induction motor (Types and Applications) - Three phase induction motors(Types, Characteristics) - Braking of Electric motors.

UNIT III STARTING METHODS 9

Necessity of a starters – Types of DC Motor Starters – Types of 3 phase squirrel cage and slip ring Induction Motor Starters.

UNIT IV CONVENTIONAL AND SOLID STATE SPEED CONTROL OF DC DRIVES 9

Speed control of DC series and shunt motors - Armature and field control - Ward-Leonard control system using controlled rectifiers and DC choppers.

UNIT V CONVENTIONAL AND SOLID STATE SPEED CONTROL OF AC DRIVES 9

Speed control of three phase induction motor - Voltage control, voltage / frequency control and slip power recovery scheme using inverters and AC voltage regulators.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	G. K. Dubey	Fundamentals of Electrical Drives	CRC press	2002
2.	Vedam Subrahmaniam	Electric Drives (Concepts and Applications)	Tata McGraw-Hill	2010

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	Gnanavadivel J Karthikeyan J Chitra Selvi S	Electrical Drives and Controls	Anuradha Publishers	2004
2.	Thiyagarajan V	Electrical Drives and Controls	A.R. Publications	2015
3.	Pillai SK	A First Course on Electric Drives	New age international publishers	2013
4.	Jagadeesh Babu V	Electrical Drives and Controls	Scitech Publications	2015
5.	Austin Hughes and Bill Drury	Electric Motors and Drives	Newness Heinemann Publishers	2018

19GES22 ELECTRICAL DRIVES AND CONTROLS LABORATORY

L	T	P	C
3	0	0	1

OBJECTIVES:

- To study the conventional and solid-state drives
- To study the different methods of starting D.C motors and induction motors.
- To understand the basic concepts of different types of electrical machines and their performance.

LIST OF EXPERIMENTS:

1. Load test on DC Shunt & DC Series motor.
2. O.C.C & Load characteristics of DC Shunt and DC Series generator.
3. Speed control of DC shunt motor (Armature, Field control).
4. Load test on single phase transformer.
5. O.C & S.C Test on a single phase transformer.
6. V curves and inverted V curves of synchronous Motor.
7. Load test on three phase squirrel cage Induction motor.
8. Speed control of three phase slip ring Induction Motor.
9. Load test on single phase Induction Motor.
10. Study of DC & AC Starters.

TOTAL: 45 Hours

19GES23 ANALOG AND DIGITAL COMMUNICATION

L	T	P	C
3	0	0	3

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COURSE OBJECTIVES

1. To Understand basic elements of a communication system
2. To Conduct analysis of baseband signals in time domain and in frequency domain
3. To Demonstrate understanding of various analog and digital modulation and demodulation techniques technique
4. To Analyses the performance of modulation and demodulation techniques in various transmission environments
5. To appreciate the importance of synchronization in communication systems

COURSE OUTCOMES

1. Explain and apply various types of modulation and demodulation in analog and digital Communication.
2. Describe the concept of digital communicationtechniques.
3. Describe the concept of various digital transmissiontechniques.
4. Comprehend the Cellular communicationtechniques.
5. Explain the concepts of Satellite communication and Optical communication

UNIT I FUNDAMENTALS OF ANALOG COMMUNICATION 9

Principles of amplitude modulation - AM envelope - frequency spectrum and bandwidth - modulation index andpercent modulation - AM Voltage distribution - AM power distribution - Angle modulation - FM and PM waveforms - phase deviation and modulation index - frequency deviation and percent modulation - Frequency analysis of angle modulated waves - Bandwidth requirements for Angle modulated waves.

UNIT II DIGITAL COMMUNICATION 9

Shannon limit for information capacity - Digital amplitude modulation - Frequency Shift Keying - FSK bit rateand baud - FSK transmitter - BW consideration of FSK - FSK receiver - Phase Shift Keying – BPSK, QPSK8- PSK - Quadrature Amplitude modulation – 8-QAM - bandwidth efficiency - Carrier recovery – squaring loop, Costas loop - DPSK.

UNIT III DIGITAL TRANSMISSION 9

Pulse modulation - PCM – PCM sampling - Sampling rate - Signal to Quantization noise rate - Commanding-analog and digital - Delta modulation PCM - Adaptive Delta modulation PCM - Differential PCM – Inter symbol interference - Eye patterns.

UNIT IV **CELLULAR COMMUNICATION** **9**

Fundamental concept of Cellular telephone - Frequency reuse, Interference - Co-channel Interference, Adjacent channel Interference - Cell splitting - Cell sectoring - Segmentation and Dualization - Roaming and Handoff.

UNIT V **SATELLITE AND OPTICAL COMMUNICATION** **9**

Kepler's Law - Satellite Orbits - Geo synchronous satellites - satellite system link models -Optical Fiber Communication system - Optical Fiber configurations - Optical Fiber classification Losses in Optical fiber cables - Optical sources - LED , Injection laser diode - Light detector - PIN diodes, Avalanche photo diode.

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Wayne Tomasi,	Electronic Communication Systems Fundamentals through Advanced	Pearson Education	2008
2.	H.Taub,D L Schilling,G Saha	Principles of Communication	Pearson Education	2008

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	B.P.Lathi	Modern Analog and Digital Communication	Oxford	2008

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		systems	University Press	
2.	Blake	Electronic Communication Systems	Thomson Delmar Publications	2002
3.	Martin S.Roden	Analog and Digital Communication System	PHI	2002
4.	B.Sklar	Digital Communication Fundamentals and Applications	Pearson Education	2007
5.	Simon Haykin	Communication Systems	John Wiley & Sons	2010.

19GES24 DIGITAL PRINCIPLES AND SYSTEM DESIGN **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To know about the basics of Boolean Algebra and Logic Gates.
- To Design and Implement Combinational Logic.
- To Design and Implement Synchronous Sequential Logic.
- To Design and Implement of Asynchronous Sequential Logic.
- Be familiar with the theory, construction, and operation of Basic Memory And Programmable Logic.

COURSE OUTCOMES:

- To Learn about the basics of Boolean Algebra and Logic Gates.
- To Learn about the basics Combinational Logic.
- To Learn about the basics Synchronous Sequential Logic.
- To Learn about the basics of Asynchronous Sequential Logic.
- Be familiar with the theory, construction, and operation of Basic Memory and Programmable Logic.

UNIT I: BOOLEAN ALGEBRA AND LOGIC GATES **6**

Review of Number Systems –Arithmetic Operations -Binary Codes–Boolean Algebra and Theorems – Boolean Functions–Simplification of Boolean Functions using Karnaugh Map and \Tabulation Methods – Logic Gates–NAND and NOR Implementations.

UNIT II :COMBINATIONAL LOGIC 6

Combinational Circuits –Analysis and Design Procedures–Circuits for Arithmetic Operations, Code Conversion –Decoders and Encoders –Multiplexers and Demultiplexers –Introduction to HDL –HDL Models of Combinational circuits.

UNIT III:SYNCHRONOUS SEQUENTIAL LOGIC 6

Sequential Circuits –Latches and Flip Flops –Analysis and Design Procedures –State Reduction and State Assignment –Shift Registers–Counters –HDL for Sequential Logic Circuits.

UNIT IV:ASYNCHRONOUS SEQUENTIAL LOGIC 6

Analysis and Design of Asynchronous Sequential Circuits–Reduction of State and Flow Tables –Race-free State Assignment–Hazards.

UNIT V:MEMORY AND PROGRAMMABLE LOGIC 6

RAM and ROM –Memory Decoding –Error Detection and Correction –Programmable Logic Array – Programmable Array Logic –Sequential Programmable Devices –Application Specific Integrated Circuits.

TOTAL: 30 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Education	IV Edition, 2008.
2.	John F. Wakerly,	Digital Design Principles and Practices	Pearson Education	IV Edition, 2007

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

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1.	Charles H. Roth Jr,	Fundamentals of Logic Design	Jaico Publishing House	Fifth Edition–, Mumbai, 2003
2.	Donald D. Givone	Digital Principles and Design	Tata Mcgraw Hill	2003
3.	Kharate G. K	Digital Electronics	Oxford University Press	2010
4.	Thomas L. Floyd	Digital Fundamentals	Pearson Education Inc	10th Edition, 2011
5.	Donald D.Givone	Digital Principles and Design	TMH	2003

19GES25 DIGITAL PRINCIPLES AND SYSTEM DESIGN LABORATORY

L	T	P	C
3	0	0	3

LIST OF EXPERIMENTS

1. Verification of Boolean theorems using digital logic gates
2. Design and implementation of combinational circuits using basic gates
3. Design and implementation of 4-bit binary adder / subtractor using basic gates and MSI devices.
4. Design and implementation of parity generator / checker using basic gates and MSI devices
5. Design and implementation of magnitude comparator.
6. Design and implementation of application using multiplexers/ Demultiplexers.
7. Design and implementation of Shift registers
8. Design and implementation of Synchronous and Asynchronous counters
9. Design and implementation of Coding combinational / sequential circuits using HDL

Programme Code & Name: RA & B.E-Robotics and Automation

19GES26	ENGINEERING DRAWING	L	T	P	C
		1	0	3	3

COURSE OBJECTIVES

- To construct various curves in engineering applications.
- To draw the projection of three dimensional objects representing machine structure.
- To analyze the principles of projection of various planes by different angle to project points, lines and planes.
- To draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- To identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- To transform the manual drawings to CAD drawings.

COURSE OUTCOMES

- Construct various curves in engineering applications.
- Draw the projection of three dimensional objects representing machine structure.
- Analyze the principles of projection of various planes by different angle to project points, lines and planes.
- Draw the projection of simple solid when axis is inclined to one reference plane by change of position method.
- Identify the interior components of machinery (or) buildings by sectioning the solid, and to study the development of simple solids for fabrication of sheet metals.
- Transform the manual drawings to CAD drawings.

CONCEPTS AND CONVENTIONS (Not for Examination) 4

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

COMPUTER AIDED DRAFTING (Not for Examination) 6

Importance 2d Drafting, sketching, modifying, transforming and dimensioning.

UNIT I: PLANE CURVES 13

Curves used in engineering practices, Conics, Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: ISOMETRIC TO ORTHOGRAPHIC VIEWS 13

Representation of three dimensional objects, General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects.

UNIT III: PROJECTION OF POINTS, LINES AND PLANE 13

(Free hand sketching) Projection of points, Projection of straight lines located in the first quadrant, Determination of true lengths and true inclinations, Projection of polygonal surface and circular lamina inclined to both reference planes.

UNIT IV: PROJECTION OF SOLIDS 13

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(Free hand sketching) Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by change of position method.

UNIT V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES **13**

(Free hand sketching) Sectioning of simple solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, (Obtaining true shape of section is not required). Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.

TOTAL: L: 15 + P: 60 = 7

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	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
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House, 50th Edition	2010

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19GES27 **ENGINEERING GEOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart the concepts of geological agents and their processes.
- To provide knowledge on various properties of minerals and their engineering significance.
- To give knowledge on various classifications of rocks.
- To understand the importance of geological investigations and mapping.
- To understand the applications of geological surveys in civil engineering structures.
- To give knowledge on various minerals.

COURSE OUTCOMES

- Understand the application of geology knowledge to Civil Engineering construction.
- Understand the concepts of various geological materials.
- Understand the properties, behaviour and engineering significance of different type of rocks and minerals.
- Learned the interpretation skills of geological maps having different type of geological features.
- Learned consideration and importance of geological aspects in civil engineering related infrastructure projects.
- Understand the concepts of various weathering processes.

UNIT I : PHYSICAL GEOLOGY **9**

Role of Geology in civil engineering – Branches of geology – Earth structures and composition – Elementary knowledge on continental drift and plate tectonics – Earth processes – weathering – soils – Geological work of river, wind and sea – Engineering importance – Earthquake belts in India – Ground water – Mode of occurrence –Prospecting .

UNIT II : MINEROLOGY **9**

Elementary knowledge on symmetry elements of important crystallographic systems – Physical properties of minerals – Study of the rock forming minerals – Quartz family – Feldspar family – Mica – Pyroxene family minerals – Fundamentals of process of formation of ore minerals – Properties, behaviour and engineering significance of clay minerals – Coal and petroleum – Their origin and occurrence in India.

UNIT III : PETROLOGY **9**

Classification of rocks – Distinction between igneous, sedimentary and metamorphic rocks – Occurrence, Engineering properties and distribution – Igneous rocks – Granite, syenite, diorite, gabbro, pegmatite, dolerite and basalt – sedimentary rocks – Sandstone, limestone, shale, conglomerate and breccias – Metamorphic rocks –Quartzite, marble, slate, phyllite, gneiss and schist.

UNIT IV : STRUCTURAL GEOLOGY AND MAP **9**

Attitude of beds – Outcrops – Contours – Introduction to geological maps – Folds – Faults and joints – Their bearing on engineering construction – Seismic and electrical methods for civil engineering investigations. Study of structures.

UNIT V : GEOLOGICAL INVESTIGATION **9**

Remote sensing for civil engineering applications; Geological conditions necessary for design and construction of Dams, Reservoirs, Tunnels, and Road cuttings. Causes and preventions – Sea erosion and Coastal protection.

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TOTAL: (L:45):45

EXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Parbin Singh.	A Text book of Engineering and General Geology	Katson publishing house, Ludhiana.	2010
2	Varghese, P.C	Engineering Geology for Civil Engineering	PHI Learning Private Limited, New Delhi	2012

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Muthiayya, V.D	A Text of Geology	Oxford IBH Publications, Calcutta.	2010
2	Blyth F.G.H. and De Freitas M.H	Geology for Engineers	Edward Arnold, London	2010
3	F.G.Bell.	Fundamentals of Engineering Geology	B.S. Publications. Hyderabad	2011
4	Dobrin, M.B	An introduction to geophysical prospecting	McGraw0Hill, New Delhi	2010
5	KVGK Gokhale	Principles of Engineering Geology	BS Publications, Hyderabad	2011

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19GES28 **ENGINEERING MECHANICS** **L T P C**
3 1 0 3

COURSE OBJECTIVES

- To generalize the scalar and vector representation of forces and moments.
- To explore truss, beam, frame and cable problems and respond to the distributed force systems.
- To predict Centroid and Moment of Inertia.
- To realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
- To recognize the effect of impact of elastic bodies.
- To comprehend the effect of friction on equilibrium.

COURSE OUTCOMES

- Generalize the scalar and vector representation of forces and moments.
- Explore truss, beam, frame and cable problems and respond to the distributed force systems.
- Predict Centroid and Moment of Inertia.
- Realize the Laws of Motion, Principle of Work and Energy, Kinematics & Kinetics of Motion and the interrelationship.
- Recognize the effect of impact of elastic bodies.
- Comprehend the effect of friction on equilibrium.

UNIT I: BASICS AND STATICS OF PARTICLES **15**

Introduction – Units and Dimensions – Laws of Mechanics – Lami's theorem, Parallelogram and triangular Law of forces – Vectorial representation of forces – Vector operations of forces – additions, subtraction, dot product, cross product – Coplanar Forces – rectangular components – Equilibrium of a particle – Forces in space – Equilibrium of a particle in space – Equivalent systems of forces – Principle of transmissibility .

UNIT II: EQUILIBRIUM OF RIGID BODIES **15**

Free body diagram – Types of supports – Action and reaction forces –stable equilibrium – Moments and Couples – Moment of a force about a point and about an axis – Vectorial representation of moments and couples – Scalar components of a moment – Varignon's theorem – Single equivalent force -Equilibrium of Rigid bodies in two dimensions – Equilibrium of Rigid bodies in three dimensions

UNIT III: PROPERTIES OF SURFACES AND SOLIDS **15**

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

UNIT IV: DYNAMICS OF PARTICLES **15**

Displacements, Velocity and acceleration, their relationship – Relative motion – Curvilinear motion – Newton's laws of motion – Work Energy Equation – Impulse and Momentum – Impact of elastic bodies.

UNIT V: FRICTION **15**

Friction force – Laws of sliding friction – equilibrium analysis of simple systems with sliding friction – wedge friction – Rolling – resistance.

TOTAL:L : 45 + T :30 = 75

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Beer, F.P and Johnston. E.R.,	Vector Mechanics for Engineers: Statics and Dynamics	Tata McGraw-Hill Publishing company, New Delhi	2013
2.	S. Timoshenko, D.H. Young, J.V. Rao and Sukumar Pati	Engineering Mechanics	McGraw Hill Education; 5 edition	2013

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hibbeller, R.C and Ashok Gupta	Engineering Mechanics: Statics and Dynamics	Pearson Education	2010
2	Irving H. Shames and Krishna Mohana Rao. G	Engineering Mechanics – Statics and Dynamics	Pearson Education	2006
3	Meriam J.L. and Kraige L.G	Engineering Mechanics	John Wiley & Sons	2013
4	Rajasekaran S and Sankarasubramanian G	Engineering Mechanics	Vikas Publishing House Pvt. Ltd	2005
5	Bhavikatti, S.S	Engineering Mechanics	New Age International (P) Limited Publishers	2015

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PROFESSIONAL CORES

(PC)

For

Robotics and Automation

Programme Code & Name: RA & B.E-Robotics and Automation

19RAC01 APPLIED HYDRAULICS AND PNEUMATICS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart the knowledge on applications of Fluid Power Engineering in Power transmission system.
- To familiarize hydraulic system and its components.
- To design hydraulic circuits for various application.
- To understand pneumatic systems, related components used in a system.
- To design the pneumatic system circuits.

COURSE OUTCOMES

19RAC01.CO1 Apply the fundamental laws of fluid power systems on real time applications.
19RAC01.CO2 Select the hydraulic pumps and actuators to the various engineering applications.
19RAC01.CO3 Design the hydraulic circuits for engineering applications.
19RAC01.CO4 Design the basic pneumatic circuits using various pneumatic components.
19RAC01.CO5 Design the hydro-pneumatic circuits using advanced fluid power techniques.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC01.CO1	X	X	X	X	-	X	X	-	-	X	-	X	X	-	-
19RAC01.CO2	X	X	X	-	-	X	X	-	-	X	-	X	X	-	-
19RAC01.CO3	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-
19RAC01.CO4	X	X	X	-	-	X	X	-	-	X	-	-	X	-	-
19RAC01.CO5	X	X	X	-	-	-	X	-	X	X	-	-	X	-	-

UNIT I: FLUID POWER SYSTEMS AND FUNDAMENTALS 9

Introduction to fluid power, Advantages of fluid power, Application of fluid power system. Types of fluid power systems, Properties of hydraulic fluids – General types of fluids –Fluid power symbols. Basics of Hydraulics-Applications of Pascal's Law- Laminar and Turbulent flow – Reynold's number – Darcy's equation – Losses in pipe, valves and fittings.

UNIT II: HYDRAULIC SYSTEM & COMPONENTS 9

Sources of Hydraulic Power: Pumping theory – Pump classification – Gear pump, Vane Pump, piston pump, construction and working of pumps – pump performance – Variable displacement pumps. Fluid Power Actuators: Linear hydraulic actuators – Types of hydraulic cylinders – Single acting, Double acting special cylinders like tanden, Rodless, Telescopic, Cushioning mechanism, Construction of double acting cylinder, Rotary actuators – Fluid motors, Gear, Vane and Piston motors.

UNIT III: DESIGN OF HYDRAULIC CIRCUITS 9

Construction of Control Components: Directional control valve – 3/2-way valve – 4/2-way valve – Shuttle valve – check valve – pressure control valve – pressure reducing valve, sequence valve, Flow control valve – Fixed and adjustable, electrical control solenoid valves, Relays, ladder diagram. Accumulators and Intensifiers: Types of accumulators – Accumulators circuits, sizing of accumulators, intensifier – Applications of Intensifier – Intensifier circuit.

UNIT IV: PNEUMATIC SYSTEMS AND COMPONENTS 9

Pneumatic Components: Properties of air – Compressors – Filter, Regulator, and Lubricator Unit – Air control valves, Quick exhaust valves, and pneumatic actuators. Fluid Power Circuit Design, Speed control circuits, synchronizing circuit, Pneumatic hydraulic circuit, Sequential circuit design for simple applications using cascade method.

UNIT V: DESIGN OF PNEUMATIC CIRCUITS 9

Servo systems – Hydro Mechanical servo systems, Electro hydraulic servo systems and proportional valves. Fluidics – Introduction to fluidic devices, simple circuits, Introduction to Electro Hydraulic Pneumatic logic circuits, ladder diagrams, PLC applications in fluid power control. Fluid power circuits; failure and troubleshooting.

TOTAL: L: 45

TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Anthony Esposito	Fluid Power with Applications	Pearson Education	2013
2	Majumdar S.R	Oil Hydraulics Systems-Principles and Maintenance	Tata McGraw-Hill	2001

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Srinivasan.R	Hydraulic and Pneumatic controls	Vijay Nicole	2006
2	Shanmugasundaram.K	Hydraulic and Pneumatic controls	Chand & Co.	2006
3	Majumdar S. R	Pneumatic systems– Principles and maintenance	Tata McGraw Hill	2001
4	Anthony Lal	Oil hydraulics in the service of industry	Allied publishers	1982
5	Harry L. Stevart D.B	Practical guide to fluid power	Taraoeala sons and Port Ltd.	1976

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19RAC02 FLUID MECHANICS AND MACHINERY

L T P C
3 0 0 3

COURSE OBJECTIVES

- To understand the applications of fluid in various engineering requirements.
- To explain the various losses in pipes.
- To understand the importance of dimensional analysis.
- To interpret the various types of pumps and its principles.
- To comprehend the types of flow in turbines.

COURSE OUTCOMES

19RAC02.CO1 Interpret the concepts of fluid properties and its characteristics
19RAC02.CO2 Analyze major and minor losses that can be applied in Engineering applications.
19RAC02.CO3 Identify the nature of physical quantities with dimensional analysis
19RAC02.CO4 Demonstrate the performance characteristics of hydraulic pumps
19RAC02.CO5 Demonstrate the performance characteristics of hydraulic turbines

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC02.CO1	X	X	X	-	-	X	X	X	-	X	-	X	X	-	-
19RAC02.CO2	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19RAC02.CO3	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19RAC02.CO4	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-
19RAC02.CO5	X	X	X	X	-	-	X	X	-	X	-	X	X	-	-

UNIT I: FLUID PROPERTIES AND FLOW CHARACTERISTICS 9

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics concept of control volume - application of continuity equation, energy equation and momentum equation

UNIT II: FLOW THROUGH CIRCULAR CONDUITS 9

Hydraulic and energy gradient - Laminar flow through circular conduits and circular annuli-Boundary layer concepts – types of boundary layer thickness – Darcy Weisbach equation –friction factor- Moody diagram- commercial pipes- minor losses – Flow through pipes in series and parallel.

UNIT III: DIMENSIONAL ANALYSIS 9

Need for dimensional analysis – methods of dimensional analysis – Similitude –types of similitude Dimensionless parameters- application of dimensionless parameters – Model analysis.

UNIT IV: PUMPS 9

Impact of jets - Euler"s equation - Theory of roto-dynamic machines – various efficiencies– velocity components at entry and exit of the rotor- velocity triangles - Centrifugal pumps– working principle -work done by the impeller - performance curves - Reciprocating pump- working principle – Rotary pumps classification.

UNIT V: TURBINES 9

Classification of turbines – heads and efficiencies – velocity triangles, axial, radial and mixed flow turbines, Pelton wheel, Francis turbine and Kaplan turbines- working principles - work done by water on the runner – draft tube. Specific speed - unit quantities – performance curves for turbines – governing of turbines.

TOTAL: L: 45: = 45

TEXT BOOKS

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dr. P.N. Modi& Dr. S.M. Seth	Hydraulics and Fluid Mechanics Including Hydraulics Machines	Rajsons Publications Pvt. Ltd. 20th edition	2015
2.	Dr. R. K. Bansal	A Textbook of Fluid Mechanics and Hydraulic Machines	Laxmi Publications, Ninth edition	2017

REFERENCE BOOKS

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Streeter, V. L. and Wylie E. B.	Fluid Mechanics	McGraw Hill Publishing Co.	2010
2	Kumar K. L.	Engineering Fluid Mechanics	Eurasia Publishing House(p) Ltd., New Delhi	2004
3	Robert W.Fox, Alan T. McDonald, Philip J.Pritchard,	Fluid Mechanics	Wiley, 9th Edition	2015
4	Graebel. W.P,	Engineering Fluid Mechanics	Taylor & Francis, Indian Reprint	2011
5	R.K.Rajput	A text book of Fluid Mechanics	S.Chand & co, New Delhi	2007

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC03 **MANUFACTURING TECHNOLOGY** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on the concepts and basic mechanism of metal cutting.
- To understand the constructional features and working principle of centre lathe, and special purpose lathes.
- To familiarize the working principle of various machining operations such as milling, shaping, planning, slotting, drilling and broaching.
- To understand the various abrasive processes.
- To understand the concepts of computer numerical control (CNC) machine tool and CNC programming

COURSE OUTCOMES

19RAC03.CO1 Analysis the metal cutting tool parameters for various machine tool working conditions.
19RAC03.CO1 Suggest the suitable Lathe machine and its operations for various engineering applications.
19RAC03.CO1 Suggest the suitable shaper and milling machines and its operations for making gears.
19RAC03.CO1 Select the suitable machine operation in grinding and broaching machine tool for engineering applications.
19RAC03.CO1 Write the various CNC part programming produce the engineering components.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC03.CO1	X	X	X	-	-	X	-	-	-	-	-	X	-	-	X
19RAC03.CO2	X	X	-	X	X	X	-	-	-	-	-	X	-	-	X
19RAC03.CO3	X	-	X	X	X	-	-	-	-	-	-	X	-	-	X
19RAC03.CO4	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X
19RAC03.CO5	X	X	-	-	-	-	-	-	-	-	-	X	-	-	X

UNIT I: THEORY OF METAL CUTTING 9

Mechanics of chip formation, single point cutting tool, forces in machining, Types of chip, cutting tools– nomenclature, orthogonal metal cutting, thermal aspects, cutting tool materials, tool wear, tool life, surface finish, cutting fluids and Machinability.

UNIT II: TURNING MACHINES 9

Centre lathe, constructional features, specification, operations – taper turning methods, thread cutting methods, special attachments, machining time and power estimation. Capstan and turret lathes- tool layout – automatic lathes: semi-automatic – single spindle: Swiss type, automatic screw type – multi spindle

UNITIII: SHAPER, MILLING AND GEAR CUTTING MACHINES 9

Shaper - Types of operations. Drilling, reaming, boring, Tapping. Milling operations-types of milling cutter. Gear cutting – forming and generation principle and construction of gear milling, hobbling and gear shaping processes – finishing of gears.

UNIT IV: ABRASIVE PROCESS AND BROACHING 9

Abrasive processes: grinding wheel – specifications and selection, types of grinding process– cylindrical grinding, surface grinding, centerless grinding and internal grinding- Typical applications – concepts of surface integrity, broaching machines: broach construction – push, pull, surface and continuous broaching machines

UNIT V: CNC MACHINING 9

Numerical Control (NC) machine tools – CNC types, constructional details, special features, machining center, part programming fundamentals CNC – manual part programming – micromachining – wafer machining

TOTAL: L: 45: = 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hajra Choudhury	Elements of Workshop Technology	Media Promoters	2008
2	Rao. P. N	Manufacturing Technology - Metal Cutting and Machine Tools	Tata McGraw-Hill	2013

REFERENCE BOOKS:

S. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Richerd R Kibbe, John E. Neely, Roland O. Merges and Warren J.White	Machine Tool Practices	Prentice Hall of India	2010
2	Jain.R.K	Production Technology: Manufacturing Processes, Technology and Automation	Khanna Publishers	2011
3	GeofreyBoothroyd	Fundamentals of Metal Machining and Machine Tools	McGraw Hill	2007
4	Roy. A.Lindberg	Manufacturing Technology - Metal Cutting and Machine Tools	PHI/Pearson Education	2006
5	Dr. B. Kumar	Manufacturing Technology	Khanna Publishers	2009

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC04 **DIGITAL ELECTRONICS** **L T P C**

3 0 0 3

COURSE OBJECTIVES

- To understand the basic postulates of Boolean algebra and shows the correlation between Boolean expressions
- To impart the knowledge on procedures for the analysis and design of combinational circuits
- To understand the procedures for the analysis and design of sequential circuits
- To understand the principles of synchronous and asynchronous sequential circuits
- To understand the concept of VHDL and programmable logic devices.

COURSE OUTCOMES

19RAC04.CO1 Apply Boolean algebra, K-Map and Tabulation method for simplification of Boolean expression.
19RAC04.CO2 Design combinational logic circuits for various applications.
19RAC04.CO3 Design shift registers, Modulo-N asynchronous and synchronous counters.
19RAC04.CO4 Design and analyze state machines for the given specifications.
19RAC04.CO5 Design Logic Memories and built VHDL Program.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC04.CO1	X	X	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC04.CO2	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-
19RAC04.CO3	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-
19RAC04.CO4	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-
19RAC04.CO5	X	X	X	-	X	-	-	-	-	-	-	-	X	X	-

UNIT I: BASIC CONCEPTS OF DIGITAL SYSTEMS AND LOGIC FAMILIES **9**

Review of Number systems, Number Representation, Boolean algebra, Boolean postulates and laws - De-Morgan 's Theorem - Principle of Duality, Simplification using Boolean algebra, Canonical forms - Sum of product and Product of sum - Minimization using Karnaugh map and Tabulation method, Digital Logic Families- TTL, ECL, CMOS

UNIT II: COMBINATIONAL CIRCUITS **9**

Realization of combinational logic using gates, Design of combinational circuits: Adder, Subtractor, Parallel adder Subtractor, carry look ahead adder, Magnitude Comparator, Parity generator and checker, Encoder, Decoder, Multiplexer, De-Multiplexer - Function realization using Multiplexer, Decoder - Code converters

UNITIII: SEQUENTIAL CIRCUITS **9**

Flip-flops - SR, JK, D and T- Master-Slave – Triggering - Characteristic table and equation – Application table – Asynchronous and synchronous counters - Shift registers - Types – Universal shift registers – Ring counter –Johnson Counters- Serial adder / Subtractor.

UNIT IV: SYNCHRONOUS AND ASYNCHRONOUS SEQUENTIAL CIRCUITS **9**

Mealy and Moore models – State diagram - State table – State minimization – State assignment - Excitation table - Design of Synchronous sequential circuits: Counters and Sequence generators- Circuit implementation - Asynchronous sequential circuits - Asynchronous sequential circuits, Hazard free combinational circuits.

UNIT V: PROGRAMMABLE LOGIC DEVICES MEMORY AND VHDL **9**

Memories: ROM, PROM, EPROM, PLA, PLD, FPGA – VHDL Programming: RTL Design – Combinational Logic – Types – Operators – Packages – Sequential Circuits – Sub Programs – Testbenches. (Examples: adders, counters, flip flops, FSM, Multiplexers / De-Multiplexers).

TOTAL: L: 45: = 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Morris Mano M. and Michael D. Ciletti	Digital Design	Pearson Education	2013
2	Donald D.Givone,	Digital Principles and Design	Tata Mc-Graw Hill Publishing company limited, New Delhi	2002

REFERENCE BOOKS:

S.No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Thomas L. Floyd	Digital Fundamentals	Pearson Education Inc	2011
2	Charles H. Roth Jr,	Fundamentals of Logic Design	Jaico Publishing House	2003
3	Leach D, Malvino A P & Saha	Digital Principles and Applications	Tata McGraw-Hill Publishing Company	2014
4	John F. Wakerly,	Digital Design Principles and Practices	Pearson Education	2007
5	John. M Yarbrough	Digital Logic Applications and Design	Thomson – Vikas Publishing House	2002

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC05 FLUID MECHANICS AND MACHINERY LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- To train to conduct the experiments using fluid flow measuring instruments.
- To train to conduct fluid flow losses using pipe line instrument.
- To train to conduct centrifugal /submergible pumps experiments.
- To train to conduct Reciprocating / gear pumps experiments.
- To train to conduct Pelton/ Francis/ Kaplan turbines experiments.

COURSE OUTCOMES

19RAC05.CO1 Interpret the results observed from the experiments using fluid flow measuring instruments.
19RAC05.CO2 Analysis the results observed from fluid flow losses in pipe lines.
19RAC05.CO3 Analysis the performance characteristics of centrifugal /submergible pumps
19RAC05.CO4 Analysis the performance characteristics of Reciprocating / gear pumps
19RAC05.CO5 Analysis the performance characteristics of Pelton/ Francis/ Kaplan turbines

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC05.CO1	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC05.CO2	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC05.CO3	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC05.CO4	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC05.CO5	X	-	-	X	-	-	-	-	-	-	-	X	-	-	X

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
6. Conducting experiments and drawing the characteristic curves of reciprocating pump.
7. Conducting experiments and drawing the characteristic curves of Gear pump.
8. Conducting experiments and drawing the characteristic curves of Pelton wheel.
9. Conducting experiments and drawing the characteristics curves of Francis turbine.
10. Conducting experiments and drawing the characteristic curves of Kaplan turbine.

TOTAL: P: 30 = 30

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19RAC06 MANUFACTURING TECHNOLOGY LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- To train to operate the Lathe machine tool.
- To train to make the simple engineering components using Milling machine tool.
- To train to make the gears using Milling/ Gear Hobbing/ Gear Shaping machine tools.
- To train to make the simple engineering components using various grinding machine tools.
- To train to measure the cutting force on the Milling / Turning machine tools.

COURSE OUTCOMES

19RAC06.CO1 Make the simple components using Lathe Machine tool.
19RAC06.CO2 Make the simple components using Milling machine tool
19RAC06.CO3 Make the various Gear using Milling/ Gear Hobbing/ Gear Shaping machine tools.
19RAC06.CO4 Make the simple engineering components using different Grinding machine tools.
19RAC06.CO5 Analysis the various cutting forces in the Milling / Turning machine tools.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC06.CO1	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO2	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO3	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO4	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X
19RAC06.CO5	-	-	-	X	-	-	-	-	-	-	-	X	-	-	X

LIST OF EXPERIMENTS

1. Eccentric Turning, Thread Cutting
2. Contour milling using vertical milling machine
3. Spur gear cutting in milling machine
4. Helical Gear Cutting in hobbing machine
5. Gear generation in hobbing machine
6. Gear generation in gear shaping machine
7. Plain Surface grinding
8. Cylindrical grinding
9. Tool angle grinding with tool and Cutter Grinder
10. Centreless grinding
11. Measurement of cutting forces in Milling / Turning Process

TOTAL: P : 30= 30

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UNIT – IV ALGEBRAIC STRUCTURES 9+3

Algebraic systems-Semi groups and monoids-Groups-Subgroups and homomorphisms- Cosets and Lagrange's
Theorem - Ring & Fields (Definitions and examples)

UNIT – V LATTICES AND BOOLEAN ALGEBRA 9+3

Partial ordering-Posets-Lattices as Posets- Properties of lattices-Lattices as Algebraic systems –Sub lattices –direct product and Homomorphism-Some Special lattices- Boolean Algebra

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Narsingh Deo	Graph Theory with Applications to Engineering and Computer Science, Reprint edition	Dover Publications Inc.	2016
2.	Tremblay J.P, Manohar R	Discrete Mathematical Structures with application to computer science,30th Reprint	Tata Mc Graw Hill Pub.Co.Ltd,New Delhi,	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bernard Kolman , Robert C.Busby, Sharan Culter Ross	Discrete Mathematical Structures, 6th Edition	Pearson Education Pvt Ltd. ,New Delhi	2015
2.	Richard Johnsonbaugh	Discrete Mathematics , 7th Edition	Pearson Education Asia, New Delhi	2014
3.	Seymour Lipschutz, Mark Lipson, Varsha H. Patil	Discrete Mathematics Schaum's Outlines , Revised 3rd Edition	Mc Graw Hil Pub.Co.Ltd.,New Delhi	2013
4.	Ralph. P.Grimaldi	Discrete and combinatorial Mathematics : An Applied Introduction, 5th Edition	Pearson Education Asia,Delhi	2012
5.	Kenneth H. Rosen	Discrete Mathematics and its Applications, 7th Edition	Tata Mc Graw Hill Pub . co.Ltd.,New Delhi,Special Indian Edition	2011

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Programme Code & Name: RA & B.E-Robotics and Automation

19BSS25 **STATISTICAL AND QUEUING MODEL** **L T P C**
3 1 0 4

COURSE OBJECTIVES

- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To understand the basic concepts of Control charts for measurements.
- Identify the concept of queueing models and apply in engineering.
- To understand the significance of advanced queueing models.

COURSE OUTCOMES

- Provides knowledge to apply testing of hypothesis to real life problems.
- This course enhances the students in design of experiments model for research problems
- Apply the concept of Statistical Quality Control in engineering disciplines.
- Acquire skills in analyzing queueing models.
- Understand and characterize phenomenon which evolve with respect to time in a probabilistic manner

UNIT I TESTING OF HYPOTHESIS **9 + 3**

Sampling distributions - Estimation of parameters - Statistical hypothesis -Tests based on t, Chi-square and F distributions for mean, variance and proportion - Contingency table (test for independent) - Goodness of fit.

UNIT II DESIGN OF EXPERIMENTS **9 + 3**

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

UNIT III STATISTICAL QUALITY CONTROL **9 + 3**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np charts) – Tolerance limits - Acceptance sampling.

UNIT IV QUEUEING MODELS **9 + 3**

Markovian queues – Birth and death processes – Single and multiple server queueing models – Little's formula – Queues with finite waiting rooms – Queues with impatient customers : Balking and reneging.

UNIT V ADVANCED QUEUEING MODELS **9 + 3**

Finite source models – M/G/1 queue – Pollaczek Khinchin formula – M/D/1 and M/EK/1 as special cases – Series queues – Open Jackson networks.

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Devore. J.L.,	"Probability and Statistics for Engineering and the Sciences	Cengage Learning, New Delhi	2014

2.	John F. Shortle, James M.Thompson, Carl M. Harris Donald Gross	Fundamentals of Queueing Theory, 4th Edition	Wiley	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
4.	Yates, R.D. and Goodman. D. J	"Probability and Stochastic Processes"	Wiley India Pvt. Ltd., Bangalore	2012
5.	Trivedi.K.S.,	Probability and Statistics with Reliability, Queueing and Computer Science Applications, 2nd Edition	John Wiley and Sons	2008

19BSS26 NUMERICAL METHODS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To solve a set of algebraic equations representing steady state models formed in engineering problems
- To deal with interpolation and approximation for the application of finite element analysis
- To find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- To predict the system dynamic behaviour through solution of ODEs modeling the system
- To solve PDE models representing spatial and temporal variations in physical systems through numerical methods

COURSE OUTCOMES

- The students will have a clear perception of the power of numerical techniques

- The students will have the ability to solve a set of algebraic equations representing steady state models formed in engineering problems
- The students can deal with interpolation and approximation for the application of finite element analysis
- It equips the knowledge in numerical differentiation and numerical integration
- This course makes students easy in solving initial and boundary value problems

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

Solution of algebraic and transcendental equations - Newton Raphson method – Solution of linear system of a equations - Gauss elimination method –Gauss Jordon method - Iterative methods of Gauss Jacobi and Gauss-Seidel -Eigen value of a matrix by power method

UNIT – II INTERPOLATION AND APPROXIMATION 9+3

Interpolation with unequal intervals – Lagrange's interpolation – Newton's divided difference interpolation – Interpolation with equal intervals – Newton's forward and backward difference formulae.

UNIT – III NUMERICAL DIFFERENTIATION AND INTEGRATION 9+3

Approximation of derivatives using interpolation polynomials – Numerical integration using Trapezoidal, Simpson's 1/3 rule – Two point and three point Gaussian quadrature formulae – Evaluation of double integrals by trapezoidal and Simpsons's 1/3 rules.

UNIT – IV INITIAL VALUE PROBLEMS FOR ORDINARY DIFFERENTIAL EQUATIONS 9+3

Single step methods – Taylor's series method – Euler's method – Modified Euler's method – Fourth order Runge-Kutta method for solving first order equations – Multi step methods – Milne's and Adams-Bash forth predictor corrector methods for solving first order equations.

UNIT – V BOUNDARY VALUE PROBLEMS IN ORDINARY AND PARTIAL DIFFERENTIAL EQUATIONS 9+3

Finite difference methods for solving two-point linear boundary value problems – Finite difference techniques for the solution of two Laplace's and Poisson's equations on rectangular domain – one dimensional heat equation by explicit and implicit (Crank Nicholson) methods – One dimensional wave equation by explicit method.

TOTAL: 45 + 15 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication

1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010
2.	M.K. Jain	Numerical Methods for Scientific & Engineering Computation, 6th Edition	New Age International Publishers	2010
3.	Sankara Rao. K.	Numerical methods for Scientists and Engineers, 3rd Edition	Prentice Hall of India Private, New Delhi	2007
4.	Brian Bradie	A friendly introduction to Numerical analysis	Pearson Education, Asia, New Delhi	2007
5.	Gerald. C. F. Wheatley. P. O.	Applied Numerical Analysis,6th Edition	Pearson Education, Asia, New Delhi	2006

19BSS27 PROBABILITY & RANDOM PROCESSES

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- Analyze random or unpredictable experiments and investigate important features of random experiments.
- Construct probabilistic models for observed phenomena through distributions which play an important role in many engineering applications.
- To acquire the knowledge the concept of convergence of random sequence and the study of random signals
- To be familiar with application of auto correlation and cross correlation functions.
- To learn the concept of spectral density

COURSE OUTCOMES

- The students will have a fundamental knowledge of the probability concepts.
- It helps to use standard distributions to the real life problems.
- Associate random variables by designing joint distributions and correlate the random variables.
- It also helps to understand and characterize phenomenon which evolve with respect to time in a probabilistic manner.
- Gained knowledge in correlation and spectral densities

UNIT - I PROBABILITY AND RANDOM VARIABLES 9+3

Axioms of probability–conditional probability– Baye's theorem, random variables– Discrete and continuous random variables – MGF

UNIT – II STANDARD DISTRIBUTIONS 9+3

Discrete distributions : Binomial, Poisson, Geometric, Negative Binomial and their properties – Continuous distributions : Uniform, Exponential, Gamma, Normal distributions and their properties

UNIT – III TWO - DIMENSIONAL RANDOM VARIABLES 9+3

Joint distributions – Marginal and conditional distributions – Covariance – Correlation and regression – Transformation of random variables

UNIT – IV RANDOM PROCESSES 9+3

Classification – Stationary process – Markov process - Poisson process – Discrete parameter Markov chain – Chapman Kolmogorov equations

UNIT – V CORRELATION AND SPECTRAL DENSITIES 9+3

Auto correlation - Cross correlation - Properties – Power spectral density – Cross spectral density - Properties – Wiener-Khintchine relation – Relationship between cross power spectrum and cross correlation function

TOTAL: 45 + 15=60 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Oliver. C Ibe.	Fundamentals of Applied Probability and Random Processes, 2nd Edition	Academic Press	2014
2.	Stark. H., Woods. J.W.	Probability and Random Processes with Applications to Signal Processing, 4th Edition	Pearson Education, Asia	2014

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	HweiP.Hsu	Schaum"s Outline of Theory and Problems of Probability, Random Variables and Random Processes	Mc Graw Hill Publishing Company, New Delhi	2014

2.	Henry Stark , John W. Woods	Probability, Statistics, and Random Processes for Engineers" , 2nd Edition	Pearson Education	2014
3.	Miller. S.L., Childers. D.G.	Probability and Random Processes with Applications to Signal Processing and Communications , 2nd Edition	Academic Press (Elsevier)	2012
4.	Yates. R.D., Goodman. D.J.	Probability and Stochastic Processes, 2nd Edition	Wiley India Pvt. Ltd., Bangalore	2012
5.	Peyton Peebles	Problems and Solutions in Probability, Random Variables and Random Signal Principles (SIE), 1st Edition	Mc Graw Hill Publishing Company, New Delhi	2012

19BSS28 STATISTICS AND NUMERICAL METHODS

L	T	P	C
3	2	0	4

COURSE OBJECTIVES

- To understand concepts of testing of hypothesis
- To develop design of experiments model for research problems
- To find the trend information from discrete data set through numerical differentiation and summary information through numerical integration
- To predict the system dynamic behaviour through solution of ODEs modeling the system
- To introduce numerical tools for the solutions of ordinary differential equations that model several physical processes

COURSE OUTCOMES

- Provides knowledge to apply testing of hypothesis to real life problems.
- This course enhances the students in design of experiments model for research problems
- The students will have a clear perception of the power of numerical techniques
- It equips the knowledge in numerical differentiation and numerical integration
- This course makes students easy in solving ordinary differential equations

UNIT - I TESTING OF HYPOTHESIS 9+3

Sampling distributions - Tests for single mean, Difference of means (large and small samples) – Tests for single variance and equality of variances – chi-square test for goodness of fit – Independence of attributes.

UNIT – II DESIGN OF EXPERIMENTS 9+3

Completely randomized design – Randomized block design – Latin square design – One way- Two way Classification.

UNIT – III SOLUTION OF EQUATIONS AND EIGENVALUE PROBLEMS 9+3

Newton-Raphson method- Gauss Elimination method – Gauss-Jordan methods – Iterative methods of Gauss-Jacobi and Gauss-Seidel - Horner's Method – Eigen values of a matrix by Power method .

UNIT – IV INTERPOLATION, NUMERICAL DIFFERENTIATION AND NUMERICAL INTEGRATION **9+3**

Lagrange's and Newton's divided difference interpolation –Newton's forward and backward difference interpolation - Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal and Simpson's 1/3 rules

UNIT – V NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS **9+3**

Taylor's series method - Euler's method - Modified Euler's method - Fourth order Runge-Kutta method for solving first and second order equations – Adam's and Milne's predictor corrector methods for solving first order equations

TOTAL: 45 + 15

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	S. K. Gupta	Numerical Methods for Engineers , 3rd Edition	New Age International Pvt Ltd Publishers	2015
2.	Walpole. R.E., Myers. R.H., Myers. S.L., Ye. K.	Probability and Statistics for Engineers and Scientists, 8th Edition	Pearson Education, Asia	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Douglas C. Montgomery, George C. Runger	Applied Statistics and Probability for Engineers (International Student Version)", 6th Edition	John Wiley & Sons, Inc.	2016
2.	Spiegel. M.R., Schiller. J., Srinivasan.R.A.	Schaum's Outlines on Probability and Statistics, 4th Edition	Tata McGraw Hill Education	2013
3.	Chapra. S.C., Canale.R.P.	Numerical Methods for Engineers, 6th Edition	Tata McGraw Hill, , New Delhi	2012
4.	Johnson. R.A., and Gupta. C.B.	Miller,Freund's Probability and Statistics for Engineers,11th Edition	Pearson Education, Asia	2011
5.	Grewal. B.S.	Numerical Methods in Engineering & Science: with Programs in C and C++, 10th Edition	Khanna Publishers, New Delhi	2010

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Programme Code & Name: RA & B.E-Robotics and Automation

19GES01 PROGRAMMING FOR PROBLEM SOLVING USING C L T P C

3 0 0 3

COURSE OBJECTIVES

- To understand basic programming concepts
- To provide knowledge for problem solving through
- To provide hands-on experience with the concepts programming

COURSE OUTCOMES

- Understand the fundamentals of C programming
- Choose the loops and decision making statements to solve the problem
- Implement different Operations on arrays and Use functions to solve the given problem
- Understand String and structures
- Understand pointers and Implement file Operations in C programming for a given application

UNIT I INTRODUCTION TO C PROGRAMMING 9 HOURS

Introduction to computer software, Program Design Tools: Algorithms, Flowcharts, Pseudo codes, Structure of a C program, Writing the first C program, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, Input / Output Statements in C, Operators in CArithmetic, Relational, Logical, Conditional, Type conversion an Typecasting.

UNIT II CONDITIONAL AND LOOPING STATEMENTS 9 HOURS

Conditional branching statements, if, if-else, if-else-if and switch statements, Iterative statements, while, do-while and for loop statements, Nested loops, the break and continue statements.

UNIT III FUNCTIONS AND ARRAYS 9 HOURS

Functions: Function Declaration/Function Prototype, Function definition, Function call, passing parameters to functions. Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, operations on 1-d arrays – Inserting an Element of an array, Deleting an Element from an Array, searching for a Value in an Array, two-dimensional arrays, operations on twodimensional arrays – Sum, Difference.

UNIT IV STRINGS AND STRUCTURES 9 HOURS

Strings: Introduction, Operations on Strings – finding the length of a String, converting characters of a string into upper case, Converting characters of a string into lower case. Structures: Introduction to Structures, Copying and comparing structures, Nested structures.

UNIT V **POINTERS AND FILE PROCESSING** **9 HOURS**

Pointers: Introduction to Pointers, Declaring pointer variables, Passing arguments to function using pointers.

File Processing: Introduction to Files, Read Data from Files, Writing data to Files.

Total Periods:45 hours

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Computer Fundamentals and Programming in C	Oxford University Press	Second Edition.
2.	Reema Thareja	Programming in C	Oxford University Press	Second Edition.

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Programming in C	Oxford University Press	Second Edition.
2.	B S Gottfried: Schaums	Programming with C	Outline Series	2003

19GES02 **PROGRAMMING FOR PROBLEM SOLVING TECHNIQUES**

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To understand basic programming concepts
- To provide knowledge for problem solving through programming
- To provide hands-on experience with the concepts

COURSE OUTCOMES

- Understand the fundamentals of C programming
- Choose the loops and decision making statements to solve the problem
- Implement different Operations on arrays and Use functions to solve the given problem

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- Develop Simple Python Programs using Appropriate Syntax, Control Structure and Expression
- Explain the Concept of Tuples and Files in Python Programming Language

UNIT I **INTRODUCTION TO C PROGRAMMING** **9 HOURS**

Introduction to computer software, Program Design Tools: Algorithms, Flowcharts, Pseudo codes, Structure of a C program, Writing the first C program, Keywords, Identifiers, Basic Data Types in C, Variables, Constants, Input / Output Statements in C, Operators in CArithmetic, Relational, Logical, Conditional, Type conversion and Typecasting.

UNIT II **CONDITIONAL AND LOOPING STATEMENTS** **9 HOURS**

Conditional branching statements, if, if-else, if-else-if and switch statements, Iterative statements, while, do-while and for loop statements, Nested loops, the break and continue statements.

UNIT III **FUNCTIONS AND ARRAYS** **9 HOURS**

Functions: Function Declaration/Function Prototype, Function definition, Function call, passing parameters to functions. Arrays: Declaration of arrays, accessing the elements of an array, storing values in arrays, operations on 1-d arrays – Inserting an Element of an array, Deleting an Element from an Array, searching for a Value in an Array, two-dimensional arrays, operations on twodimensional arrays – Sum, Difference

UNIT IV **INTRODUCTION TO PYTHON PROGRAMMING** **9 HOURS**

Introduction- Python interpreter and interactive mode- Creating and executing Python program- Data types: Numeric, Boolean, string, List, tuple and Dictionary-Comments- Expressions- Conditional statements: if, if-else and if-elif-else- Iterative statements: while, for, continue and pass- Functions- Fruitful functions- Recursive functions- Illustrative programs: Linear search and Binary search

UNIT V **STRINGS, LISTS, TUPLES AND DICTIONARIES** **9 HOURS**

Strings: Assignment- String slices and String methods- Lists: List operations and list methods-Tuples: Tuple assignment and Tuple operations- Dictionaries: Operations and methods. Illustrative Programs: Quick sort and Merge sort.

Total Periods: 45

TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Computer Fundamentals and Programming in C	Oxford University Press	Second

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				Edition
2.	John V Guttag	Introduction to Computation and Programming Using Python	Revised and expanded Edition, MIT Press	2013

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Reema Thareja	Programming in C	Oxford University Press	Second Edition
2.	Robert Sedgewick, Kevin Wayne, Robert Dondero	Introduction to Programming in Python: An Inter-disciplinary Approach	Pearson India Education Services Pvt. Ltd.,	2016
3.	Timothy A. Budd	Exploring Python	Mc-Graw Hill Education (India) Private Ltd	2015
4.	Kenneth A. Lambert	Fundamentals of Python: First Programs	CENGAGE Learning	2012.

19GES03 PROGRAMMING IN C LAB

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

1. Develop a program to find the largest of three numbers.
2. Develop an interactive program to calculate roots of quadratic equation by accepting the coefficients.
3. Develop a program to sum the series: 1/1! + 4/2! + 27/3! +….. using functions.
4. Develop a program to insert a number at a given location in an array.
5. Implement a program to perform a binary search on 1D sorted Array.
6. Develop a program to read a two dimensional array "marks" which stores marks of 5 students in three subjects. Display the highest marks in each subject
7. Develop a program to concatenate two strings and determine the length of the concatenated string
8. Develop a program to read and display the information about a student using structures.
9. Implement a program to enter a character and then determine whether it is a vowel or not using pointers.
10. Develop a program to read data from the keyboard, write it to a file called "Input", again read the

same data from the "Input" file and display it on the screen.

11. Mini Projects

19GES04 PROGRAMMING IN C AND PYTHON LAB

L	T	P	C
0	0	3	1

LIST OF EXPERIMENTS

1. Develop a C program to find the largest of three numbers.
2. Develop an interactive C program to calculate roots of quadratic equation by accepting the coefficients.
3. Develop a C program to sum the series: 1/1! + 4/2! + 27/3! +….. using functions.
4. Develop a C program to insert a number at a given location in an array.
5. Implement a C program to perform a Fibonacci series.
6. Develop a C program to read a two dimensional array "marks" which stores marks of 5 students in three subjects. Display the highest marks in each subject.
7. Write a Python program to find GCD of two numbers.
8. Write a Python Program to find the square root of a number by Newton's Method.
9. Write a Python program to find the exponentiation of a number.
10. Write a Python Program to find the maximum from a list of numbers.
11. Write a Python Program to perform Linear Search.

19GES05 ELECTRICAL AND ELECTRONICS SCIENCES

L T P C
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on DC & AC circuits and its analysis
- To impart knowledge of measuring instruments.
- To study the operation of electrical machines.
- To impart the fundamentals of semiconductor.
- To understand the principles of micro computing.

COURSE OUTCOMES

- Able to analyze DC and AC circuits
- Able to explain the different type of measuring instruments
- Able to exhibit the operation of electrical machines
- Able to demonstrate the operation of rectifier and DAC/ADC
- Able to explain the principles of micro computing

UNIT I ELECTRICAL CIRCUITS 9

Ohm's law - Kirchhoff's laws - Resistors in series and parallel circuits (simple problem) - Introduction to ac circuits and its parameters - Three phase power supply – Star connection – Delta connection – Balanced and Unbalanced Loads.

UNIT II MEASUREMENTS AND INSTRUMENTATION 9

Operating principles of Moving Coil and Moving Iron instruments - Principles of Electrical Instruments, Multimeters, Oscilloscopes - Static and Dynamic Characteristics of Measurement – Errors in Measurement – Transducers - Classification of Transducers

UNIT III ELECTRICAL MACHINES 9

Construction, Principle of operation, Basics equation, of DC Motor and Generators - Single phase Induction motors, Construction, Types and speed control methods - Single Phase Transformer, voltage regulation and efficiency (Qualitative & Quantitative treatment only)

UNIT IV SEMICONDUCTOR DEVICES AND DIGITAL ELECTRONICS 9

Operation and characteristics of PN Junction Diode - Half wave Rectifiers - Full wave Rectifiers - Bipolar Junction Transistor - Binary Number System - Logic Gates - Boolean algebra - Half and Full Adders - Registers and Counters - A/D and D/A Conversion.

UNIT V INTRODUCTION TO MICROCOMPUTING 9

Architecture of 8051 – instruction set – addressing mode – serial port programming - interrupts – ADC/DAC

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	D P Kothari and I.J Nagarath	Basic Electrical and Electronics Engineering	McGraw Hill Education(India) Private Limited	2016
2.	S.K.Bhattacharya	Basic Electrical and Electronics Engineering	Pearson India	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Giorgio Rizzoni	Principles and Applications of Electrical Engineering	McGraw Hill Education(India)	2010

			Private Limited	
2.	A.E.Fitzgerald, David E Higginbotham and Arvin Grabel,	Basic Electrical Engineering	McGraw Hill Education(India) Private Limited	2009
3.	Mittle N	Basic Electrical Engineering	Tata McGraw Hill Edition	2016
4.	Rajendra Prasad	Fundamentals of Electrical engineering	Prentice Hall of India	2006
5.	Del Toro	Electrical Engineering Fundamentals	Pearson Education, New Delhi	2015

19GES06 **MECHANICAL AND BUILDING SCIENCES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To get the knowledge on various type of power generation,
- To know about IC Engines and Boilers.
- To familiarize on Refrigeration and Air Conditioning.
- To posses knowledge about Surveying
- To know about the Civil Engineering materials and Building Elements

COURSE OUTCOMES

- Demonstrate the various power generation techniques.
- Outline the working principles of IC Engines and Boilers.
- Familiarize the Refrigeration and Air Conditioning systems.
- Understand the principles of field measurement in surveying.
- Gathered knowledge in civil engineering materials and Building Elements

A. MECHANICAL ENGINEERING

UNIT I: POWER PLANT ENGINEERING **8**

Introduction, Classification of Power Plants – Working principle of steam, Gas, Diesel, Hydro-electric and Nuclear Power plants – Merits and Demerits – Pumps– working principle of Reciprocating pumps (single acting and double acting) – Centrifugal Pump.

UNIT II:IC ENGINES **8**

Internal combustion engines– Working principle of Petrol and Diesel Engines – Four stroke and two stroke cycles – Comparison of four stroke and two stroke engines – Boiler –fire tube-water tube-Bensen boiler.

UNIT III: REFRIGERATION AND AIR CONDITIONING SYSTEM **7**

Terminology of Refrigeration and Air Conditioning. Principle of vapor compression and absorption system – Layout of typical domestic refrigerator – Window and Split type room Air conditioner.

B. BUILDING SCIENCES

UNIT IV : FUNDAMENTALS OF SURVEYING **7**

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Surveying – objectives – divisions – classification – principles – measurements of distances – angles – leveling – determination of areas – illustrative examples.

UNIT V : MATERIALS AND FOUNDATIONS 7

Civil Engineering Materials: Bricks – stones – sand – cement – concrete – steel sections – Foundations: Types, Bearing capacity – Requirement of good foundations.

UNIT VI : BUILDING ELEMENTS AND STRUCTURES 8

Superstructure: Brick masonry – stone masonry – beams – columns – lintels – roofing – flooring – plastering – basics of interior design – Bridges – Dams.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shanmugam G and Palanichamy M S	Basic Civil and Mechanical Engineering	McGraw Hill Publishing Co., New	**1996**
2.	Ramamrutham S	Basic Civil Engineering	DhanpatRai Publishing Co. (P) Ltd.	2015

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Venugopal K. and Prahu Raja V	Basic Mechanical Engineering	Anuradha Publishers, Kumbakonam	2016
2.	Shantha Kumar S R J	Basic Mechanical Engineering	Hi-tech Publications, Mayiladuthurai	2014
3.	PrabhuT.J,Jai Ganesh. V and Jebaraj.S	Basic Mechanical Engineering	ScitechPublications,Chennai	2010
4.	Seetharaman S	Basic Civil Engineering	Anuradha Agencies	2015
5.	SatheeshGopi	Basic Civil Engineering	Pearson Publishers	2009

19GES07 COMPUTER AIDED DRAFTING LABORATORY **L T P C**
0 0 3 1

COURSE OBJECTIVES

- To construct various curves in engineering applications.
- To understand the principles of projection to project points, lines and planes.
- To draw the orthographic views of solids.

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- To draw the projection of solids in simple position and with their axis inclined.
- .To be able to construct the development of surfaces.

COURSE OUTCOMES

- Understand the basics of drawing instruments and standards.
- Construct various curves used in engineering applications.
- Comprehend and draw orthographic vies of various solids
- Explain and draw the projection of points, lines and planes
- Draw the projection of solids and development of surfaces using CAD software.

CONCEPTS AND CONVENTIONS 4

(Not for Examination) Importance of graphics in engineering applications, Use of drafting instrument, BIS conventions and specifications - Size, layout and folding of drawing sheets, Lettering and dimensioning.

COMPUTER AIDED DRAFTING (Not for Examination) 6

Importance 2d Drafting, sketching, modifying, transforming and dimensioning

UNIT I: PLANE CURVES 10

Curves used in engineering practices, Conics, Construction of ellipse, Parabola and hyperbola by eccentricity method, Construction of cycloid, construction of involutes of square and circle, Drawing of tangents and normal to the above curves.

UNIT II: PROJECTION OF POINTS, LINES AND PLANES 10

General Principles of Orthographic projection, Need for importance of multiple views and their placement, First angle projection, layout of views, Projection of points, Projection of straight lines located in the first quadrant, Projection of polygonal surface inclined to both reference planes.

UNIT III: ISOMETRIC TO ORTHOGRAPHIC VIEWS 10

Representation of three dimensional objects, Developing visualization skills through free hand sketching of multiple views from pictorial views of objects, Drawing orthographic views of various solids, Dimensioning.

UNIT IV: PROJECTION OF SOLIDS 10

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane.

UNIT V SECTION OF SOLIDS AND DEVELOPMENT OF SURFACES 10

Sectioning of simple solids like prisms, pyramids, cylinder and cone in simple vertical position by cutting planes inclined to one reference plane and perpendicular to the other, Development of lateral surfaces of simple and truncated solids, Prisms, pyramids, cylinders and cones.

****NOTE: Students have to give descriptive answers to the questions from first two units and need to draw the answer figures using CAD software for the questions from the last three units in end semester exam.**

TOTAL: P: 60 = 60

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Natrajan K.V	A text book of Engineering Graphics	Dhanalakshmi Publishers, Chennai	2015
2.	Basant Agrawal and C.M. Agrawal	Engineering Drawing	McGraw Hill Education; Second edition	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gopalakrishnan K.R	Engineering Drawing (Vol. I&II combined)	Subhas Stores Bangalore	2007
2	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
3	Shah M.B., and Rana B.C	Engineering Drawing	Pearson, 2nd Edition	2009
4	Venugopal K. and Prabhu Raja V	Engineering Graphics	New Age International (P) Limited	2008
5	Bhatt N.D. and Panchal V.M	Engineering Drawing	Charotar Publishing House, 50th Edition	2010

19GES08 **PYTHON PROGRAMMING** **L T P C**

3 0 0 3

COURSE OBJECTIVES

1. To read and write simple Python programs.
2. To develop Python programs with conditionals and loops.
3. To define Python functions and call them.

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

COURSE OUTCOMES

1. Read, write, execute by hand simple Python programs.
2. Structure simple Python programs for solving problems.
3. Decompose a Python program into functions.
4. Represent compound data using Python lists, tuples, dictionaries.
5. Read and write data from/to files in Python Programs.

UNIT I INTRODUCTION **9 HOURS**

The way of programming-What is programming- debugging – formal and natural languages - Python: Features - Installing - Running – Python interpreter and interactive mode.

UNIT II VARIABLES, EXPRESSIONS, CONDITIONALS **9 HOURS**

Values and types: int, float, boolean, string, and list; variables, expressions, statements, tuple assignment, precedence of operators, comments; Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass;

UNIT III FUNCTIONS, STRINGS **9 HOURS**

Functions, function definition and use, flow of execution. 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.

UNIT IV 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.

UNIT V FILES, MODULES, PACKAGES **9 HOURS**

Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages.

Total: 45 Hours

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TEXT BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Allen B. Downey	Think Python: How to Think Like a Computer Scientist	O'Reilly Publishers	2016
2.	Guido van Rossum and Fred L. Drake Jr	An Introduction to Python	Network Theory Ltd	2011

REFERENCE BOOK

Sl.No	AUTHOR(s)	TITLE OF THE BOOK	PUBLISHER	YEAR OF PUBLICATION
1.	Charles Dierbach	Introduction to Computer Science using Python: A Computational Problem-Solving Focus	Wiley India Edition	2013
2.	John V Guttag	Introduction to Computation and Programming Using Python	MIT Press	2013
3.	Kenneth A. Lambert	Fundamentals of Python: First Programs	CENGAGE Learning	2012
4.	Paul Gries, Jennifer Campbell and Jason Montojo	Practical Programming: An Introduction to Computer Science using Python 3	Pragmatic Programmers,LLC	2013
5.	Timothy A. Budd	Exploring Python	Mc-Graw Hill Education (India) Private Ltd	2015

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19GES09 **PROGRAMMING IN PYTHON LAB** **L T P C**
0 0 3 1

LIST OF EXPERIMENTS

1. Compute the GCD of two numbers.
2. Find the square root of a number (Newton's method)
3. Exponentiation (power of a number)
4. Find the maximum of a list of numbers
5. Linear search and Binary search
6. Selection sort, Insertion sort
7. Merge sort
8. First n prime numbers
9. Multiply matrices
10. Programs that take command line arguments (word count)
11. Find the most frequent words in a text read from a file
12. Simulate elliptical orbits in Pygame
13. Simulate bouncing ball using Pygame

PLATFORM NEEDED

Python 3 interpreter for Windows/Linux

19GES10 **SOFT SKILLS LABORATORY** **L T P C**
0 0 3 2

COURSE OBJECTIVES

- To Analyse the Strength and Weakness of an Individual
- To build an effective team in work place
- To develop effective Time Management Skills
- To describe the qualities of an Effective Presenter
- To improve Health and Social life

COURSE OUTCOMES

- Identifying the Career Path
- Developing the leadership Qualities for the betterment of the team
- Developing Effective Time Management Skill
- Understanding the importance of Effective Communication
- Handling Stress and Developing Problem Solving Skill

UNIT I Self Analysis

SWOT Analysis – Intra Personal Skill – Inter Personal Skill

UNIT II Team Work

Importance of a Team Player – Leadership Quality – Decision Making Skill

UNIT III Time management

Effective Planning – Goal Setting – Spending right time on right job

UNIT IV Presentation skill

Verbal Communiction – Non Verbal Communication

UNIT V Stress Management

Eustress -- Distress – Emotional Intelligence – Fear Management (Crowd Fear, Exam Fear, Stage Fear)

19GES11	ELECTRONIC DEVICES	L	T	P	C
		3	0	0	3

COURSE OBJECTIVES:

- To know about the basics of Semiconductor Diodes
- To know about the working principle and characteristics of BJT.
- To know about the operation and characteristics of FET.
- To know about the biasing techniques of BJT and FET.
- To understand the working function and applications of special diodes and optoelectronic devices.

COURSE OUTCOMES:

After the completion of the course, the students can able to

- Understand the theory, operation and characteristics of semiconductor diodes.
- Explain the basics and characteristics of BJT
- Describe the construction, working principle and characteristics of FET
- Discuss about the biasing of BJT and FET.
- Understand the working function and applications of special diodes and optoelectronics devices.

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UNIT I: SEMICONDUCTOR DIODES 9

Review of Semiconductor Physics-Drift and diffusion currents-Continuity Equation-Theory of PN Junction Diode-Diode Current Equation-Current Voltage Characteristics-Effect of Temperature on PN Junction diodes-Diffusion Capacitance-Applications: Rectifiers, Clippers, Clampers-Avalanche Breakdown Mechanism-Zener Diode as a Voltage Regulator.

UNIT II: BIPOLAR JUNCTION TRANSISTORS 9

Bipolar Junction Transistor Operations-Configurations: CC, CB, CE-Transistor Current Components-Ebermoll's Model of Transistor-Small Signal Low Frequency Hybrid-High Frequency Effects-Transistor as an Amplifier and Switch.

UNIT III: FIELD EFFECT TRANSISTORS 9

Operation and Characteristics of JFET-Configurations of JFET-JFET as Amplifier, Switch, Voltage Variable Resistor-Metal Oxide Semiconductor Field Effect Transistor (MOSFET)-Enhancement and Depletion Mode MOSFET-Characteristics of n-MOS and p-MOS-Introduction to CMOS.

UNIT IV: BIASING OF BJT AND FET 9

DC operating point and Load line-Q point-Bias Stability-Transistor Biasing Methods: Fixed Bias-Collector to Base Bias-Self biasing, Thermal Runaway, Thermal Stability-FET biasing methods: Self bias-Source bias-Voltage divider bias-Biasing MOSFETs.

UNIT V: SPECIAL DIODES AND OPTO ELECTRONIC DEVICES 9 Theory and Characteristics of Schottky Diode-Tunnel Diode-Varactor Diode-SCR-TRIAC-LDR-UJT-Photoemissivity and Photoconductivity-Photoconductive Cell-Photo Voltaic Cell-Photodiode-Phototransistors-Construction and Characteristics of LCD and LED-LASER Diodes- Opto Couplers, FINFET.

TOTAL: 45

TEXT BOOKS

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Jacob Millman, Christos Halkias & Satyabrata Jit, Millman's	Electronic Devices and Circuits	McGraw Hill	2nd Edition, 2008.
2	Robert L.Boylestad, Louis Nashelsky	Electronic Devices and Circuit Theory	Pearson education	11th Edition,2012

REFERNCE BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Allen Mottershead	Electronic Devices and Circuits	Prentice Hall of India	2008
2	Douglas.A.Pucknell, Kamran Eshraghian	Basic VLSI Design, Principles and Application	Prentice Hall of India	2009

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3	S.Salivahanan, N.Sureshkumar and A.Vallavaraj	Electronic Devices and Circuits	Tata McGraw Hill	2nd Edition, , 2008
4	Donald A. Neamen	Semiconductor Physics and Devices	Tata McGraw Hill	Third Edition
5	S. M. Sze	Semiconductor Devices: Physics and Technology	Wiley	Second Edition

19GES12 ELECTRONIC SIMULATION LABORATORY

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

The objectives of this laboratory course are,

- To understand the operation of semiconductor devices using laboratory equipments and simulation software.
- To design and test the electronic circuits using laboratory devices, equipments and simulation software.

COURSE OUTCOMES:

After the completion of the course, the students can able to

- Measure and interpret the parameters of diodes and transistors
- Construct and analyze the amplifier using BJT.
- Construct and analyze the voltage regulator.
- Design and measure various wave shaping circuits using diodes.
- Measure and interpret the parameters of different special diodes.

LIST OF EXPERIMENTS:

1. Analyze the Device Behaviour of Semiconductor Diodes.
2. Analyze the Characteristics of Bipolar Junction Transistors.
3. Design and Analysis of BJT as an amplifier.
4. Analyze the Device Behaviour of FETs.
5. Design and Analysis of Voltage Regulators.
6. Design and Analysis of Rectifiers.
7. Design and Analysis of Clippers and Clampers.
8. Analyze the device Behaviour of UJT.
9. Analyze the device Behaviour of SCR.
10. Analyze the characteristics of LED, LDR and Photodiode.

19GES13 ELECTRIC CIRCUITS

L	T	P	C
2	1	0	3

COURSE OBJECTIVES

- To communicate the knowledge on DC circuits and its analysis.
- To impart knowledge on AC circuits and its analysis.

- To impart knowledge on solving circuits equations using network theorems.
- To introduce the concept of resonance circuits and transient response in circuits.
- To impart knowledge on balanced and unbalanced in three phase circuits.

COURSE OUTCOMES

- Able to analyze DC circuits
- Able to give details on the AC circuits and analyze.
- Able to solve the different type of network problems
- Able to implement the resonance condition in the power circuits.
- Able to analyze the different type of load in three phase circuits.

UNIT I DC CIRCUITS **6+3**

Basic circuit elements - Ohm's law - Resistors in series and parallel circuits - Voltage division and current division - Kirchhoff's laws - Source transformation - Star-Delta conversion - Mesh and nodal analysis.

UNIT II AC CIRCUITS **6+3**

Introduction to AC circuits- Form Factor - Phase and phase difference - Sinusoidal Voltage and Current - Single phase AC circuits - Series and parallel RL, RC and RLC circuits - Power - Power factor.

UNIT III NETWORK THEOREMS FOR DC AND AC CIRCUITS **6+3**

Superposition theorem - Thevenin's theorem - Norton's theorem - Maximum power transfer theorem - Reciprocity theorem- Compensation theorem

UNIT IV RESONANCE CIRCUITS AND TRANSIENT RESPONSE **6+3**

Series and parallel resonance - Quality factor and bandwidth - Transient response of RL, RC and RLC Circuits using Laplace transform for DC input.

UNIT V THREE PHASE CIRCUITS **6+3**

Three phase balanced / unbalanced voltage sources - Analysis of three phase 3-wire and 4-wire circuits with star and delta connected loads, balanced & un balanced loads - Phasor diagram of voltages and currents - Power and Power factor measurements in three phase circuits.

TOTAL: 45 Hours

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles K. Alexander, Mathew N.O. Sadiku	Fundamentals of Electric Circuits	McGraw Hill	2013
2.	William H. Hayt Jr, Jack E. Kemmerly and Steven M. Durbin	Engineering Circuits Analysis	McGraw Hill publishers New Delhi	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jegatheesan, R	Analysis of Electric Circuits	McGraw Hill	2015
2.	Mahadevan, K., Chitra, C	Electric Circuits Analysis	Prentice-Hall of India Pvt Ltd., New Delhi	2015
3.	Sudhakar A and Shyam Mohan SP	Circuits and Network Analysis and Synthesis	McGraw Hill	2015
4.	M E Van Valkenburg	Network Analysis	Prentice-Hall of India Pvt Ltd, New Delhi	2015
5.	Chakrabarti A	Circuits Theory (Analysis and synthesis)	Dhanpath Rai & Sons, New Delhi	2011

19GES14 **ELECTRIC CIRCUITS LABORATORY** **L T P C**
0 0 3 1

COURSE OBJECTIVES

- To simulate various electric circuits using Matlab
- To gain practical experience on electric circuits and verification of theorems

COURSE OUTCOMES

- Able to simulate the electrical circuits
- Able to design the circuit and implement in hardware

LIST OF EXPERIMENTS:

1. Verification of ohm's law
2. Verification of Kirchhoff's voltage and current laws.
3. Verification of Thevenin's theorem
4. Verification of Norton 's theorem
5. Verification of Superposition theorem
6. Verification of Maximum Power Transfer Theorem.
7. Study of CRO and measurement of sinusoidal voltage and frequency.
8. Determination of time constant of series R-C electric circuits.
9. Determination of frequency response of series & parallel RLC circuits.
10. Calibration of single phase energy meter.
11. Determination of power in three phase circuits by two-watt meter method.

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TOTAL: 45 Hours

19GES15 **MANUFACTURING PROCESSES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the students to the concept of some basic production processes and fabrication techniques.
- Understand the Concept of metal castingproceses,
- To understand metal joining processes.
- Understanding metal forming Processes.
- To study the Plastic and composite materialmouldingprocesses

COURSE OUTCOMES

- Understand the concepts of casting processes..
- Study about fabrication processes to join the different metals.
- Understand the concept of bulk deformation process.
- Study about the metal forming processes.
- Understand the process of composite materials.

UNIT I **CASTING PROCESSES** **9**

Introduction–Patterns, Requirements of a good pattern, pattern materials, types of patterns, pattern allowances–Mould making, types of moulds, moulding processes, types of sand moulding–Coremaking,typesofcores,coreprints,corebox-MouldingSand Properties of mouldings and, types of moulding sand–Melting equipment, cupola furnace, crucible furnace, electric furnace–Gating system–Casting processes, Sand casting, Shell-mould casting, Investment casting, Die casting, centrifugal casting –Defects, Cleaning and Inspection of casting.

UNIT II **FABRICATION PROCESSES** **9**

Introduction–Classification of welding processes–Resistance welding, spot, seam, projection, butt welding–Gaswelding,oxy-acetylenewelding,equipments–Arcwelding,shielded arc welding, TIG, MIG, submerged arc welding, electro-slag welding, ultrasonic welding, plasma arc welding, laser beam welding, friction welding–Soldering and Brazing–Testing and Inspection of welded joints, Defects in welds.

UNIT III **BULK DEFORMATION PROCESSES** **9**

Introduction–Cold and hot working processes Rolling, classification of rolling, principle, rolling stand arrangement, defects in rolling–Forging, classification of forging, methods of forging, defects in forging–Extrusion, Classification of extrusion, Hot and cold extrusion processes, extrusion defects and equipments–Drawing, Drawing of rods, wire and tubes.

UNIT IV **METAL FORMING PROCESSES** **9**

Introduction-Metal stamping and forming, bending, deep drawing, stretch forming, metals pinning, blanking, piercing, embossing and coining, notching, punching, roll forming, rubber press forming, hydro-mechanical forming–Comparison of metal forming processes–Defects in sheet metal formed parts.

UNIT V **PLASTIC AND COMPOSITE MATERIAL PROCESSES** **9**

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Processing of plastics, compression moulding, transfer moulding, injection moulding, blow moulding, thermo forming and calendaring-advantages of plastic materials–Introduction to composite material–Classification of composite materials–advantages of composite materials.

TOTAL: 45 Hours

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RajputR.K	ATextBookofManufacturingTechnology	Laxmipublications(P) Ltd,NewDelhi,	**2008**
2.	SharmaP.C	ATextBookofProductionTechnology	S.ChandandCompany IVEdition,	2004

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	RaoP.N,	ManufacturingTechnologyVol. 1	TataMcGrawHillpublishingcompanylimited,NewDelhi,3rd edition,	2009
2.	HajraChoudhury	ElementsofWorkshopTechnologyVol.1&2.	MediapromotersPvtLtd. ,Mumbai	2007.
3.	SeropeKalpajianand Steven R.Schmid	Manufacturing Engineering and Technology	PearsonEducationInc. , SecondIndianReprint	2002
4.	JainR.K	Production Technology	KhannaPublications	2001
5.	LuqmanMidhat	Production Processes	CBS; 1ST edition	2010

19GES16 **MANUFACTURING PROCESSES LAB** **L T P C 0 0 3 1**

COURSE OBJECTIVES

- To introduce the students to the concept of some basic production processes and fabrication techniques.
- Understand the Concept of metal casting proceses,
- To understand metaljoining processes.
- Understanding metal forming Processes.
- To study the Plastic and composite material moulding processes

COURSE OUTCOMES

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- Understand the concepts of casting processes..
- Study about fabrication processes to join the different metals.
- Understand the concept of bulk deformation process.
- Study about the metal forming processes.
- Understand the process of composite materials.

List of Experiments

1. Fitting work :preparation of l joint, v-joint
2. Carpentry work :Preparation of T-Joint, Lap joint, Dovetail Joint
3. Plumbing Work : Basic pipe connections (PVC) involving the fittings like Valves, Taps, and Bends., Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends
4. Sheet metal Work: Construction of Tray, Funnel and cone
5. Foundry : Solid pattern Moulding, Split pattern Moulding , Core making
6. Welding : Vertical Welding and Horizontal Welding
7. Lathe Work operation. : Plain Turning, Step Turning, Taper Turning, and Knurling

TOTAL: 30 Hours

16GES17 MECHANICAL AND BUILDING SCIENCES LAB

L	T	P	C
0	0	3	1

COURSE OBJECTIVES:

- At the end of course the student will plan the pipe connections in PVC, G.I pipes.
- Analyze to separate the woods with tools and made of several pieces with proper types of joints using tools and machines.
- Demonstrate and remove materials from metal components and assemble the components.
- Join two metals by melting their edges by electric arc welding.
- Demonstrate Residential house wiring and Fluorescent lamp wiring.

COURSE OUTCOMES

- The students are able to make different pipe connections using PVC, G.I pipes.
- The students demonstrate different types of joints using carpentry and power tools.
- They categories various sheet metal working tools and fitting tools.
- They are able to use welding equipments to join structures.
- Students organize household wirings.

UNIT I: CIVIL ENGINEERING PRACTICE **25**

1. PLUMBING WORK

1. Study of pipeline joints, its location and functions: valves, taps, couplings, unions, reducers, Elbows and household fittings.
2. Basic pipe connections (PVC) involving the fittings like Valves, Taps, and Bends.
3. Mixed pipe (PVC and G.I) connections involving the fitting like Valves, Taps, and Bends

2. CARPENTRY WORK

1. Study of Carpentry Tools
2. Preparation of T-Joint
3. Preparation of Lap joint
4. Preparation of Dovetail Joint

UNIT II **MECHANICAL ENGINEERING PRACTICE** **25**

FITTING WORK

1. Study of Sheet Metal Work.
2. Preparation of L joint
3. Preparation of V-joint

WELDING

1. Study of Welding Equipments and Tools
2. Preparation of Butt joint
3. Preparation of Lap joint
4. Preparation of Tee joint
5.

MACHINE ASSEMBLY PRACTICE

1. Assembly and Dismantling for gear box.
2. Assembly and Dismantling for the two wheeler wheel.

UNIT III **ELECTRICAL ENGINEERING PRACTICE** **10**

1. Residential house wiring
2. Fluorescent lamp wiring.
3. Stair-case Wiring and Door bell wiring

19GES18 **CONSTRUCTION MATERIALS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce students to various materials commonly used in civil engineering construction and their properties.
- To study about the concrete design mix.
- To know about the procedures in concreting.
- To understand special concrete and their use.
- To know about the manufacture of cement.

COURSE OUTCOMES

At the end of the course the student will be able to

- Demonstrate knowledge of construction materials and their usages in building projects.
- Learning to further research in advancement of civil engineering materials field.

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- Identify the materials including their sources and production and properties.
- Understood characteristics of conventional building materials like stone, brick, wood etc.
- Learned about new and composite materials and their value adding characteristic of being lightweight, energy efficient, speedy construction among others.

UNIT I: STONES – BRICKS – CONCRETE BLOCKS 9

Stone as building material – Criteria for selection – Tests on stones – Deterioration and Preservation of stone work – Bricks – Classification – Manufacturing of clay bricks – Tests on bricks – brick earth – composition and harmful constituents – Efflorescence – Bricks for special use –Refractory bricks – Cement, Concrete blocks – Light weight concrete blocks.

UNIT II : CEMENT – AGGREGATES – MORTAR 9

Cement – Ingredients – Manufacturing process – Types and Grades – Properties of cement and Cement mortar – Hydration – Tests on cement– Industrial byproducts – Fly ash Aggregates – Natural stone aggregates – Crushing strength – Impact strength – Flakiness Index – Elongation Index – abrasion Resistance – Grading – Sand Bulking.

UNIT III : CONCRETE 9

Concrete – Ingredients – Manufacturing Process – RMC – Tests on fresh and hardened concrete – Modulus of rupture – Mix specification – Mix proportioning – BIS method –Admixtures and their functions – High Strength Concrete and HPC – Other types of Concrete – Durability of Concrete – Corrosion – Causes and effects – remedial measures – Thermal properties of concrete – Micro cracking of concrete – Quality of Water for mixing and curing – use of sea water for mixing concrete.

UNIT IV : TIMBER AND OTHER MATERIALS 9

Timber – Market forms – Industrial timber– Plywood – Veneer – Thermacole – Panels of laminates .
Ferrous metals: Iron and steel, basic metallurgy, composition and grades, market forms and heat treatment 0 Steel as reinforcement – Corrosion of metals and protection.
Non –ferrous metals: Aluminum, copper, brass and glass products – properties – applications.

UNIT V : MODERN MATERIALS 9

Glass – Ceramics – Sealants for joints – Fiber glass reinforced plastic – Clay products – Refractory's – Composite materials – Types – Applications of laminar composites – Fiber textile – Geo membranes and Geotextiles for earth reinforcement – polymers and plastics: walls, pipes and sanitary ware, glues and mastics – acid and chemical resistant products.

TOTAL : 45 Periods

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Duggal.S.K	Building Materials	4th Edition, New Age International	2016
2	Edward Allen and Joseph Iano	Fundamentals of Building Construction: Materials and Methods	Wiley, 6th Edition	2013

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19RAC07 DIGITAL ELECTRONICS LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- To train to use the different logic gate.
- To train to make the different flip flops circuits.
- To train to construct the various electronic logical circuits using registers
- To train to construct the various electronic logical circuits using counters.

COURSE OUTCOMES

19RAC07.CO1 Demonstrate various Logical Gate and its circuits.
19RAC07.CO2 Demonstrate various flip flops circuits.
19RAC07.CO3 Make the electronic logical circuits using registers for various engineering applications.
19RAC07.CO4 Make the electronic logical circuits using counters for various engineering applications.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC07.CO1	X	X	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC07.CO2	X	X	X	X	X	-	-	-	-	-	-	-	X	-	-
19RAC07.CO3	X	X	X	X	X	-	-	-	-	-	-	-	X	-	-
19RAC07.CO4	X	X	X	X	X	-	-	-	-	-	-	-	X	-	-

LIST OF EXPERIMENT

1. Logic Gates
    1. AND, OR, NOT, XOR, XNOR
2. Flip flops
    1. SR
    2. JK
    3. D-Type Flip flop
    4. T- Type Flip Flop
3. Registers
4. Counters

TOTAL: P : 30= 30

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC08 CONTROL SYSTEM ENGINEERING

L T P C

3 0 0 3

COURSE OBJECTIVES

- To introduce the elements of control system and their modeling using various Techniques.
- To impart knowledge for analyzing the time response of control system
- To introduce the frequency response of given system
- To impart the knowledge to analysis of stability of systems
- To introduce the state variable analysis method

COURSE OUTCOMES

19RAC08.CO1 Determine the transfer functions and analogy of control systems.
19RAC08.CO2 Analysis the time responses of the controller system using MATLAB program.
19RAC08.CO3 Analysis of frequency responses of control system using various frequency response plots using MATLAB program.
19RAC08.CO4 Analysis the stabilities of control system using MATLAB program.
19RAC08.CO5 Apply the various state variable analysis methods to engineering applications.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC08.CO1	X	X	X	-	-	-	-	-	-	-	-	-	X	-	-
19RAC08.CO2	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
19RAC08.CO3	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
19RAC08.CO4	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
19RAC08.CO5	X	X	X	X	-	-	-	-	-	-	-	-	X	-	-

UNIT I: CONTROL SYSTEM MODELING 9

Basic Elements of Control System – Open loop and Closed loop systems - Differential equation - Transfer function, Modeling of Electric systems, Translational and rotational mechanical systems - Block diagram reduction Techniques - Signal flow graph

UNIT II: TIME RESPONSE ANALYSIS 9

Time response analysis - First Order Systems - Impulse and Step Response analysis of second order systems - Steady state errors – P, PI, PD and PID Compensation, Analysis using MATLAB

UNIT III: FREQUENCY RESPONSE ANALYSIS 9

Frequency Response - Bode Plot, Polar Plot, Nyquist Plot - Frequency Domain specifications from the plots - Constant M and N Circles - Nichol's Chart - Use of Nichol's Chart in Control System Analysis. Series, Parallel, series-parallel Compensators - Lead, Lag, and Lead Lag Compensators, Analysis using MATLAB.

UNIT IV: STABILITY ANALYSIS 9

Stability, Routh-Hurwitz Criterion, Root Locus Technique, Construction of Root Locus, Stability, Dominant Poles, Application of Root Locus Diagram - Nyquist Stability Criterion - Relative Stability, Analysis using MATLAB

UNIT V: STATE VARIABLE ANALYSIS 9

State space representation of Continuous Time systems – State equations – Transfer function from State Variable Representation – Solutions of the state equations - Concepts of Controllability and Observability – State space representation for Discrete time systems. Sampled Data control systems – Sampling Theorem – Sampler & Hold – Open loop & Closed loop sampled data systems.

TOTAL: L : 45= 45

TEXTBOOK

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	J.Nagrath and M.Gopal	Control System Engineering	New Age International Publishers, 5th Edition	2007

REFERENCES

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Benjamin.C.Kuo	Automatic control systems	Prentice Hall of India, 7th Edition	1995
2	M.Gopal	Control System – Principles and Design	Tata McGraw Hill, 2nd Edition	2002
3	Schaum's Outline Series	Feedback and Control Systems	Tata Mc Graw-Hill	2007
4	John J.D'Azzo & Constantine H.Houpis	Linear Control System Analysis and Design'	Tata Mc Graw-Hill	1995
5	Richard C. Dorf and Robert H. Bishop	Modern Control Systems	Addison – Wesley	1999

Programme Code & Name: RA & B.E-Robotics and Automation

19RAC09 STRENGTH OF MATERIALS

L T P C
3 0 0 3

COURSEOBJECTIVES

- To provide the theoretical knowledge on simple stress, strain concepts.
- To understand the Shear force, Bending Moment and deflection diagrams for different beams.
- To impart the analytical skill to solve various torsion and spring problems.
- To provide the analytical skill to solve slope and deflection problems on different beams.
- To impart the knowledge on analysis of thick and thin cylinders

COURSE OUTCOMES

19RAC09.CO1 Apply the various stress and strain principles to solve the engineering problems.
19RAC09.CO2 Draw Shear force, Bending Moment and deflection diagrams for different beams and load configurations.
19RAC09.CO3 Apply the concepts of mechanics to solve various torsion and spring problems.
19RAC09.CO4 Analysis the slope and deflections of different beams.
19RAC09.CO5 Analysis the thick and thin cylinders for different engineering applications.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC09.CO1	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19RAC09.CO2	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-
19RAC09.CO3	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19RAC09.CO4	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19RAC09.CO5	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-

UNIT I: STRESS, STRAIN AND DEFORMATION OF SOLIDS 9

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

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–Shear stress distribution.

UNIT III: TORSION 9

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts–Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs

UNIT IV: DEFLECTION OF BEAMS 9

Slope and deflection of simply supported beams and cantilevers- Double integration- Macaulay's Method-moment area method- conjugate beam method.

UNIT V: THIN CYLINDERS, SPHERES AND THICK CYLINDERS 9

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin and thick cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame's theorem.

TOTAL: L : 45= 45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bansal, R. K	Strength of Materials	Laxmi Publications (P) Ltd.,	2017
2.	Egor. P.Popov	Engineering Mechanics of Solids	Prentice Hall of India, New Delhi	2015

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jindal U.C	Strength of Materials	Asian Books Pvt. Ltd., New Delhi	2007
2.	Subramanian R	Strength of Materials	Oxford University Press, Oxford Higher Education Series	2007
3.	Ferdinand P. Been, Russell Johnson, J.r. and John J. Dewole	Mechanics of Materials	TataMcGraw Hill Publishingco. Ltd., New Delhi	2005
4.	D. K. Singh	Mechanics of Solids	Pearson Education New Delhi	2006
5.	B. K. Sarkar	Strength of Materials	Tata McGraw Hill Publishing Company Pvt Ltd, New Delhi	2006

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19RAC10 **METROLOGY AND MEASUREMENTS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide knowledge on various terminologies used in metrology.
- To provide knowledge on the correct procedure to be adopted to measure linear or angular dimensions.
- To introduce advanced measurement instruments.
- To familiarize students with from various form measuring instruments.
- To introduce the various Power, Flow and Temperature measuring instruments.

COURSE OUTCOMES

19RAC10.CO1 Suggest various terminologies used while using measuring instruments.
19RAC10.CO2 Use the linear or angular instruments to measure linear or angular measurements.
19RAC10.CO3 Suggest the suitable advanced measurement instruments for the various engineering applications.
19RAC10.CO4 Analysis the observation results from various form measurements.
19RAC10.CO5 Suggest the suitable measuring instruments for Power, Flow and Temperature measurements.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC10.CO1	X	X	-	-	X	X	-	-	-	-	-	-	X	-	-
19RAC10.CO2	X	X	-	-	X	X	-	-	-	-	-	-	-	-	-
19RAC10.CO3	X	X	-	-	X	X	-	-	-	-	-	-	X	X	-
19RAC10.CO4	X	X	-	-	X	X	-	-	-	-	-	-	-	X	-
19RAC10.CO5	X	X	-	-	X	X	-	-	-	-	-	-	X	X	-

UNIT I: BASICS OF METROLOGY 5

Introduction to Metrology – Need – Elements – Work piece, Instruments – Persons – Environment – their effect on Precision and Accuracy – Errors – Errors in Measurements – Types – Control – Types of standards.

UNIT II: LINEAR AND ANGULAR MEASUREMENTS 10

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 III: ADVANCES IN METROLOGY 12

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.

UNIT IV: FORM MEASUREMENT 10

Principles and Methods of straightness – Flatness measurement – Thread measurement, gear measurement, surface finish measurement, Roundness measurement – Applications.

UNIT V: MEASUREMENT OF POWER, FLOW AND TEMPERATURE 8

Force, torque, power - m e c h a n i c a l , Pneumatic, Hydraulic and Electrical type. Flow measurement: Venturimeter, Orifice meter, rotameter, pitot tube – Temperature: bimetallic strip, thermocouples, electrical resistance thermometer – Reliability and Calibration – Readability and Reliability.

TOTAL: L: 45 =45

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jain R.K	Engineering Metrology	Khanna Publishers	2018
2	Gupta. I.C.,	Engineering Metrology	Dhanpatrai Publications	2018

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Charles Reginald Shotbolt	Metrology for Engineers	Cengage Learning EMEA	1990
2	Backwith, Marangoni, Lienhard	Mechanical Measurements	Pearson Education	2006
3	Jay.L.Bucher	The Metrology Handbook	Measurement Quality Division (ASQ)	2015
4	L.V. Ragavendra and L.Krishnamoorthy	Engineering Metrology and Measurements	Oxford Higher Education	2013
5	Anand K. Bewoor Vinay A . Kulgarni	Metrology and Measurements	McGraw Hill Companies	2016

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC11 COMPUTER AIDED DESIGN AND MANUFACTURING **L T P C 3 0 0 3**

COURSE OBJECTIVES

- To provide the basic computer graphics knowledge used in mechanical engineering field.
- To understand the characteristics of geometric curves, surfaces, solids elements
- To impart the knowledge on CAD Standards.
- To understand the fundamental concepts and part programming concepts.
- To learn the principles of cellular manufacturing and flexible manufacturing systems.

COURSE OUTCOMES

19RAC11.CO1 Determine the geometric transformations matrix for simple two/ three dimensional objects.
19RAC11.CO2 Apply the various representation of geometric curves, surfaces, solids elements.
19RAC11.CO3 Suggest the geometrical data exchanging formats to transfer CAD Models between various platforms.
19RAC11.CO4 Write the CNC part programming for the making engineering parts in CNC machines.
19RAC11.CO5 Demonstrate the cellular manufacturing and flexible manufacturing systems used in industrial processes.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC11.CO1	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC11.CO2	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC11.CO3	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC11.CO4	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC11.CO5	X	-	X	-	X	-	-	-	-	-	-	-	-	X	-

UNIT I: INTRODUCTION 9

Introduction to CAD/CAM –CAD/CAM concept - Computer aided design – CAD system architecture- Computer graphics – co-ordinate systems- 2D and 3D transformations– Manufacturing Planning, Manufacturing controls — Types of production.

UNIT II: GEOMETRIC MODELING 9

Representation of curves- Hermite curve- Bezier curve- B-spline curves-rational curves-Techniques for surface modeling – surface patch- Coons and bicubic patches- Bezier and B-spline surfaces. Solid modeling techniques- CSG and B-rep.

UNIT III: CAD STANDARDS 9

Standards for computer graphics- Graphical Kernel System (GKS) - standards for exchange images Open Graphics Library (OpenGL) - Data exchange standards - IGES, STEP, CALS etc. - communication standards.

UNIT IV: FUNDAMENTAL OF CNC AND PART PROGRAMING 9

Introduction to NC systems and CNC – Machine axis and Co-ordinate system- CNC machine tools- Principle of operation CNC- Construction features including structure- Drives and CNC controllers- 2D and 3D machining on CNC- Introduction of Part Programming, types – Detailed Manual part programming on Lathe & Milling machines using G codes and M codes- Cutting Cycles, Loops, Sub program and Macros- Introduction of CAM package.

UNIT V: CELLULAR MANUFACTURING AND FLEXIBLE MANUFACTURING SYSTEM (FMS) 9

Group Technology (GT),Part Families–Parts Classification and coding–Simple Problems in Opitz Part Coding system–Production flow Analysis–Cellular Manufacturing–Composite part concept–Types of Flexibility – FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control–Quantitative analysis in FMS ME8691 Computer Aided Design and Manufacturing

TOTAL: L: 45 =45

Programme Code & Name: RA & B.E-Robotics and Automation

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ibrahim Zeid	CAD CAM	Tata McGraw-Hill	2007
2	Radhakrishnan P, SubramanyanS.andRaju V.	CAD/CAM/CIM	New Age International (P) Ltd, New Delhi	2007

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chris McMahon and Jimmie Browne	CAD/CAM Principles, Practice and Manufacturing management	Pearson Education	1999
2	Donald Hearn and M. Pauline Baker	Computer Graphics	Prentice Hall, Inc.	2010
3	Foley, Wan Dam, Feiner and Hughes	Computer graphics principles & practice	Pearson Education	2003

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19RAC12 MICROPROCESSORS AND APPLICATIONS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To provide the basic knowledge on microprocessor and instructions sets.
- To understand the various interfacing techniques with microprocessor circuits.
- To understand the interface devices with microprocessors.
- To provide the various microprocessor circuits using peripheral devices.
- To provide the knowledge micro controller products using case studies.

COURSE OUTCOMES

19RAC12. CO1 Use microprocessor kit to execute the basic 8085 programs.
19RAC12. CO2 Apply the various interfacing techniques to develop the microprocessor circuits.
19RAC12. CO3 Interface the various controllers with microprocessors.
19RAC12. CO4 Design the various microprocessor circuits using peripheral devices.
19RAC12. CO5 Demonstrate the various micro controller applications and case studies.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC12.CO1	X	X	X	-	X	X	-	-	-	-	-	-	X	-	-
19RAC12.CO2	X	X	X	X	X	-	-	-	-	-	-	-	X	X	-
19RAC12.CO3	X	X	X	X	X	-	-	-	-	-	-	-	X	X	-
19RAC12.CO4	X	X	X	X	X	-	-	-	-	-	-	-	X	X	-
19RAC12.CO5	X	X	X	X	X	-	-	-	-	-	-	-	X	X	-

UNIT I: INTRODUCTION 10

Organization of 8085: Architecture, Internal Register Organization and Pin Configuration – Instruction Set of 8085 – addressing modes – instruction machine cycles with states and timing diagram.- 8085 assembly language programming- Examples.

UNIT II: INTERFACING TECHNIQUES 9

Need for Interfacing - Memory Interfacing, address space partitioning – address map – Address decoding – Designing decoders circuit. I/O Interfacing: Data transfer schemes – programmed Synchronous and asynchronous – Interrupt driven Transfer – Multiple devices and multiple interrupt levels – enabling disabling and masking of interrupts. DMA transfer: Cycle stealing – Burst mode – Multiple DMA devices – DMA transfer in 8085 system – serial data transfer.

UNIT III: INTERFACING DEVICES 9

Programmable peripheral device (8255) – programmable interval timer (8353) – Programmable communication interface (8251) (USART) – Programmable interrupt controller – Programmable DMA Controller (8257)- Programmable Keyboard/display controllers (8279)

UNIT IV: DESIGN USING PERIPHERAL DEVICES 9

Interfacing A/D and D/A converters – Matrix Keyboard design using 8255 with 8085 programs. Designing real time clock, detecting power failure, detecting presence of objects using 8253 - Design of Keyboard and display interfacing using 8279 – Design of digital transmission with modems and telephone lines using 8251 A.

UNIT V: MICROPROCESSOR APPLICATIONS 8

Temperature monitoring system – Automotive applications – Closed loop process control – Stepper motor control.

TOTAL: L: 45 =45

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TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rafiquzzaman	Microprocessors and Microcomputer-Based System Design	Taylor & Francis,	2009
2	Ramesh Gonakar	Microprocessor Architecture. Programming and Applications with the 8085	Penram International Publishing (India) Private Limited	2005

REFERENCES:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Aditya P Mathur	Introduction to Microprocessor	3rd Edition, Tata McGraw Hill Publishing, Co Ltd., New Delhi	2003
2	Douglas V. Hall	Microprocessors and Interfacing, Programming and Hardware	Tata McGraw – Hill Publishing Company Ltd., New Delhi	1997

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19RAC13 STRENGTH OF MATERIALS LABORATORY

L T P C
0 0 2 1

COURSEOBJECTIVES

- To impart knowledge on the concepts and basic methods of material testing process.
- To understand the procedure of Tension test, Shear test, torsion test impact test of Steel material.
- To familiarize the testing procedure of hardness test of Rockwell and Brinell Hardness Testing Apparatus.
- To understand the various deflection tests on metal beam using given apparatus.
- To impart the knowledge of compression and deflection tests procedure of helical and carriage springs.

COURSE OUTCOMES

19RAC13.CO1 Demonstrate tensile and shear testing as per ASTM Standards.
19RAC13.CO2 Demonstrate torsion and impact testing as per ASTM Standards.
19RAC13.CO3 Demonstrate hardness test of given specimens
19RAC13.CO4 Analysis the defection of given specimen using deflection tester.
19RAC13.CO5 Demonstrate compression and deflection test of given springs.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC13.CO1	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19RAC13.CO2	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-
19RAC13.CO3	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19RAC13.CO4	X	X	X	X	-	-	-	-	-	-	-	X	X	X	X
19RAC13.CO5	X	X	X	X	-	-	-	-	-	-	-	X	X	-	-

LIST OF EXPERIMENTS

1. Tension test on mild steel rod
2. Double shear test on metal
3. Torsion test on mild steel rod
4. Impact test on metal specimen (Izod and Charpy)
5. Hardness test on metals (Rockwell and Brinell Hardness Tests)
6. Deflection test on metal beam
7. Compression test on helical spring
8. Deflection test on carriage spring

TOTAL: P:30 = 30

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC14 **MICRO CONTROLLER LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES

- To demonstrate microcontroller kit to execute the various programs.
- To provide skill to interface stepper and DC motors with microcontrollers kit.
- To provide the training on the microcontroller program using instructions set.
- To impart the knowledge to develop the micro controller system.
- To impart the knowledge to develop the micro controller system Programmable Logic controller system.

COURSE OUTCOMES

19RAC14.CO1 Use the microcontroller kit to execute the various programs.
19RAC14.CO2 Interface stepper and DC motors with microcontrollers kit.
19RAC14.CO3 Write the microcontroller program using instructions set to perform the various tasks.
19RAC14.CO4 Develop the various micro controller system with interfacing of various actuators and sensors.
19RAC14.CO5 Develop the various real time control system using Programmable Logic controller.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC14.CO1	X	-	-	X	-	X	-	X	-	-	-	-	X	X	-
19RAC14.CO2	X	-	-	X	-	-	-	X	-	-	-	-	X	X	-
19RAC14.CO3	X	-	-	X	-	-	-	X	-	-	-	-	X	X	-
19RAC14.CO4	X	-	-	X	-	-	-	X	-	-	-	-	X	X	-
19RAC14.CO5	X	-	-	X	-	-	-	X	-	-	-	-	X	X	-

LIST OF EXPERIMENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.
6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

TOTAL: P:30 = 30

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21RAC15 ASSEMBLY DRAWING AND MODELING LABORATORY **L T P C 0 0 3 1**

COURSE OBJECTIVES

- To develop skill to use software for creating 2 Dimensional models.
- To provide an overview of how computers are being used in mechanical component design.
- To make the students understand the computer graphics fundamentals.
- To build the students to identify with the various file types used in the CAD software.
- To provide an overview of how computers are being used in component manufacturing.

COURSE OUTCOMES

- Ability to use the software packers for drafting and modeling.
- Demonstrate proficiency in CAD skills by creating complex 2D drawings from 3D solid modeling techniques.
- Plan critically and use creativity in the design of mechanical components and systems.
- Ability to export / import CAD drawings for different applications.
- Ability to generate CNC part programming using CAM package

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
21MEC22.CO1	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO2	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO3	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO4	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
21MEC22.CO5	X	-	X	-	X	-	-	-	-	-	-	-	-	X	-

CAD

Drawing of Parts and assembly drawings of following components using any CAD package.

1. Fasteners (Square and Hexagonal headed bolt and nut)
2. Flange coupling (Unprotected),
3. Footstep Journal Bearing
4. Screw Jack
5. Plummer block.
6. Gib and cotter joint
7. Cotter joint with sleeve.

CAM

1. COMPUTER AIDED PART PROGRAMMING
   Generate CL Data and Post process data using CAM packages for Machining and Turning Centre.
2. STUDY OF CNC EDM
3. STUDY OF ADDITIVE MANUFACTURING PROCESS: FDM or SLA or SLS or LOM

Note: Plotting of drawings must be made for each exercise and attached to the records written by Students.

TOTAL P: 30=30

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19RAC15 ASSEMBLY DRAWING AND MODELING LABORATORY

L T P C
0 0 2 1

COURSE OBJECTIVES

- To develop skill to use software for creating 2 Dimensional models.
- To provide the skill on three-dimensional modeling.
- To provide the skills of creating special features in the three-dimensional models.
- To provide the skills to create assembly drawing.
- To provide the skill to draw the various views of CAD models.

COURSE OUTCOMES

19RAC15.CO1 Draw the two-dimensional and three-dimensional models of the given engineering components.
19RAC15.CO2 Analysis of structural characteristics of simple engineering components using FEM software.
19RAC15.CO3 Analysis of dynamic and vibration characteristics of engineering components using FEM software
19RAC15.CO4 Analysis of thermal characteristics of engineering components using FEM software.
19RAC15.CO5 Analysis the Kinematic and Dynamic of given simple mechanisms.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC15.CO1	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC15.CO2	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC15.CO3	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC15.CO4	X	-	X	-	X	-	-	-	-	-	-	-	X	-	-
19RAC15.CO5	X	-	X	-	X	-	-	-	-	-	-	-	-	X	-

LIST OF EXERCISES USING SOFTWARE CAPABLE OF DRAFTING AND MODELING

1. Solid modeling of engineering components and assembly.
2. Determination of stresses and factor of safety in simple machine components by FEM and experimental validation of the results by strain measurement.
3. Dynamic analysis of chassis frame of an automobile by FEM.
4. Thermal analysis using FEA software.
5. Kinematic and Dynamic analysis of mechanisms using mechanism analysis software.

TOTAL P: 30=30

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19RAC16 **DYNAMICS OF MACHINES** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn about the force-motion relationship in components subjected to external forces and analysis of standard mechanisms.
- To impart knowledge on static and dynamic balancing.
- To understand the concept of single degree of freedom of vibrations and its damping mechanism.
- To gain knowledge on the basic vibrations on the constrained body and its critical position of vibrations.
- To understand principles in mechanisms used for governing of machines.

COURSE OUTCOMES

19RAC16.CO1: Gain knowledge on forces like static, dynamic forces and Inertia force and inertia torque on the reciprocating engines
19RAC16.CO2: Acquire knowledge on turning moment diagrams of flywheels and follower mechanisms.
19RAC16.CO3: Know the concepts of balancing mechanisms of different types of engines and machines.
19RAC16.CO4: Understand different types of vibration occurring in the moving system.
19RAC16.CO5: Understand the effect of Dynamics of undesirable vibrations

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC16.CO1	X	X	X	X	-	X	-	-	-	X	-	-	X	-	-
19RAC16.CO2	X	X	-	X	-	X	-	-	-	X	-	X	X	-	-
19RAC16.CO3	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19RAC16.CO4	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19RAC16.CO5	X	X	-	X	-	X	-	-	X	X	-	X	X	-	X

UNIT I: FORCE ANALYSIS 9

Applied and constraint forces – Free body diagrams – Static equilibrium conditions – Static force analysis of simple mechanisms – Dynamic force analysis – Inertia force and Inertia torque – D Alembert's principle –Dynamic Analysis in reciprocating engines – Gas forces – Inertia effect of connecting rod– Bearing loads – Crank shaft torque – Turning moment diagrams – Fly Wheels – Flywheels of punching presses- Dynamics of Cam-follower mechanism.

UNIT II: BALANCING 9

Static and dynamic balancing – Balancing of rotating masses – Balancing a single cylinder engine – Balancing Multi-cylinder engines – Partial balancing in locomotive engines – Balancing of linkages – Balancing machines.

UNIT III: SINGLE DEGREE FREE VIBRATION 9

Basic features of vibratory systems – Degrees of freedom – single degree of freedom – Free vibration – Equations of motion – Natural frequency – Types of Damping – Damped vibration – Torsional vibration of shaft – Critical speeds of shafts – Torsional vibration – Two and three rotor torsional systems.

UNIT IV: FORCED VIBRATION 9

Response of one degree freedom systems to periodic forcing – Harmonic disturbances –
Disturbance caused by unbalance – Support motion –transmissibility – Vibration isolation vibration measurement.

UNIT V: MECHANISM FOR CONTROL 9

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

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Shigley	Theory of Machines and Mechanisms	Oxford University Press	2016
2.	Sadhu Singh	Theory of Machines	Pearson Education	2005

REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Rattan. S.S	Theory of Machines	Tata McGraw-Hill	2009
2.	Thomas Bevan	Theory of Machines	CBS Publishers and Distributors	2005
3.	Cleghorn. W. L,	Mechanisms of Machines	Oxford University Press	2005
4	Benson H. Tongue	Principles of Vibrations	Oxford University Press	2007
5	Ballaney.P.L	Theory of Machines	Khanna Publishers	2001

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19RAC17 POWER ELECTRONICS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To get an overview of different types of power semiconductor devices and their switching characteristics.
- To understand the operation, characteristics and performance parameters of controlled rectifiers
- To study the operation, switching techniques and basics topologies of DC-DC switching regulators.
- To learn the different modulation techniques of pulse width modulated inverters and to understand harmonic reduction methods.
- To study the operation of AC voltage controller and various configurations.

COURSE OUTCOMES

19RAC17.CO1: Explain the working principles of various Power-semi-Conductor Devices
19RAC17.CO2: Understand the various Phase-Controlled Convertors.
19RAC17.CO3: Understand the various principles on DC to DC Converter.
19RAC17.CO4: Understand the various phase changing inverters
19RAC17.CO5: Understand the various principles on AC to AC Converter.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC17.CO1	X	X	-	X	X	X	-	-	-	-	-	-	X	-	-
19RAC17.CO2	X	X	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC17.CO3	X	X	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC17.CO4	X	X	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC17.CO5	X	X	-	X	X	-	-	-	-	-	-	-	X	-	-

UNIT I : POWERSEMI-CONDUCTOR DEVICES 9

Study of switching devices, Diode, SCR, TRIAC, GTO, BJT, MOSFET, IGBT-Static and Dynamic characteristics - Triggering and commutation circuit for SCR- Design of Driver and snubber circuit.

UNIT II: PHASE-CONTROLLED CONVERTERS 9

2- pulse,3-pulse and 6-pulseconverters– performance parameters –Effect of source inductance— Gate Circuit Schemes for Phase Control–Dual converters.

UNIT III: DC TO DC CONVERTER 9

Step-down and step-up chopper-control strategy–Forced commutated chopper–Voltage commutated, Current commutated, Load commutated, Switched mode regulators- Buck, boost, buck- boost converter, Introduction to Resonant Converters.

UNIT IV: INVERTERS 9

Single phase and three phase voltage source inverters(both 120^0 mode and 180^0 mode)–Voltage& harmonic control--PWM techniques: Sinusoidal PWM, modified sinusoidal PWM - multiple PWM – Introduction to space vector modulation –Current source inverter.

UNIT V: AC TO AC CONVERTERS 9

Single phase and Three phase AC voltage controllers–Control strategy- Power Factor Control – Multistage sequence control -single phase and three phase cyclo converters –Introduction to Matrix converters.

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.H.Rashid	Power Electronics: Circuits, Devices and Applications	Pearson Education, 3rd Edition New Delhi,	2004
2.	P.S.Bimbra	Power Electronics	Khanna Publishers	2003

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	L. Umanand	Power Electronics Essentials and Applications	Wiley	2010

2.	Daniel.W.Hart	Power Electronics	Indian Edition Mc Graw Hill	2013
3.	M.D. Singh and K.B. Khanchandani	Power Electronics	Mc Graw Hill India	2013
4.	Joseph Vithayathil	Power Electronics, Principles and Applications	McGraw Hill Series	2013
5.	Philip T. Krein	Elements of Power Electronics	Oxford University Press	2004

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19RAC18 **DESIGN OF MACHINE ELEMENTS** **L T P C**
3 0 0 3

(Use of approved Design Data book is permitted)

COURSE OBJECTIVES

- To select the materials based on mechanical properties, different types of loading, simple, steady and variable stresses.
- To know the design procedure for various types of shafts, keys and couplings.
- To design the threaded fasteners, bolted joints including eccentric loading and welded joints for pressure vessels and structures.
- To design the various types of springs like helical, leaf, disc and torsional springs.
- To state the design procedure for various types of bearings and flywheel

COURSE OUTCOMES

19RAC18.CO1: Select the materials based on mechanical properties, different types of loading and introduction about simple, steady and variable stresses.
19RAC18.CO2: Know the design procedure for various types of shafts, keys and couplings.
19RAC18.CO3: Design the threaded fasteners, bolted joints including eccentric loading and welded joints for pressure vessels and structures.
19RAC18.CO4: Design the various types of springs like helical, leaf, disc and torsional springs.
19RAC18.CO5: Design various types of bearings like sliding contact, rolling contact bearing and flywheels.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC18.CO1	X	X	-	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO2	X	X	X	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO3	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO4	X	X	X	-	-	X	-	-	-	-	-	-	X	-	-
19RAC18.CO5	X	-	X	-	-	X	-	-	-	-	-	-	X	-	-

UNIT I: STEADY AND VARIABLE STRESSES 9

Introduction to the design process - factor influencing machine design, selection of materials based on mechanical properties, preferred numbers – direct, bending and torsional stress equations – calculation of principle stresses for various load combinations, eccentric loading – design of curved beams – crane hook and 'c' frame - factor of safety - theories of failure – stress concentration – design for variable loading – Soderberg, Goodman and Gerber relations.

UNIT II: DESIGN OF SHAFTS AND COUPLINGS 9

Design of Solid And Hollow Shafts Based on Strength And Rigidity – Design Of Keys - Design Of Rigid And Flexible Couplings.

UNIT III: DESIGN OF FASTNERS AND WELDED JOINTS 9

Threaded fasteners - design of bolted joints including eccentric loading – design of welded joints for structures.

UNIT IV: DESIGN OF SPRINGS 9

Design of helical, leaf and torsional springs under constant loads and varying loads – concentric torsion springs - belleville springs introduction to modern spring like wave spring, constant force spring (theory only).

UNIT V: DESIGN OF BEARINGS AND FLYWHEELS 9

Design of bearings – sliding contact and rolling contact types. – cubic mean load – design of journal bearings – mckees equation – lubrication in journal bearings – calculation of bearing dimensions – design of flywheels involving stresses in rim and arm.

TOTAL: L: 45 =45

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TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Richard G Budynas J.Keith Nisbett	Shigley's Mechanical Engineering Design	Mc Graw Hill	2011
2	Khurmi R.S, Gupta J.K	Machine Design	Eurasia publishing house	2005

REFERENCE BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Norton R.L	Design of Machinery	Tata McGraw-hill book co	2002
2	Orthwein W	Machine Component Design	Jaico Publishing co	2003
3	Ugural A.C	Mechanical Design – An Integral Approach	Mcgraw-hill book co	2004
4	Spotts M.F., Shoup T.E	Design and Machine Elements	Pearson Education	2004
5	V B Bhandari	Design of Machine Elements	Tata Mcgraw-hill.	2007

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC19 **PRINCIPLES OF ROBOTICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To introduce the functional elements of Robotics
- To impart knowledge on the direct and inverse kinematics
- To introduce the manipulator differential motion and control
- To educate on various path planning techniques
- To introduce the dynamics and control of manipulators

COURSE OUTCOMES:

19RAC19.CO1: Understand basic concept of robotics.
19RAC19.CO1: Analyze Instrumentation systems and their applications to various
19RAC19.CO1: Explain differential motion add statics in robotics
19RAC19.CO1: Understand about the various path planning techniques.
19RAC19.CO1: Explain dynamics and control in robotics industries.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC19.CO1	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO2	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO3	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO4	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X
19RAC19.CO5	X	X	X	X	X	-	-	-	-	-	-	-	X	X	X

UNIT I: BASIC CONCEPTS **9**

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and Control issues- Various manipulators – Sensors - work cell - Programming languages.

UNIT II: DIRECT AND INVERSE KINEMATICS **9**

Mathematical representation of Robots - Position and orientation – Homogeneous transformation Various joints-Representation using the Denavit Hattenberg parameters -Degrees of freedom-Direct kinematics-Inverse kinematics-SCARA robots- Solvability – Solution methods-Closed form solution.

UNIT III: MANIPULATOR DIFFERENTIAL MOTION AND STATICS **9**

Linear and angular velocities-Manipulator Jacobian-Prismatic and rotary joints–Inverse -Wrist and arm singularity - Static analysis - Force and moment Balance.

UNIT IV: PATH PLANNING **9**

Definition-Joint space technique-Use of p-degree polynomial-Cubic polynomial-Cartesian space technique - Parametric descriptions - Straight line and circular paths - Position and orientation planning.

UNIT V: DYNAMICS AND CONTROL **9**

Lagrangian mechanics-2DOF Manipulator-Lagrange Euler formulation-Dynamic model – Manipulator control problem-Linear control schemes-PID control scheme-Force control of robotic manipulator.

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	R.K.Mittal and I.J.Nagrath	Robotics and Control	Tata McGraw Hill, New Delhi,4th Reprint	2005
2	JohnJ.Craig	Introduction to Robotics Mechanics and Control	Third edition, Pearson Education,	2009.

REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ashitava Ghoshal	Robotics-Fundamental Concepts and Analysis	Oxford University Press, Sixth impression	2010
2	K. K.Appu Kuttan	Robotics	I K International	2007
3	Edwin Wise	Applied Robotics	Cengage Learning	2003
4	R.D.Klafter,T.A.Chimielewski and M.Negin	Robotic Engineering–An Integrated Approach	Prentice Hall of India, New Delhi	1994
5	S.Ghoshal	Embedded Systems & Robotics Projects using the 8051 Microcontroller	Cengage Learning	2009

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19RAC20 **ROBOTICS AND MACHINE VISION SYSTEM** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To learn about basics of robots, programming and Machine vision applications in robots.
- To learn the working principles of varies robots end effectors.
- To learn robot mechanics
- To understand the mission vision concepts.
- To learn the robotics programmes.

COURSE OUTCOMES:

19RAC20.CO1: Understand the basics of robots, programming and Machine vision applications in robots.
19RAC20.CO2: Explain working principles of varies robots end effectors.
19RAC20.CO3: Explain the various robot mechanics
19RAC20.CO4: Explain the various applications using mission vision concepts.
19RAC20.CO5: Write the various robotics programmes.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC20.CO1	X	-	-	X	X	X	X	-	-	-	-	X	X	X	-
19RAC20.CO2	X	-	-	X	X	-	X	-	-	-	-	X	X	X	-
19RAC20.CO3	X	-	-	X	X	-	X	-	-	-	-	X	X	X	-
19RAC20.CO4	X	-	-	X	X	-	X	-	-	-	-	X	X	X	-
19RAC20.CO5	X	-	-	X	X	-	X	-	-	-	-	X	X	X	-

UNIT I : BASICS OF ROBOTICS **9**

Introduction- Basic components of robot-Laws of robotics- classification of robot-work space- accuracy-resolution –repeatability of robot. Power transmission system: Rotary to rotary motion, Rotary to linear motion, Harmonics drives

UNIT II:ROBOT END EFFECTORS **9**

Robot End effectors: Introduction- types of End effectors- Mechanical gripper- types of gripper mechanism- gripper force analysis- other types of gripper- special purpose grippers.

UNIT III:ROBOT MECHANICS **10**

Robot kinematics: Introduction- Matrix representation- rigid motion & homogeneous transformation- forward & inverse kinematics- trajectory planning. Robot Dynamics: Introduction - Manipulator dynamics – Lagrange - Euler formulation- Newton - Euler formulation

UNIT IV: MACHINE VISION FUNDAMENTALS **9**

Machine vision: image acquisition, digital images-sampling and quantization-levels of computation Feature extraction-windowing technique- segmentation- Thresholding- edge detection- binary morphology - grey morphology

UNIT V:ROBOT PROGRAMMING **8**

Robot programming: Robot Languages- Classification of robot language-Computer control and robot software-Val system and Languages- application of robots.

TOTAL: L: 45: = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	M.P.Groover, M.Weiss ,R.N. Nagal, N.G.Odrey	Industrial Robotics - Technology, programming and Applications	Tata McGraw-Hill Education Pvt Limited	2008

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REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Sathya Ranjan Deb	Robotics Technology & flexible Automation	Sixth edition, Tata McGraw- Hill Publication	2003
2	K.S.Fu, R.C.Gonzalez, C.S.G.Lee	Robotics: Sensing, Vision & Intelligence	Tata McGraw-Hill Publication	1987
3	John.J.Craig	Introduction to Robotics: Mechanics & control	Tata McGraw-Hill Second edition	2002
4	Jazar	Theory of Applied Robotics: Kinematics, Dynamics and Control	Springer, Indian Reprint	2010

Programme Code & Name: RA & B.E-Robotics and Automation

19RAC21 **DYNAMICS OF MACHINES LABORATORY** **L T P C**
0 0 3 1

COURSE OBJECTIVES:

- To learn about basics of various links and mechanisms.
- To learn the working principles of gyroscopes and cams
- To learn various governors.
- To understand the mission vibrating instruments.
- To learn the balancing of rotating and reciprocating masses.

COURSE OUTCOMES:

19RAC21.CO1: Understand the basics of various links and mechanisms
19RAC21.CO2: Use gyroscopes and cams.
19RAC21.CO3: Operate the various governors.
19RAC21.CO4: Measure the various parameters using vibrating instruments.
19RAC21.CO5: Analysis the balancing of rotating and reciprocating masses.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC21.CO1	X	X	X	X	-	X	-	-	-	X	-	-	X	-	-
19RAC21.CO2	X	X	-	X	-	X	-	-	-	X	-	X	X	-	-
19RAC21.CO3	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19RAC21.CO4	X	X	X	X	-	X	-	-	X	X	-	X	X	-	-
19RAC21.CO5	X	X	-	X	-	X	-	-	X	X	-	X	X	-	X

LIST OF EXPERIMENTS

1. a) Study of gear parameters.
2. b) Experimental study of velocity ratios of simple, compound, Epicyclic and differential gear trains.
3. a) Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating
    1. cylinder Mechanisms.
4. b) Kinematics of single and double universal joints.
5. a) Determination of Mass moment of inertia of Fly wheel and Axle system.
6. b) Determination of Mass Moment of Inertia of axisymmetric bodies using Turn Table apparatus.
7. c) Determination of Mass Moment of Inertia using bifilar suspension and compound pendulum.
8. Motorized gyroscope – Study of gyroscopic effect and couple.
9. Governor - Determination of range sensitivity, effort etc., for Watts, Porter, Proell, and Hartnell
10. Governors.
11. Cams – Cam profile drawing, Motion curves and study of jump phenomenon
12. a) Single degree of freedom Spring Mass System – Determination of natural frequency and verification
    1. of Laws of springs – Damping coefficient determination.
13. b) Multi degree freedom suspension system – Determination of influence coefficient.
14. a) Determination of torsional natural frequency of single and Double Rotor systems. - Undamped and
    1. Damped Natural frequencies.
15. b) Vibration Absorber – Tuned vibration absorber.
16. Vibration of Equivalent Spring mass system – undamped and damped vibration.
17. Whirling of shafts – Determination of critical speeds of shafts with concentrated loads.
18. a) Balancing of rotating masses.
19. b) Balancing of reciprocating masses.
20. a) Transverse vibration of Free-Free beam – with and without concentrated masses.
21. b) Forced Vibration of Cantilever beam – Mode shapes and natural frequencies.
22. c) Determination of transmissibility ratio using vibrating table

TOTAL: P: 30: = 30

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC22 **POWER ELECTRONICS LABORATORY** **L T P C**
0 0 3 2

COURSE OBJECTIVES:

- To train for using the SCR, MOSFET & IGBT characteristics.
- To understand the electronics components.
- To train for using the Controller circuits
- To train for using the Control the AC and DC motors
- To train for using the Chopper and Invertors

COURSE OUTCOMES:

19RAC22.CO1: Use SCR, MOSFET, TRIAC in electronic circuit
19RAC22.CO2: Perform characteristic study on the electronics components.
19RAC22.CO3: Make the varies Controller circuits
19RAC22.CO4: Control the AC and DC motors
19RAC22.CO5: Use the Chopper and Invertors

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC22.CO1	X	-	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC22.CO2	X	-	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC22.CO3	X	-	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC22.CO4	X	-	-	X	X	-	-	-	-	-	-	-	X	X	-
19RAC22.CO5	X	-	-	X	X	-	-	-	-	-	-	-	X	X	-

LIST OF EXPERIMENTS

1. Study of SCR, MOSFET & IGBT characteristics
2. UJT, R, RC firing circuits for SCR
3. Voltage & current commutated chopper
4. SCR phase control circuit
5. TRIAC phase control circuit
6. Study of half controlled & fully controller converters
7. Study of three phase AC regulator
8. Speed control of DC shunt motor using three phase fully controlled converter.
9. SCR single-phase cyclo converter
10. SCR series and parallel inverters
11. IGBT Chopper
12. IGBT based PWM inverter (single phase

TOTAL: P: 30: = 30

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19RAC23 **MICROCONTROLLER AND PLC** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To impart basics of varies microcontrollers.
- To impart the knowledge on 8051 microcontrollers Programme.
- To impart the knowledge on interfacing various microcontrollers.
- To impart the knowledge on PLC.
- To impart the knowledge on Applications of various PLC.

COURSE OUTCOMES

19RAC23.CO1: Familiarize varies microcontrollers.
19RAC23.CO2: Write the 8051 microcontrollers Programme.
19RAC23.CO3: Interface various microcontrollers.
19RAC23.CO4: Explain various PLC systems.
19RAC23.CO5: Illustrate the various applications of PLC.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC23.CO1	X	-	-	X	X	X	-	-	-	-	-	X	X	-	-
19RAC23.CO2	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAC23.CO3	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAC23.CO4	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAC23.CO5	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-

UNIT I: INTRODUCTION TO MICROCONTROLLER **9**

8051 Architecture: – Memory map - Addressing modes, I/O Ports –Counters and Timers – Serial data - I/O – Interrupts –Instruction set, Data transfer instructions, Arithmetic and Logical Instructions, Jump and Call Instructions, Assembly Language Programming tools.

UNIT II: MICROCONTROLLER PROGRAMMING **9**

8051 Assembly Language Programming- Block transfer, arithmetic operations, Code conversion, Time delay generation, Interrupt programming, Lookup table techniques

UNIT III: MICROCONTROLLER APPLICATIONS **8**

Interfacing of Keyboards – Interfacing of Display Devices – Pulse measurement – Analog to Digital and Digital to Analog Converter – Interfacing Hardware Circuit – Serial Data Communication – Network Configuration.

UNIT IV: PROGRAMMABLE LOGIC CONTROLLERS **9**

Introduction — Principles of operation – PLC Architecture and specifications – PLC hardware components Analog & digital I/O modules, CPU & memory module – Programming devices – PLC ladder diagram, Converting simple relay ladder diagram in to PLC relay ladder diagram. PLC programming Simple instructions – Manually operated switches – Mechanically operated a Proximity switches - Latching relays,

UNIT V: APPLICATIONS OF PROGRAMMABLE LOGIC CONTROLLERS. **9**

Timer instructions - On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Simple materials handling applications, Automatic control of warehouse door, Automatic lubrication of supplier Conveyor belt, motor control, Automatic car washing machine, Bottle label detection and process control application.

TOTAL: L: 45: = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Muhammad Ali Mazdi, J.G.Mazdi & R.D.McKinlay	The 8051 Microcontroller& Embedded systems Using assembly & C	2nd Edition Pearson Education	2006
2	Udayasankara.v & Mallikarjunaswamy .M.S	8051 Microcontroller, Hardware, Software & Applications	Tata McGraw Hill Education Pvt Limited. New Delhi	2009

3	Gary Dunning	Introduction to Programmable Logic Controllers	Thomson Learning	2001

REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Singh. B.P	Microprocessors and Microcontrollers	Galcotia Publications (P) Ltd, First edition, New Delhi	1997
2	Parr	Programmable Controllers: An Engineers Guide	3rd Edition, Elsevier, Indian Reprint	2013
3	Valdes-Perez	Microcontrollers: Fundamentals and Applications with PIC	Taylor & Francis, Indian Reprint	2013
4	Bolton	Programmable Logic Controllers	5th Edition Newnes	2009

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC24 **SENSORS AND SIGNAL PROCESSING** **L T P C**
3 0 0 3

COURSE OBJECTIVES:

- To impart basics of sensors and the methods of processing their signals.
- To impart the knowledge on instruments for mechanical measurements.
- To impart the knowledge on instruments for Electrical Measurement.
- To impart the knowledge on smart sensors.
- To impart the knowledge on signal conditioning and data acquisition.

COURSE OUTCOMES

19RAC24.CO1: Familiarize sensors and the methods of processing their signals.
19RAC24.CO2: Explain the working principle of mechanical measurements.
19RAC24.CO3: Explain the working principle of instruments for Electrical Measurement.
19RAC24.CO4: Illustrate the working principle of smart sensors.
19RAC24.CO5: Illustrate the working principle of signal conditioning and data acquisition.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC24.CO1	X	X	X	-	X	-	-	-	-	-	-	X	X	-	-
19RAC24.CO2	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAC24.CO3	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAC24.CO4	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAC24.CO5	X	X	X	X	X	-	-	-	-	-	-	X	X	-	-

UNIT I: SCIENCE OF MEASUREMENT **9**

Units and Standards – Calibration techniques –Errors in Measurements – Generalized Measurement System – Static and dynamic characteristics of transducers – Generalized Performance of Zero Order and First Order Systems - Response of transducers to different time varying inputs – Classification of transducers

UNIT II: MECHANICAL MEASUREMENTS **9**

Temperature: Filled thermometer – Bimetallic thermometer – monometers – elastic transducers – bourdon gauge – bellows – diaphragm. Vacuum: McLeod gauge, thermal conductivity gauge – Ionization gauge, flow measurement: orifice, venture, nozzle, pilot tube, turbine flow meter, hot wire anemometer.'

UNIT III: ELECTRICAL MEASUREMENTS **9**

Resistive transducers – Potentiometer– RTD – Thermistor – Thermocouple – Strain gauges – use in displacement, temperature, force measurement – Inductive transducer – LVDT – RVDT – use in displacement – Capacitive transducer – Piezo electric transducer – Digital displacement transducers.

UNIT IV: SMART SENSORS **9**

Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors – applications - Automobile, Aerospace, Home appliances, Manufacturing, Medical diagnostics, Environmental monitoring.

UNIT V: SIGNAL CONDITIONING AND DATA ACQUISITION **9**

Amplification – Filtering – Sample and Hold circuits –Data Acquisition: Single channel and multi channel data acquisition – Data logging.

TOTAL: L: 45: = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Doebelin. E. O	Measurement Systems – Applications and Design	Tata McGraw Hill	1992
2	Patranabis. D	Sensors and Transducers	2nd Edition PHI, New Delhi	2003

REFERENCES:

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Programme Code & Name: RA & B.E-Robotics and Automation

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Ian SinclaIr . R	Sensors and transducers	Newnes ,Elaiver Indian print	2011
2	Beckwith, Marangoni and Lienhard	Mechanical Measurements	Addison Wesley	2000
3	Venkatesan. S.P	Mechanical Measurements	Ane Books Pvt Ltd, India	2008

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19RAC25 AUTOMATION SYSTEM DESIGN

L T P C
3 0 0 3

COURSE OBJECTIVES

- To know about the basic concepts in industrial automation
- To design automated systems.
- To know about transfer lines and automated assembly
- To expose to pneumatic, electric, hydraulic and electronic systems in automation of mechanical operations.
- To know about the advancement in hydraulics and pneumatics

COURSE OUTCOMES

19RAC25.CO1: Familiarize the industrial automation by transfer lines and automated assembly lines.
19RAC25.CO2: Design an automated system
19RAC25.CO3: Understanding of automated controls using pneumatic and hydraulic systems
19RAC25.CO4: Understand the electronic control systems in metal machining and other manufacturing processes.
19RAC25.CO5: Understand advancement in hydraulics and pneumatics systems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC25.CO1	X	-	-	-	X	X	X	-	-	-	-	X	X	-	-
19RAC25.CO2	X	-	-	X	X	-	X	-	-	-	-	X	X	X	X
19RAC25.CO3	X	-	-	X	X	-	X	-	-	-	-	X	X	X	X
19RAC25.CO4	X	-	-	X	X	-	X	-	-	-	-	X	X	-	-
19RAC25.CO5	X	-	-	X	X	-	X	-	-	-	-	X	X	-	-

UNIT I: FUNDAMENTAL CONCEPTS OF INDUSTRIAL AUTOMATION 9

Fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation.

UNIT II: TRANSFER LINES AND AUTOMATED ASSEMBLY 10

General terminology and analysis, analysis of transfer lines without storage, partial automation. Automated flow lines with storage buffers. Automated assembly-design for automated assembly, types of automated assembly systems, part feeding devices, analysis of multi-station assembly machines. AS/RS, RFID system, AGVs, modular fixturing. Flow line balancing.

UNIT III: DESIGN OF MECHATRONIC SYSTEMS 8

Stages in design, traditional and mechatronic design, possible design solutions. Case studies-pick and place robot, engine management system.

UNIT IV: PROGRAMMABLE AUTOMATION 9

Special design features of CNC systems and features for lathes and machining centers. Drive system for CNC machine tools. Introduction to CIM; condition monitoring of manufacturing systems.

UNIT V:DESIGN FOR HIGH SPEED AUTOMATIC ASSEMBLY 9

Introduction, Design of parts for high speed feeding and orienting, high speed automatic insertion. Analysis of an assembly. General rules for product design for automation.

TOTAL: L: 45: = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Mikell P Groover	Automation Production Systems and Computer- Integrated Manufacturing	Pearson Education, New Delhi	2001
2	Bolton W	Mechatronics	Pearson Education	1999

REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Mikell P Groover	Industrial Robots – Technology Programmes and Applications	McGraw Hill, New York, USA	2000
2	Steve F Krar	Computer Numerical Control Simplified	Industrial Press	2001
3	Joffrey Boothroyd, Peter Dewhurst and Winston A. Knight	Product Design for manufacture and Assembly	CRC Press	2011

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC26 **MICRO CONTROLLER LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES

- To provide knowledge Microcontroller Kits.
- To provide knowledge on interfacing the stepper and D.C motors.
- To provide knowledge on interface the microcomputer port
- To provide knowledge to control the speeds.
- To provide hands-on PLC systems

COURSE OUTCOMES

19RAC26.CO1: Use Microcontroller Kits.
19RAC26.CO2: Interface the stepper and D.C motors.
19RAC26.CO3: Interface the microcomputer port lines, LED relays and LCD displays
19RAC26.CO4: Control the speed using Hydraulic actuators.
19RAC26.CO5: Control the various devices using PLC.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC27.CO1	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-
19RAC27.CO2	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO3	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO4	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO5	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-

LIST OF EXPERIMENTS

1. Study of Microcontroller Kits.
2. 8051 / 8031 Programming Exercises.
3. Stepper Motor interface.
4. D.C. motor controller interface.
5. Study of interrupt structure of 8051.
6. Interfacing high power devices to microcomputer port lines, LED relays and LCD displays.
7. Linear actuation of hydraulic cylinder with counter and speed control.
8. Hydraulic rotation with timer and speed control.
9. Sequential operation of pneumatic cylinders.
10. Traffic light controller.
11. Speed control of DC motor using PLC.
12. Testing of Relays using PLC.

TOTAL: P: 30: = 30

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAC27 **SENSORS AND SIGNAL PROCESSING LABORATORY** **L T P C**
0 0 2 1

COURSE OBJECTIVES

- To provide knowledge thermal and displacement sensors.
- To provide knowledge Torque and strain sensors.
- To provide knowledge Servomotor position control and wave Shaping sensors.
- To provide knowledge comparators and controllers.
- To provide hands-on experience on encoders and data acquisition system.

COURSE OUTCOMES

19RAC27.CO1: Use thermal and displacement sensors.
19RAC27.CO2: Measure Torque and strain using sensors.
19RAC27.CO3: Use Servomotor position control and wave Shaping sensors.
19RAC27.CO4: Use comparators and controllers.
19RAC27.CO5: Operate encoders and data acquisition system.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC27.CO1	X	-	-	X	X	X	-	-	-	-	-	X	X	X	-
19RAC27.CO2	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAC27.CO3	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO4	X	-	-	X	X	-	-	-	-	-	-	X	X	X	X
19RAC27.CO5	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-

LIST OF EXPERIMENTS

1. Measurement of temperature using thermocouple, thermistor and RTD
2. Measurement of displacement using POT, LVDT & Capacitive transducer
3. Torque measurement using torque measuring devices
4. Strain Measurement using strain gauge
5. Servomotor position control using photo electric pickup
6. Wave Shaping circuit
7. Analog to Digital Converters
8. Digital Comparator
9. Voltage to frequency converter
10. Frequency to Voltage Converter
11. Position and velocity measurement using encoders
12. Study on the application of data acquisition system for industrial purposes.

TOTAL: P: 30: = 30

Programme Code & Name: RA & B.E-Robotics and Automation

19RAC28 **FIELD AND SERVICE ROBOTICS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To study the various parts of robots and fields of robotics.
- To study the various kinematics and inverse kinematics of robots.
- To study about the localization, planning and navigation.
- To study the control of robots for some specific applications.
- To study about the humanoid robots.

COURSE OUTCOMES

19RAC28.CO1: Explain the basic concepts of working of robot
19RAC28.CO2: Analyze the function of sensors in the robot
19RAC28.CO3: Write program to use a robot for a typical application
19RAC28.CO4: Use Robots in different applications
19RAC28.CO5: Know about the humanoid robots.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAC28.CO1	-	-	-	X	-	-	X	-	-	-	-	X	X	X	X
19RAC28.CO2	-	-	-	X	-	-	X	-	-	-	-	X	X	X	X
19RAC28.CO3	-	-	-	X	-	-	X	-	-	-	-	X	X	X	X
19RAC28.CO4	-	-	-	X	-	-	X	-	-	-	-	X	X	X	X
19RAC28.CO5	-	-	-	X	-	-	X	-	-	-	-	X	X	X	X

UNIT I: INTRODUCTION 9

History of service robotics – Present status and future trends – Need for service robots – applications examples and Specifications of service and field Robots. Non conventional Industrial robots.

UNIT II: LOCALIZATION 9

Introduction-Challenges of Localization- Map Representation- Probabilistic Map based Localization Monte carlo localization- Landmark based navigation-Globally unique localization- Positioning beacon systems- Route based localization.

UNIT III : PLANNING AND NAVIGATION 9

Introduction-Path planning overview- Road map path planning- Cell decomposition path planning Potential field path planning-Obstacle avoidance - Case studies: tiered robot architectures.

UNIT IV:FIELD ROBOTS 9

Ariel robots- Collision avoidance-Robots for agriculture, mining, exploration, underwater, civilian and military applications, nuclear applications, Space applications.

UNIT V: HUMANOIDS 9

Wheeled and legged, Legged locomotion and balance, Arm movement, Gaze and auditory orientation control, Facial expression, Hands and manipulation, Sound and speech generation, Motion capture/Learning from demonstration, Human activity recognition using vision, touch, sound, Vision, Tactile Sensing, Models of emotion and motivation. Performance, Interaction, Safety and robustness, Applications, Case studies.

TOTAL: L: 45: = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza	Introduction to Autonomous Mobile Robots	Bradford Company Scituate, USA	2004
2	Riadh Siaer	The future of Humanoid Robots- Research and applications	Intech Publications	2012

REFERENCES:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Richard D Klafter, Thomas A, Chmielewski, Michael Negin	Robotics Engineering – An Integrated Approach	Eastern Economy Edition, Prentice Hall of India P Ltd	2006
2	Kelly, Alonzo; Iagnemma, Karl Howard, Andrew	Field and Service Robotics	Springer,	2011

PROFESSIONAL ELECTIVES (PE)

For

Robotics and Automation

19RAE01 ADVANCED MACHINING PROCESSES **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the surface treatment techniques.
- To understand the non-traditional machining
- To familiarize the laser beam machining and electron beam machining.
- To understand the manufacturing processes of ceramic composites.
- To understand the various Processing of Composites.

COURSE OUTCOMES

19RAE01.CO1: Understand the fundamentals of Surface treatment.
19RAE01.CO2: Illustrate the concepts of non-traditional machining processes
19RAE01.CO3: Explain the working principle of laser beam machining and electron beam machining
19RAE01.CO4: Summarize the fabrication techniques of microelectronic devices.
19RAE01.CO5: Comprehend the fabrication and processing of ceramic composites

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE01.CO1	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE01.CO2	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE01.CO3	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE01.CO4	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE01.CO5	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-

UNIT I: SURFACE TREATMENT **9**

Scope, Cleaners, Methods of cleaning, Surface coating types, and ceramic and organic methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying, Ion implantation, diffusion coating, Diamond coating and cladding.

UNIT II: NON-TRADITIONAL MACHINING **9**

Introduction, need, AJM, Parametric Analysis, Process capabilities, USM –Mechanics of cutting, models, Parametric Analysis, WJM –principle, equipment, process characteristics , performance, EDM – principles, equipment, generators, analysis of R-C circuits, MRR , Surface finish, WEDM.

UNIT III: BEAM, ARC AND CHEMICAL MACHINING **9**

Laser beam, electron beam, plasma arc & electro chemical machining-Principle of working, equipment, Material removal rate, Process parameters, performance characterization, Applications.

UNIT IV: FABRICATION OF MICROELECTRONIC DEVICES **9**

Crystal growth and wafer preparation, Film Deposition oxidation, lithography, bonding and packaging, reliability and yield, Printed Circuit boards, computer aided design in microelectronics, surface mount technology, Integrated circuit economics. E-Manufacturing, nanotechnology

UNIT V: PROCESSING OF CERAMICS AND COMPOSITES 9

Applications, characteristics, classification. Processing of particulate ceramics, Powder preparations, consolidation, drying, sintering, Hot compaction, Area of application, finishing of ceramics. Composite Layers, Particulate and fiber reinforced composites, Elastomers, Reinforced plastics, MMC, CMC, Polymer matrix composites.

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	V. K. Jain	Advanced Machining Processes	Allied Publishers	2009
2	J. A. McGeough	Advanced Methods of Machining	Springer	2011

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kalpakijian	Manufacturing Engineering and Technology	Adisson Wesley	2010
2	R. A. Lindburg	Process and Materials of Manufacturing	PHI	2003
3	Chang Liu	Foundation of MEMS	Pearson	2012
4	Hassan El-Hofy,	Advanced Machining Processes: Nontraditional and Hybrid Machining Processes	McGraw-Hill	2005
5	V. K. Jain	Introduction to Micromachining	Alpha Science International Limited	2010

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19RAE02 TOTAL QUALITY MANAGEMENT **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the Total Quality Management concept and principles and the various tools available to achieve Total Quality Management
- To understand the application of statistical approach for quality control
- To create an awareness about the ISO and QS certification process and its need for the industries
- To apply the quality concepts in product design, manufacturing etc in order to maximize customer Satisfaction
- Human involvement to improve quality and the development and transformation

COURSE OUTCOMES

19RAE02.CO1: Understand the concept of total quality management
19RAE02.CO2: Comprehend and illustrate the TQM principles
19RAE02.CO3: Solve quality related problems using statistical process control
19RAE02.CO4: Understand proven methodologies to enhance management processes
19RAE02.CO5: Illustrate the salient features of quality systems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE02.CO1	-	-	-	-	-	X	X	X	X	X	-	X	-	X	-
19RAE02.CO2	-	-	-	-	-	X	X	X	X	X	-	X	X	X	-
19RAE02.CO3	-	X	X	X	-	X	X	X	X	X	-	X	X	X	-
19RAE02.CO4	-	X	X	X	-	X	X	X	X	X	-	X	X	X	-
19RAE02.CO5	-	X	-	-	X	X	X	X	X	X	X	X	-	X	-

UNIT I: INTRODUCTION 9

Definition of Quality – Dimensions of Quality – Quality Planning – Quality costs – Analysis Techniques for Quality Costs – Basic concepts of Total Quality Management – Historical Review – Quality Statements – Strategic Planning, Deming Philosophy – Crosby philosophy – Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen – Obstacles to TQM Implementation

UNIT II: TQM PRINCIPLES 9

Principles of TQM, Leadership – Concepts – Role of Senior Management – Quality Council, Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits– Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure

UNIT III: STATISTICAL PROCESS CONTROL (SPC) 9

The seven tools of quality – Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables X bar and R chart and attributes P, nP, C, and u charts, Industrial Examples, Process capability, Concept of six sigma – New seven Management tools

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UNIT IV: TQM TOOLS 9

Benchmarking – Reasons to Benchmark – Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, and Benefits – Taguchi Quality Loss Function – Total Productive Maintenance (TPM) – Concept, Improvement Needs, and FMEA – Stages of FMEA- Case studies

UNIT V: QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems – ISO 9000:2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, ISO 9000:2005 (definitions), ISO 9001:2008 (requirements) and ISO 9004:2009 (continuous improvement), TS 16949, ISO 14000, AS9100 – Concept, Requirements and Benefits- Case studies

Total:L: 45 = 45

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dale H. Besterfiled	Total Quality Management	Pearson Education Inc, New Delhi	2011
2.	James R. Evans and William M. Lidsay,	The Management and Control of Quality	South-Western	2010

REFERENCE BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	N. Gupta and B. Valarmathi,	Total Quality Management	Tata McGraw-Hill Publishing Company Pvt Ltd., New Delhi	2009
2	Dr S. Kumar	Total Quality Management,	Laxmi Publications Ltd., New Delhi	2006
3	P. N. Muherjee	Total Quality Management	Prentice Hall of India, New Delhi	2006
4	James R. Evans and William M. Lindsay	The Management and Control of Quality	8th Edition, First Indian Edition, Cengage Learning	2012
5	Suganthi.L and Anand Samuel	Total Quality Management	Prentice Hall (India) Pvt. Ltd	2006

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19RAE03 PRINCIPLES OF MANAGEMENT

L	T	P	C
3	0	0	3

COURSE OBJECTIVES

- To analyze the historic development of Management thoughts
- To learn the nature and purpose of planning, forecasting and decision making
- To expose the knowledge on concepts of organizing
- To analyze the concepts of delegation of authority and Organization culture.
- To familarise the students to the basic concepts of management in order to aid in understanding how an organization functions.

COURSE OUTCOMES

19RAE03.CO1: Understand the evolution of management thought and role of managers
19RAE03.CO2: Discuss the phases of planning process and types of plans
19RAE03.CO3: Comprehend the different types of organization structure and illustrate the HR tasks
19RAE03.CO4: Describe the communication and directing process
19RAE03.CO5: Summarize the different controlling techniques in management

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE03.CO1	X	-	-	-	X	X	X	X	-	-	-	X	X	X	-
19RAE03.CO2	X	-	-	-	X	X	X	X	-	-	-	X	X	X	X
19RAE03.CO3	X	-	-	-	X	X	X	X	-	-	-	X	X	X	X
19RAE03.CO4	X	-	-	-	X	X	X	X	-	-	-	X	X	X	X
19RAE03.CO5	X	-	-	-	X	X	X	X	-	-	X	X	-	X	-

UNIT I: INTRODUCTION TO MANAGEMENT 9

Organization- Management- Role of managers- Evolution of management thought- Organization and the environmental factors- Managing globally- Strategies for International business.

UNIT II: PLANNING 9

Nature and purpose of planning- Planning process- Types of plans- objectives- Managing by Objective (MBO) strategies- Types of strategies – Policies – Decision Making- Types of decision making process- Rational decision making process- Decision making under different conditions.

UNIT III: ORGANISING 9

Nature and purpose of organizing- Organization structure- Formal and informal groups/ organization- Line and staff authority- Departmentation- Span of control- Centralization and decentralization- Delegation of authority- Staffing- Selection and Recruitment- Orientation- Career development- Career stages- Training- Performance appraisal

UNIT IV: DIRECTING 9

Managing people- Communication- Hurdles to effective communication- Organization culture Elements and types of culture- Managing cultural diversity.

UNIT V: CONTROLLING 9

Process of controlling- Types of control- Budgetary and non-budgetary control techniques Managing productivity- Cost control- Purchase control- Maintenance control- Quality control Planning operations.

TOTAL: L: 45 = 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1	Harold Koontz and Heinz Weihrich	Essentials of management: An International & Leadership Perspective	Tata McGraw-Hill Education	2015
2	Charles W.L Hill and Steven L McShane	Principles of Management	McGraw Hill Education	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Samuel C. Certo and Tervis Certo	Modern management: concepts and skills	Pearson education	2014
2.	Heinz Weihrich, Mark V Cannice and Harold Koontz,	Management a global entrepreneurial perspective	Tata McGraw Hill	2013
3.	Stephen P. Robbins, David A.De Cenzo and Mary Coulter	Fundamentals of management	Prentice Hall of India	2012
4.	Don Hellriegel, Susan E. Jackson and John W. Slocum,	Management a competency based approach	Thompson South Western	2008
5.	Joseph L.Massie	Essentials of Management	Pearson Education	2003

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19RAE04 AUTOMOTIVE ELECTRONICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge on emission standards in automobiles.
- To impart knowledge on electronic fuel injection/ignition components and their function.
- To study the basics of electronics, emission controls and its Importance in automobiles.
- To study the various sensors and actuators used in automobiles for improving fuel economy and emission control.
- To study the various blocks of control units used for control of fuel, ignition and exhaust systems.

COURSE OUTCOMES

19RAE04.CO1: Know the importance of emission standards in automobiles.
19RAE04.CO2: Understand the electronic fuel injection/ignition components and their function.
19RAE04.CO3: Choose and use sensors and equipment for measuring mechanical quantities, temperature and appropriate actuators.
19RAE04.CO4: Diagnose electronic engine control systems problems with appropriate diagnostic tools.
19RAE04.CO5: Analyses the chassis and vehicle safety system.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE04.CO1	-	-	X	X	X	-	X	-	-	X	-	X	-	X	-
19RAE04.CO2	-	-	X	X	X	-	X	X	-	X	-	X	X	X	-
19RAE04.CO3	-	-	X	X	X	-	X	-	-	X	-	X	X	X	-
19RAE04.CO4	-	-	X	X	X	-	X	-	-	X	-	X	X	X	-
19RAE04.CO5	-	-	X	X	X	X	X	-	-	X	-	X	-	X	-

UNIT I: INTRODUCTION **8**

Evolution of electronics in automobiles – emission laws – introduction to Euro I, Euro II, Euro III, Euro IV, Euro V standards – Equivalent Bharat Standards. Charging systems: Working and design of charging circuit diagram – Alternators – Requirements of starting system - Starter motors and starter circuits.

UNIT II: IGNITION AND INJECTION SYSTEMS **10**

Ignition systems: Ignition fundamentals - Electronic ignition systems - Programmed Ignition – Distribution less ignition - Direct ignition – Spark Plugs. Electronic fuel Control: Basics of combustion – Engine fueling and exhaust emissions – Electronic control of carburetion – Petrol fuel injection – Diesel fuel injection.

UNIT III: SENSOR AND ACTUATORS IN AUTOMOTIVES **9**

Working principle and characteristics of Airflow rate, Engine crankshaft angular position, Hall effect, Throttle angle, temperature, exhaust gas oxygen sensors – study of fuel injector, exhaust gas recirculation actuators, stepper motor actuator, vacuum operated actuator.

UNIT IV: ENGINE CONTROL SYSTEMS **9**

Control modes for fuel control-engine control subsystems – ignition control methodologies – different ECU's used in the engine management – block diagram of the engine management system. In vehicle networks: CAN standard, format of CAN standard – diagnostics systems in modern automobiles.

UNIT V: CHASSIS AND SAFETY SYSTEMS 9

Traction control system – Cruise control system – electronic control of automatic transmission – antilock braking system – electronic suspension system – working of airbag and role of MEMS in airbag systems centralized door locking system – climate control of cars.

TOTAL: L: 45 = 45

TEXT BOOK:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Ribbens	Understanding	Elsevier, Indian	2013

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Barry Hollembeak	Automotive Electricity, Electronics & Computer Controls	Delmar Publishers	2001
2.	Richard K. Dupuy	Fuel System and Emission controls	Check Chart Publication	2000
3	Ronald. K. Jurgon	Automotive Electronics Handbook	McGraw-Hill	1999
4	Tom Denton	Automobile Electrical and Electronics Systems	Edward Arnold Publishers	2000

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19RAE05 ADVANCED MICROPROCESSORS AND MICROCONTROLLERS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To study the Architecture of 8085 microprocessor.
- To study the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To study about communication and bus interfacing.
- To study the Architecture of 8051 microcontroller.

COURSE OUTCOMES

19RAE05.CO1: Design and implement programs on 8085 microprocessors.
19RAE05.CO2: Design and implement programs on 8086 microprocessors.
19RAE05.CO3: Design I/O circuits.
19RAE05.CO4: Design Memory Interfacing circuits.
19RAE05.CO5: Design and implement 8051 microcontroller-based systems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE05.CO1	-	-	X	-	X	X	X	X	-	-	-	X	X	-	-
19RAE05.CO2	-	-	X	X	X	-	X	X	-	-	-	X	X	X	-
19RAE05.CO3	-	-	X	X	X	-	X	X	-	-	-	X	X	X	X
19RAE05.CO4	-	-	X	X	X	-	X	X	-	-	-	X	X	X	-
19RAE05.CO5	-	-	X	X	X	-	X	X	-	-	-	X	X	-	-

UNIT I 8086 MICROPROCESSOR 8

Architecture – Pin description – Operating modes – Registers – Interrupts – Bus cycle – Addressing modes – Typical configuration of 8086 system – Overview of Instruction set.

UNIT II 80286 MICROPROCESSOR 8

Functional block diagram - Modes of operation – Real and protected mode – Memory management and protection features.

UNIT III 80386, 80486 PROCESSORS 8

80386: Functional block diagram - Programming model - Addressing modes and instruction set overview – Address translation - Modes of operation - 80486 processor - Functional block diagram - Comparison of 80386 and 80486 processors.

UNIT IV PENTIUM MICROPROCESSOR 6

Introduction – Architecture – Special Pentium registers – Memory management.

UNIT V PIC MICROCONTROLLER 15

Architecture – Memory structure – Register File – Addressing modes – Interrupts – Timers: Modes of operation PIC PERIPHERAL FUNCTIONS AND SPECIAL FEATURES: PWM output – Analog to Digital converter – UART – Watchdog timer – RESET Alternatives – Power Down mode – I2C Bus operation

TOTAL L45 = 45

TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Barry B Brey	The Intel Microprocessor 8086/8088, 80186/80188, 80286, 80386, 80486 Pentium and Pentium processor, Pentium II,III,4	Prentice Hall of India New Delhi	2005
2.	Douglas V Hall	Microprocessors and Interfacing: Programming and Hardware	McGraw Hill, New Delhi	2005

REFERENCES:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mohammed Rafiquzzaman	Microprocessors and microcomputer-based system design	CRC Press	2005
2.	Walter A Triebel, Avtar Singh	The 8088 and 8086 microprocessors Programming Interfacing software Hardware and Applications	Pearson Education	2009
3	Myke Pred ko	Programming and Customising the PIC Microcontroller	McGraw Hill	1998
4	John B Peatman	Design with PIC Microcontroller	McGraw Hill	2001

19RAE06 **SYSTEM SOFTWARE** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To understand the phases in a software project.
- To understand fundamental concepts of requirements engineering and Analysis Modelling.
- To understand the major considerations for enterprise integration and deployment.
- To learn various testing and maintenance measures.
- To learn about various parsing techniques.

COURSE OUTCOMES:

19RAE06.CO1: Identify the key activities in managing a software project.
19RAE06.CO2: Compare different process models.
19RAE06.CO3: Concepts of requirements engineering and Analysis Modeling.
19RAE06.CO4: Apply systematic procedure for software design and deployment.
19RAE06.CO5: Compare and contrast the various testing and maintenance.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE06.CO1	X	-	-	X	X	X	-	-	-	-	-	X	X	X	-
19RAE06.CO2	X	-	-	X	X	X	-	-	-	-	-	X	X	X	-
19RAE06.CO3	X	-	-	X	X	X	-	-	-	-	-	X	X	X	-
19RAE06.CO4	X	-	-	X	X	X	-	-	-	-	-	X	X	X	-
19RAE06.CO5	X	-	-	X	X	X	-	-	-	-	-	X	X	X	-

UNIT I ASSEMBLERS **16**

General Design procedures – Design of an Assembler – data structures – format of databases – algorithm – flow chart – PASS structures – modular functions. MACRO LANGUAGE AND MACRO PROCESSORS: Macro instructions, features of a macro facility –implementation.

UNIT II LOADERS **8**

Loader schemes – compile and go loaders , general load scheme – absolute loaders – direct linking loaders and their design. Other loading schemes : linking loaders, overlays, dynamic binders.

UNIT III COMPILERS **10**

Introduction – Structure of a compiler – phases of a compiler - compiler writing tools. LEXICAL ANALYSIS: Role of a lexical analyzer – finite automata –regular expressions to finite automata – minimizing the number of states of a deterministic finite automata – implementation of a lexical analyzer.

UNIT IV PARSING TECHNIQUES **6**

Context free grammars – derivations and parse trees – ambiguity – capabilities of context free grammars. Top down and bottom up parsing – handles – shift reduce parsing – operator precedence parsing – recursive descent parsing – predictive parsing.

UNIT V INTERMEDIATE CODE GENERATION **5**

Postfix notation, Quadruples, triples , indirect triples – Representing information in a symbol table – introduction to code optimization – basic blocks – DAG representation – error detection and recovery - code generation.

TOTAL T:45 =45

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TEXT BOOKS:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Leland Beck	System Software – An Introduction to Systems Programming	Third Edition, Pearson Education, Inc	2008
2.	Srimanta Pal	Systems Programming	Oxford University Press	2011

REFERENCES:

S.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John J Donovan	Systems Programming	McGraw Hill	1999
2.	Dhamdhere D M	Systems Programming	Tata McGraw Hill	2001
3	Aho A V, Sethi R and Ullman J D	Compilers: Principles, Techniques and Tools	Addison Wesley, ongman	1999
4	Holub Allen I	Compiler Design in C	Prentice Hall	2001

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAE07 **AUTOMOBILE ENGINEERING** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To identify the different structures in automobile engineering.
- To realize the engine auxiliary systems such as fuel injection system, electrical system and ignition system.
- To understand the working principles of transmission systems.
- To scrutinize the working principle of different types of steering and brake systems.
- To Familiarize about alternative fuels and hybrid vehicles.

COURSE OUTCOMES

19RAE07.CO1: Describe the vehicle construction and function of different parts.
19RAE07.CO2: Realize the engine auxiliary systems such as fuel injection system, electrical system and ignition system.
19RAE07.CO3: Identify the working principle of different types of transmission system.
19RAE07.CO4: Scrutinize the working principle of different types of steering and brake systems.
19RAE07.CO5: Familiarize alternative fuels.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE07.CO1	X	X	-	X	X	-	X	-	-	-	-	X	-	X	-
19RAE07.CO2	X	X	-	X	X	-	X	X	-	-	-	X	X	X	-
19RAE07.CO3	X	X	-	X	X	-	X	-	-	-	-	X	X	X	-
19RAE07.CO4	X	X	-	X	X	-	X	-	-	-	-	X	X	X	-
19RAE07.CO5	X	X	-	X	X	X	X	-	-	-	-	X	-	X	-

UNIT I: VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles, vehicle construction and different layouts, chassis, frame and, body, Vehicle aerodynamics (various resistances and moments involved), IC engines –components functions and materials, variable valve timing (VVT).

UNIT II: ENGINE AUXILIARY SYSTEMS 9

Electronically controlled gasoline injection system for SI engines, electronically controlled diesel injection system (Unit injector system, Rotary distributor type and common rail direct injection system), Electronic ignition system (Transistorized coil ignition system, capacitive discharge ignition system), Turbo chargers (WGT, VGT), Engine emission control by three way catalytic converter system, Emission norms (Euro and BS).

UNIT III: TRANSMISSION SYSTEMS 9

Clutch-types and construction, gear boxes- manual and automatic, gear shift mechanisms, over drive, transfer box, fluid flywheel, torque converter, propeller shaft, slip joints, universal joints, Differential and rear axle, Hotchkiss Drive and Torque Tube Drive.

UNIT IV: STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems, Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), electronic brake force distribution (EBD) and Traction Control.

UNIT V: ALTERNATIVE ENERGY SOURCES 9

Use of Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen in Automobiles- Engine modifications required –Performance, Combustion and Emission Characteristics of SI and CI engines with these alternate fuels - Electric and Hybrid Vehicles, Fuel Cell

Note: Practical Training in dismantling and assembling of Engine parts and Transmission Systems should be given to the students.

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Kirpal Singh	Automobile Engineering Vol 1 & 2, 13th Edition	Standard Publishers, New Delhi	2012
2	Jain K.K. and Asthana .R.B	Automobile Engineering	Tata McGraw Hill Publishers, New Delhi	2002

REFERENCE BOOKS:

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Newton ,Steeds and Garet	Motor Vehicles	Butterworth Publishers	2010
2	Joseph Heitner	Automotive Mechanics, Second Edition	Second Edition, East-West Press	2004
3	Martin W, Stockel and Martin T Stockle	Automotive Mechanics Fundamentals	The Good heart Will Cox Company Inc, USA	2014
4	Heinz Heisler	Advanced Engine Technology	SAE International Publications USA	2016
5	Ganesan V	Internal Combustion Engines, Third Edition	Tata McGraw-Hill.	2007

19RAE08 INTELLECTUAL PROPERTY RIGHTS

L T P C
3 0 0 3

COURSE OBJECTIVE

- To give an idea about IPR, registration and its enforcement.
- To learn steps for registration of IPRs.
- To learn various agreements and legislations
- To learn digital Products and Law
- To learn the Enforcement of IPRs

COURSE OUTCOME

19RAE08.CO1: Give an idea about IPR, registration and its enforcement.
19RAE08.CO2: Demonstrate steps for registration of IPRs.
19RAE08.CO3: Understand various agreements and legislations
19RAE08.CO4: Apply the IPR concepts to digital Products and Law
19RAE08.CO5: Explain the enforcement of IPRs

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE08.CO1	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE08.CO2	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE08.CO3	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE08.CO4	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE08.CO5	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-

UNIT I INTRODUCTION 9

Introduction to IPRs, Basic concepts and need for Intellectual Property - Patents, Copyrights, Geographical Indications, IPR in India and Abroad – Genesis and Development – the way from WTO to WIPO –TRIPS, Nature of Intellectual Property, Industrial Property, technological Research, Inventions and Innovations – Important examples of IPR.

UNIT II REGISTRATION OF IPRs 10

Meaning and practical aspects of registration of Copy Rights, Trademarks, Patents, Geographical Indications, Trade Secrets and Industrial Design registration in India and Abroad

UNIT III AGREEMENTS AND LEGISLATIONS 10

International Treaties and Conventions on IPRs, TRIPS Agreement, PCT Agreement, Patent Act of India, Patent Amendment Act, Design Act, Trademark Act, Geographical Indication Act.

UNIT IV DIGITAL PRODUCTS AND LAW 9

Digital Innovations and Developments as Knowledge Assets – IP Laws, Cyber Law and Digital Content Protection – Unfair Competition – Meaning and Relationship between Unfair Competition and IP Laws – Case Studies.

UNIT V ENFORCEMENT OF IPRs 7

Infringement of IPRs, Enforcement Measures, Emerging issues – Case Studies.

TOTAL L 45 = 45

TEXT BOOKS

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	V. Scople Vinod	Managing Intellectual Property	Prentice Hall of India	2012
2	S.V. Satarkar	Intellectual Property Rights and Copy Rights	Ess Publications, New Delhi	2002

REFERENCES

Sl. No.	Author(s)	Title of the Book	Publisher	Year of Publication
1	Deborah E. Bouchoux	Intellectual Property: The Law of Trademarks, Copyrights, Patents and Trade Secrets	Cengage Learning, Third Edition	2012
2	Edited by Derek Bosworth and Elizabeth Webster	The Management of Intellectual Property	Edward Elgar Publishing Ltd	2013
3	Prabuddha Ganguli	Intellectual Property Rights: Unleashing the Knowledge Economy	McGraw Hill Education	2011

19RAE09 DESIGN OF PRESSURE VESSEL AND PIPING **L T P C**
3 0 0 3

(*Usage of Pressure Vessels, Design Hand Book is allowed for the students for examination*)

COURSE OBJECTIVES

- To obtain an understanding of the fundamental methods and Terminology and its application.
- To understand the membrane stress analysis and industrial related problems in vessels.
- To design principles for pressure vessels and enhance the understanding of reinforcement.
- To obtain the buckling of pressure vessels and tubes, cylinders etc.
- To design procedure of pressure vessel and Design of piping layout.

COURSE OUTCOMES

19RAE09.CO1: Develop the stresses and terminology, efficiency and its applications.
19RAE09.CO2: Analysis the vessels shells components such as cylindrical, spherical, conical and Thermal.
19RAE09.CO3: Design the pressure vessels and ASME vessels codes.
19RAE09.CO4: Estimate the design procedure of pressure vessel and Design of piping layout.
19RAE09.CO5: Design and analysis the pipe stress.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE09.CO1	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE09.CO2	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE09.CO3	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE09.CO4	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-
19RAE09.CO5	X	-	-	-	X	X	-	-	-	-	-	X	-	X	-

UNIT I: INTRODUCTION **9**

Methods for determining stresses – Terminology and Ligament Efficiency– Applications.

UNIT II: STRESS IN PRESSURE VESSELS **9**

Introduction – Stresses in a circular ring, cylinder – Membrane stress Analysis of Vessel Shell components – Cylindrical shells, spherical Heads, conical heads – Thermal Stresses – Discontinuity stresses in pressure vessels.

UNIT III: DESIGN OF VESSELS **9**

Design of Tall cylindrical self supporting process columns –Supports for short, vertical and horizontal vessels – stress concentration – at a variable Thickness transition section in a cylindrical vessel, about a circular Hole, elliptical openings. Theory of Reinforcement – pressure vessel Design. Introduction to ASME pressure vessel codes.

UNIT IV: BUCKLING OF VESSELS **9**

Buckling phenomenon – Elastic Buckling of circular ring and cylinders under external pressure – collapse of thick walled cylinders or tubes under external pressure – Effect of supports on Elastic Buckling of Cylinders – Buckling under combined External pressure and axial loading.

UNIT V: PIPING 9

Introduction – Flow diagram – piping layout and piping stress Analysis

TOTAL: L: 45=45

TEXT BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John F. Harvey	Theory and Design of Pressure Vessels	CBS Publishers and Distributors	2001
2.	Donatello Annaratone	Pressure Vessel Design	Springer	2007

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Henry H. Bedner	Pressure Vessels, Design Hand Book	CBS publishers and Distributors	2001
2	Stanley, M. Wales	Chemical process equipment, selection and Design	Buterworths series in Chemical Engineering	1988
3	John F. Harvey	Pressure Vessel Design: Nuclear and Chemical Applications	Priceton Inc.	1963
4	William. J., Bees	Approximate Methods in the Design and Analysis of Pressure Vessels and Piping	Pre ASME Pressure Vessels and Piping Conference	1997
5	Sam Kannapan	Introduction to Pipe Stress Analysis	John Wiley and Sons	1985

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19RAE10 LEAN MANUFACTURING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To acquire the general knowledge to deliver consistently high quality and value added products and services to the customer in a lean environment
- To understand the terminology relating to lean operations in both service and manufacturing organizations
- To understand various controlling and manufacturing techniques that effect lean manufacturing
- To comprehend the implementation process of lean manufacturing.
- To familiarize with the lean accounting system

COURSE OUTCOMES

19RAE10.CO1: Understand and apply the concept of lean thinking to the processes
19RAE10.CO2: Understand the work place organization process
19RAE10.CO3: Comprehend the various work flow and control techniques.
19RAE10.CO4: Illustrate various lean manufacturing techniques
19RAE10.CO5: Understand and analyze the manufacturing time and implementation of lean manufacturing

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE10.CO1	X	-	-	-	X	X	-	-	-	-	-	X	X	-	X
19RAE10.CO2	X	-	-	-	X	X	-	-	-	-	-	X	X	-	X
19RAE10.CO3	X	-	-	-	X	X	-	-	-	-	-	X	X	-	X
19RAE10.CO4	X	-	-	-	X	X	-	-	-	-	-	X	X	-	X
19RAE10.CO5	X	-	-	-	X	X	-	-	-	-	-	X	X	-	X

UNIT I: INTRODUCTION 9

History – Evolution - Toyota production system - Lean manufacturing overview.

UNIT II : ORGANIZATION OF WORK PLACE 9

Work place organization - Visual controls - Pull production and cellular manufacturing - Value flow pull - Value and perfection lean

UNIT III: WORK FLOW AND CONTROL TECHNIQUES 9

Mapping the present – Mapping the future - Product and process development – Value stream analysis - Over production - Waiting - Work In Progress - Transportation - Inappropriate processing - Excess motion or ergonomic problems - Defected products - Underutilization of employees.

UNIT IV: LEAN MANUFACTURING TECHNIQUES 9

Just In Time - Kanban tooling - Total Productive Maintenance – 5S - Single Minute Die Exchange - Lean six sigma.

UNIT V: IMPLEMENTATION OF LEAN MANUFACTURING 9

Flow charting - Identifying and eliminating unnecessary steps - Setup time - reduction approaches - Steps in implementing lean strategy – Lean accounting system.

TOTAL: L:45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dennis P Hobbs	Lean Manufacturing Implementation	J. Ross Publications	2009
2	Jay Arthur	Lean Six-Sigma Demystified	Tata McGraw-Hill Company, New Delhi	2009

REFERENCE BOOKS:

Sl. No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Jeffrey K Liker	The Toyota Way-14 Management Principles	Tata McGraw-Hill Company, New Delhi	2015
2	Pascal Dennis	Lean Production Simplified,	Productivity Press, USA	2002
3	Martin W, Stockel and Martin T Stockle	Automotive Mechanics Fundamentals	The Good heart Will Cox Company Inc, USA	2014
4	Richard J Schonberger	World Class Manufacturing	Sp Free Press	2003
5	Carreira B	Lean Manufacturing that Works	PHI	2007

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19RAE11 INDUSTRIAL DESIGN AND APPLIED ERGONOMICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To explain the general principles that governs the interaction of humans in their working environment
- To improve improving worker performance and safety.
- To know about the environmental conditions in the industry.
- To know about bio thermodynamics and bioenergetics
- To know about the human factors in industrial aspects

COURSE OUTCOMES

19RAE11.CO1: Know about ergonomic principles to design workplaces
19RAE11.CO2: improve human performance
19RAE11.CO3: judge the environmental conditions in the work place.
19RAE11.CO4: know about bio-thermodynamics and bioenergetics
19RAE11.CO5: implement latest occupational health and safety to the work place.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE11.CO1	X	-	-	-	-	X	X	X	X	X	X	X	X	-	X
19RAE11.CO2	X	-	-	-	-	-	X	X	X	X	X	X	X	-	X
19RAE11.CO3	X	-	-	-	-	-	X	X	X	X	X	X	X	-	X
19RAE11.CO4	X	-	-	-	-	-	X	X	X	X	X	X	X	-	X
19RAE11.CO5	X	-	-	-	-	-	X	X	X	X	X	X	X	-	X

UNIT I INTRODUCTION **12**

Definition, human technological system, multidisciplinary engineering approach, human–machine system, manual, mechanical, automated system, human system reliability, conceptual design, advanced development, detailed design and development. INFORMATION INPUT: Input and processing, text, graphics, symbols, codes, visual display of dynamic information, auditory, tactual, olfactory displays, speech communications.

UNIT II HUMAN OUTPUT AND CONTROL **12**

Physical work, manual material handling, motor skill, human control of systems, controls and data entry devices, hand tools and devices.

UNIT III ENVIRONMENTAL CONDITIONS **11**

Illumination, climate, noise, motion, sound, vibration, colour and aesthetic concepts. BIOMECHANICS: Biostatic mechanics, statics of rigid bodies, biodynamic mechanics, human body kinematics, kinetics, impact and collision.

UNIT IV BIOTHERMODYNAMICS AND BIOENERGETICS **5**

Biothermal fundamentals, human operator heat transfer, human system bioenergetics, thermoregulatory physiology, human operator thermo regularity, passive operator, active operator, heat stress.

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UNIT V HUMAN FACTORS APPLICATIONS 5

Human error, accidents, human factors and the automobile, organizational and social aspects, steps according to ISO/DIS6385, OSHA"s approach, virtual environments.

TOTAL L45 = 45

TEXT BOOK:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chandler Allen Phillips	Human Factors Engineering	John Wiley and Sons New York	2000

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bridger R S	Introduction to Ergonomics	Taylor and Francis, London	2003
2	Mayall W H	Indus trial Design for Engineers	London ILIFFEE Books Ltd., UK	1998
3	Mark S Sanders	Human Factors in Engineering and Design	McGraw Hill, New York	1993

19RAE12 PROCESS PLANNING AND COST ESTIMATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart the knowledge on process, equipment and tools for various industrial products.
- To impart the knowledge on process planning activity chart.
- To understand the concept of cost estimation.
- To impart the knowledge on different type of shop floor.
- To understand machining time for various machining operations.

COURSE OUTCOMES

19RAE12.CO1: Select the process, equipment and tools for various industrial products.
19RAE12.CO1: Prepare process planning activity chart.
19RAE12.CO1: Explain the concept of cost estimation.
19RAE12.CO1: Compute the job order cost for different type of shop floor.
19RAE12.CO1: Calculate the machining time for various machining operations.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE12.CO1	X	X	X	-	-	-	-	-	-	-	-	-	X	X	-
19RAE12.CO2	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
19RAE12.CO3	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
19RAE12.CO4	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-
19RAE12.CO5	X	X	X	X	-	-	-	-	-	-	-	-	X	X	-

UNIT I INTRODUCTION TO PROCESS PLANNING 9

Introduction- methods of process planning-Drawing interpretation-Material evaluation – steps in process selection-.Production equipment and tooling selection

UNIT II PROCESS PLANNING ACTIVITIES 9

Process parameters calculation for various production processes-Selection jigs and fixtures election of quality assurance methods - Set of documents for process planning-Economics of process planning- case studies

UNIT III INTRODUCTION TO COST ESTIMATION 9

Importance of costing and estimation –methods of costing-elements of cost estimation –Types of estimates – Estimating procedure- Estimation labor cost, material cost- allocation of over head charges- Calculation of depreciation cost

UNIT IV PRODUCTION COST ESTIMATION 9

Estimation of Different Types of Jobs - Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop

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UNIT V MACHINING TIME CALCULATION 9

Estimation of Machining Time - Importance of Machine Time Calculation- Calculation of Machining Time for Different Lathe Operations ,Drilling and Boring - Machining Time Calculation for Milling, Shaping and Planning -Machining Time Calculation for Grinding.

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Peter Scalon	Process planning, Design/Manufacture Interface	Elsevier science technology	2002
2.	Sinha B.P	Mechanical Estimating and Costing	Tata-McGraw Hill publishing	1995

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chitale A.V. and Gupta R.C	Product Design and Manufacturing	PHI	2002
2.	Ostwalal P.F. and Munez J.,	Manufacturing Processes and systems	John Wiley	1998
3.	Russell R.S and Tailor B.W	Operations Management	PHI	2003
4	Mikell P. Groover	Automation, Production, Systems and Computer Integrated Manufacturing	Pearson	2001
5	C. Jain & L.N. Aggarwal	K, "Production Planning Control and Industrial Management	Khanna Publishers	1990

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19RAE13 OPERATIONS RESEARCH **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide knowledge to solve the linear models problems
- To provide knowledge to solve transportation and network problems.
- To understand the Inventory models' problems
- To understand the queueing models' problems
- To understand the decision models' problems

COURSE OUTCOMES:

19RAE13.CO1: Solve the linear models problems
19RAE13.CO2: Explain transportation and network problems.
19RAE13.CO3: Solve the inventory models' problems
19RAE13.CO4: Solve the queueing models' problems
19RAE13.CO5: Solve the decision models' problems

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE13.CO1	X	-	-	X	-	X	-	-	-	-	-	X	-	X	X
19RAE13.CO2	X	-	-	X	-	X	-	-	-	-	-	X	X	X	X
19RAE13.CO3	X	-	-	X	-	X	-	-	-	-	X	X	X	X	X
19RAE13.CO4	X	-	-	X	-	X	-	-	-	-	-	X	X	X	X
19RAE13.CO5	X	-	-	X	-	X	-	-	-	-	X	X	-	X	X

UNIT I LINEAR MODELS **15**

The phase of an operation research study – Linear programming – Graphical method– Simplex algorithm – Duality formulation – Sensitivity analysis.

UNIT II TRANSPORTATION MODELS AND NETWORK MODELS **8**

Transportation Assignment Models –Traveling Salesman problem-Networks models – Shortest route – Minimal spanning tree – Maximum flow models –Project network – CPM and PERT networks – Critical path scheduling – Sequencing models.

UNIT III INVENTORY MODELS **6**

Inventory models – Economic order quantity models – Quantity discount models – Stochastic inventory models – Multi product models – Inventory control models in practice.

UNIT IV QUEUEING MODELS **6**

Queueing models - Queueing systems and structures – Notation parameter – Single server and multi server models – Poisson input – Exponential service – Constant rate service – Infinite population – Simulation.

UNIT V DECISION MODELS **10**

Decision models – Game theory – Two person zero sum games – Graphical solution- Algebraic solution– Linear Programming solution – Replacement models – Models based on service life –

Economic life– Single / Multi variable search technique – Dynamic Programming – Simple Problem.

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hillier and Libeberman	Operations Research	Holden Day	2005
2.	Taha H.A	Operations Research	Prentice Hall of India	2003

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Bazara M.J., Jarvis and Sherali H	Linear Programming and Network Flows	John Wiley	2009
2.	Budnick F.S	Principles of Operations Research for Management	Richard D Irwin	1990
3	Philip D.T. and Ravindran A	Operations Research	John Wiley	1992
4	Shennoy G.V. and Srivastava U.K	Operation Research for Management	Wiley Eastern	1994
5	Tulsian and Pasdey V	Quantitative Techniques	Pearson Asia	2002

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19RAE14 **VLSI DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To study the fundamentals of CMOS circuits and its characteristics.
- To learn the design and realization of combinational & sequential digital circuits.
- To learn the architectural choices and performance tradeoffs involved in designing
- To design the circuits in CMOS technology are discussed
- To learn the different FPGA architectures and testability of VLSI circuits.

COURSE OUTCOMES

19RAE14.CO1: Realize the concepts of digital building blocks using MOS transistor.
19RAE14.CO2: Design combinational MOS circuits and power strategies.
19RAE14.CO3: Design and construct Sequential Circuits and Timing systems.
19RAE14.CO4: Design arithmetic building blocks and memory subsystems.
19RAE14.CO5: Apply and implement FPGA design flow and testing.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE14.CO1	X	-	-	-	X	X	X	X	-	X	-	X	X	-	-
19RAE14.CO2	X	-	-	X	X	-	X	X	-	X	-	X	X	X	-
19RAE14.CO3	X	-	-	X	X	-	X	X	-	X	-	X	X	X	-
19RAE14.CO4	X	-	-	X	X	-	X	X	-	X	-	X	X	X	-
19RAE14.CO5	X	-	-	X	X	-	X	X	-	X	-	X	X	-	-

UNIT I INTRODUCTION TO MOS TRANSISTOR **9**

MOS Transistor, CMOS logic, Inverter, Pass Transistor, Transmission gate, Layout Design Rules, Gate Layouts, Stick Diagrams, Long-Channel I-V Charters tics, C-V Charters tics, Non ideal I-V Effects, DC Transfer characteristics, RC Delay Model, Elmore Delay, Linear Delay Model, Logical effort, Parasitic Delay, Delay in Logic Gate, Scaling.

UNIT II COMBINATIONAL MOS LOGIC CIRCUITS **9**

Circuit Families: Static CMOS, Ratioed Circuits, Cascode Voltage Switch Logic, Dynamic Circuits, Pass Transistor Logic, Transmission Gates, Domino, Dual Rail Domino, CPL, DCVSPG, DPL, Circuit Pitfalls. **Power:** Dynamic Power, Static Power, Low Power Architecture.

UNIT III SEQUENTIAL CIRCUIT DESIGN **9**

Static latches and Registers, Dynamic latches and Registers, Pulse Registers, Sense Amplifier Based Register, Pipelining, Schmitt Trigger, Monostable Sequential Circuits, Astable Sequential Circuits.Timing Issues : Timing Classification Of Digital System, Synchronous Design.

UNIT IV DESIGN OF ARITHMETIC BUILDING BLOCKS AND SUBSYSTEM **9**

Arithmetic Building Blocks: Data Paths, Adders, Multipliers, Shifters, ALUs, power and speed tradeoffs, Case Study: Design as a tradeoff. Designing Memory and Array structures: Memory Architectures and Building Blocks, Memory Core, Memory Peripheral Circuitry.

UNIT V IMPLEMENTATION STRATEGIES AND TESTING 9

FPGA Building Block Architectures, FPGA Interconnect Routing Procedures. Design for Testability: *Ad Hoc* Testing, Scan Design, BIST, IDDQ Testing, Design for Manufacturability, Boundary Scan.

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Neil H.E. Weste, David Money Harris	CMOS VLSI Design: A Circuits and Systems Perspective	Pearson	2017
2.	Jan M. Rabaey ,Anantha Chandrakasan, Borivoje. Nikolic	Digital Integrated Circuits:A Design perspective	Pearson	2016

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	M.J. Smith	Application Specific Integrated Circuits	Addisson Wesley	1997
2.	Sung-Mo kang, Yusuf leblebici, Chulwoo Kim	CMOS Digital Integrated Circuits:Analysis & Design	McGraw Hill Education	2013
3	Wayne Wolf	Modern VLSI Design: System On Chip	Pearson Education	2007
4	R.Jacob Baker, Harry W.LI., David E.Boyee	CMOS Circuit Design, Layout and Simulation	Prentice Hall	2005

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19RAE15 VIRTUAL INSTRUMENTATION **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To introduce the principle, programming technique with instrument interfaces
- To learn applications of virtual instruments and
- To understand the basics of data acquisition
- To understand the instrument interfaces
- To learn the tools for various applications

COURSE OUTCOMES

19RAE15.CO1: Understand the evolution, advantages, techniques, architecture and applications of visual instrumentation
19RAE15.CO2: Acquiring knowledge on VI programming techniques
19RAE15.CO3: Study about the basics of data acquisition
19RAE15.CO4: Understanding the concept of common instrument interfaces with industrial applications
19RAE15.CO5: Study about the use of analysis tools with various applications

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE15.CO1	X	-	-	-	X	X	X	-	-	-	-	X	X	X	-
19RAE15.CO2	X	-	-	X	X	-	X	-	-	-	-	X	X	X	X
19RAE15.CO3	X	-	-	X	X	-	X	-	-	-	-	X	X	X	X
19RAE15.CO4	X	-	-	X	X	-	X	-	-	-	-	X	X	X	X
19RAE15.CO5	X	-	-	X	X	-	X	-	-	-	-	X	X	-	X

UNIT I REVIEW OF VIRTUAL INSTRUMENTATION 9

Historical perspectives, advantages, block diagram and architecture of a virtual instrument, data - flow techniques, graphical programming in data flow, comparison with conventional programming.

UNIT II VI PROGRAMMING TECHNIQUES 9

VIS and sub-VIS loops and charts, arrays, clusters and graphs, case and sequence structures, formula nodes, local and global variables, string and file I/O.

UNIT III DATA ACQUISTION BASICS 9

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

UNIT IV COMMON INSTRUMENT INTERFACES 9

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

UNIT V USE OF ANALYSIS TOOLS 9

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

TOTAL L45 = 45

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TEXT BOOK:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gupta	Virtual Instrumentation Using Lab view	Tata McGraw-Hill Education	2010

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Gary Jonson	Labview Graphical Programming	Fourth Edition, McGraw Hill, New York	2006
2	Gupta.S., Gupta.J.P	PC interfacing for Data Acquisition & Process Control	Instrument Society of America	1994
3	Sokoloff	Basic concepts of Labview 4	Prentice Hall Inc., New Jersey	1998

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19RAE16 ARTIFICIAL INTELLIGENCE FOR ROBOTICS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To study the concepts of Artificial Intelligence.
- To learn the methods of solving problems using Artificial Intelligence.
- To introduce the concepts of Expert Systems and machine learning.
- To learn about planning and reasoning artificial intelligence.
- To solve the risk in artificial intelligence.

COURSE OUTCOMES

19RAE16.CO1: Identify problems that are amenable to solution by AI methods.
19RAE16.CO2: Identify appropriate AI methods to solve a given problem.
19RAE16.CO3: Formalize a given problem in the language/framework of different AI methods.
19RAE16.CO4: Implement basic AI algorithms.
19RAE16.CO5: Design and carry out an empirical evaluation of different algorithms on a problem formalization, and state the conclusions that the evaluation supports.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE16.CO1	X	-	-	-	X	-	X	X	-	X	X	X	X	-	X
19RAE16.CO2	X	-	-	X	X	-	X	X	-	X	X	X	X	X	X
19RAE16.CO3	X	-	-	X	X	-	X	X	-	X	X	X	X	X	X
19RAE16.CO4	X	-	-	X	X	-	X	X	-	X	X	X	X	X	-
19RAE16.CO5	X	-	-	X	X	-	X	X	-	X	X	X	X	-	-

UNIT I INTRODUCTION 13

History, state of the art, Need for AI in Robotics. Thinking and acting humanly, intelligent agents, structure of agents. PROBLEM SOLVING: Solving problems by searching –Informed search and exploration–Constraint satisfaction problems–Adversarial search, knowledge and reasoning– knowledge representation – first order logic.

UNIT II PLANNING 8

Planning with forward and backward State space search – Partial order planning – Planning graphs– Planning with propositional logic – Planning and acting in real world.

UNIT III REASONING: 8

Uncertainty – Probabilistic reasoning–Filtering and prediction–Hidden Markov models–Kalman filters– Dynamic Bayesian Networks, Speech recognition, making decisions.

UNIT IV LEARNING: 8

Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.

UNIT V AI IN ROBOTICS: 8

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

TOTAL L45 = 45

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TEXT BOOK:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Stuart Russell, Peter Norvig	Artificial Intelligence: A modern approach	Pearson Education	2003
2	Negnevitsky, M	Artificial Intelligence: A guide to Intelligent Systems	Harlow: Addison-Wesley	2002

REFERENCE:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	David Jefferis	Artificial Intelligence: Robotics and Machine Evolution	Crabtree Publishing Company	1992

19RAE17 SPECIAL MACHINES AND CONTROLLERS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To know about stepper motors.
- To know about switched reluctance motors
- To know about permanent magnet brushless D.C. Motors
- To know about permanent magnet synchronous motors
- To know about linear motors

COURSE OUTCOMES

19RAE17.CO1: Understanding principles of operation, types and applications of stepper motors
19RAE17.CO2: Understanding principles of operation, types and applications of switched reluctance motors
19RAE17.CO3: Knowledge in evaluating the performance of dc motors
19RAE17.CO4: To evaluate knowledge in permanent magnet synchronous motors.
19RAE17.CO5: Understand the working and applications linear motors and servo motors.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE17.CO1	X	-	-	-	X	X	X	X	-	-	-	X	X	-	-
19RAE17.CO2	X	-	-	X	X	-	X	X	-	-	-	X	X	X	-
19RAE17.CO3	X	-	-	X	X	-	X	X	-	-	-	X	X	X	-
19RAE17.CO4	X	-	-	X	X	-	X	X	-	-	-	X	X	X	-
19RAE17.CO5	X	-	-	X	X	-	X	X	-	-	-	X	X	-	-

UNIT I STEPPER MOTORS **9**

Types - Constructional features – principle of operation – variable reluctance motor – single and Multi stack configurations – Permanent Magnet Stepper motor – Hybrid stepper motor. Different modes of Excitation - theory of torque predictions – Drive systems and circuit for open loop and closed loop control of stepper motor.

UNIT II SWITCHED RELUCTANCE MOTORS **9**

Constructional features – principle of operation –Torque Equation - Power Converters for SR Motor – Rotor Sensing Mechanism & Logic Controller – Sensorless Control of SR motor - Applications.

UNIT III PERMANENT MAGNET BRUSHLESS D.C. MOTORS **8**

Principle of operation – Types – Magnetic circuit analysis – EMF and torque equations – Power controllers – Motor characteristics and control – Applications.

UNIT IV PERMANENT MAGNET SYNCHRONOUS MOTORS **8**

Principle of operation, EMF, power input and torque expressions, Phasor diagram, Power Controllers, Torque speed characteristics, Self control, Vector control, Current control Schemes – Applications.

UNIT V LINEAR MOTORS: **11**

Linear Induction motor (LIM) classification – construction – Principle of operation – Concept of current sheet – goodness factor – DC Linear motor (DCLM) types – circuit equation - DCLM control applications – Linear Synchronous motor(LSM) – Types–Applications SERVOMOTORS: Servomotor – Types – Constructional features, principle of operation - control application.

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TOTAL L:45 = 45

TEXT BOOK:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	K. Venkataratnam	Special Electrical Machines	Universities Press	2009
2	Kenjo, T and Naganori, S	Permanent Magnet and brushless DC motors	Clarendon Press, Oxford	1989

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Kenjo T	Stepping Motors and their Microprocessor Controls	Clarendon Press London	2003
2	Miller T J E	Brushless Permanent Magnet and Reluctance Motor Drives	Clarendon Press, Oxford	1989
3	Naser A and Boldea L	Linear Electric Motors: Theory Design and Practical Applications	Prentice Hall Inc., New Jersey	1987
4	Floyd E Saner	Servo Motor Applications	Pittman USA	1993
5	William H Yeadon, Alan W Yeadon	Handbook of Small Electric Motors	McGraw Hill, INC	2001

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAE18 **ADVANCED CONTROL SYSTEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide knowledge on design in state variable form
- To provide knowledge in phase plane analysis.
- To give basic knowledge in describing function analysis.
- To study the design of optimal controller.
- To study the design of optimal estimator including Kalman Filter

COURSE OUTCOMES

19RAE18.CO1: Design in state variable form
19RAE18.CO2: Knowledge in phase plane analysis.
19RAE18.CO3: Describe function analysis.
19RAE18.CO4: Know the design of optimal controller.
19RAE18.CO5: Know about the design of optimal estimator including kalman filter

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE18.CO1	X	X	-	-	X	X	X	-	-	X	-	X	X	-	-
19RAE18.CO2	X	X	X	X	X	-	X	-	-	X	-	X	X	X	X
19RAE18.CO3	X	X	X	X	X	-	X	-	-	X	-	X	X	X	X
19RAE18.CO4	X	X	X	X	X	-	X	-	-	X	-	X	X	-	-
19RAE18.CO5	X	-	X	X	X	-	X	-	-	X	-	X	X	-	-

UNIT I STATE VARIABLE DESIGN 9

Introduction to state Model- effect of state Feedback- Necessary and Sufficient Condition for Arbitrary Pole-placement- pole placement Design- design of state Observers- separation principle- servo design: -State Feedback with integral control

UNIT II PHASE PLANE ANALYSIS 9

Features of linear and non-linear systems - Common physical non-linearities – Methods of linearization Concept of phase portraits – Singular points – Limit cycles – Construction of phase portraits – Phase plane analysis of linear and non-linear systems – Isocline method.

UNIT III DESCRIBING FUNCTION ANALYSIS 9

Basic concepts, derivation of describing functions for common non-linearities – Describing function analysis of non-linear systems – limit cycles – Stability of oscillations.

UNIT IV OPTIMAL CONTROL 9

Introduction - Time varying optimal control – LQR steady state optimal control – Solution of Ricatti"s equation – Application examples.

UNIT V OPTIMAL ESTIMATION 9

Optimal estimation – Kalman Bucy Filter-Solution by duality principle-Discrete systems- Kalman Filter-Application examples.

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TEXT BOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Mohandas K. P	Modern Control Engineering	Sanguine Technical Publishers	2006
2	Thaler G.J	Automatic Control Systems	Jaico Publishing House	1993
3	Gopal ,M	Modern control system theory	New Age International Publishers	2002

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William S Levine	Control System Fundamentals : The Control Handbook	, CRC Press, Tayler and Francies Group	2011
2	Ashish Tewari	Modern control Design with Matlab and Simulink	John Wiley, New Delhi	2002
3	Ogata K	Modern Control Engineering	PHI, New Delhi	2002
4	Glad T. and Ljung L	Control theory –Multivariable and Non-linear methods	Taylor & Francis	2002
5	Naidu D.S	Optimal Control Systems	CRC Press	2009

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19RAE19 FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT

L T P C
3 0 0 03

COURSE OBJECTIVES

- To understand the global trends and development methodologies of various types of products and services
- To conceptualize, prototype and develop product management plan for a new product
- To understand requirement engineering and know how to collect, analyze and arrive at requirements
- To understand system modeling for system, sub-system and their interfaces and arrive at the optimum system specification and characteristics
- To develop documentation, test specifications and coordinate with various teams to validate and sustain up to the EoL (End of Life) support activities for engineering customer
-

OURSE OUTCOMES

19RAE19.CO1: Define, formulate and analyze a problem
19RAE19.CO2: Solve specific problems independently or as part of a team.
19RAE19.CO3: Gain knowledge of the Innovation & Product Development process in the Business Context
19RAE19.CO4: Work independently as well as in teams
19RAE19.CO5: Manage a project from start to finish

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE19.CO1	X	-	-	-	-	-	X	X	-	X	-	X	X	-	-
19RAE19.CO2	X	-	-	-	-	-	X	X	-	X	-	X	X	-	-
19RAE19.CO3	X	-	-	-	-	-	X	X	-	X	-	X	X	-	-
19RAE19.CO4	X	-	-	-	-	-	X	X	-	X	-	X	X	-	-
19RAE19.CO5	X	-	-	-	-	-	X	X	-	X	-	X	X	-	-

UNIT I FUNDAMENTALS OF PRODUCT DEVELOPMENT 9

Global Trends Analysis and Product decision - Social Trends - Technical Trends- Economical Trends - Environmental Trends - Political/Policy Trends - Introduction to Product Development Methodologies and Management - Overview of Products and Services - Types of Product Development - Overview of Product Development methodologies - Product Life Cycle – Product Development Planning and Management.

UNIT II REQUIREMENTS AND SYSTEM DESIGN 9

Requirement Engineering - Types of Requirements - Requirement Engineering - traceability Matrix and Analysis - Requirement Management - System Design & Modeling - Introduction to System Modeling - System Optimization - System Specification - Sub-System Design - Interface Design.

UNIT III DESIGN AND TESTING 9

Conceptualization - Industrial Design and User Interface Design - Introduction to Concept generation Techniques – Challenges in Integration of Engineering Disciplines - Concept Screening & Evaluation - Detailed Design - Component Design and Verification – Mechanical, Electronics and Software Subsystems - High Level Design/Low Level Design of S/W Program - Types of Prototypes, S/W Testing- Hardware Schematic, Component design, Layout and Hardware Testing – Prototyping - Introduction to Rapid Prototyping and Rapid Manufacturing - System Integration, Testing, Certification and Documentation

UNIT IV SUSTENANCE ENGINEERING AND END-OF-LIFE (EOL) SUPPORT 9

Introduction to Product verification processes and stages - Introduction to Product Validation processes and stages - Product Testing Standards and Certification - Product Documentation - Sustenance -Maintenance and Repair – Enhancements - Product EoL - Obsolescence Management – Configuration Management - EoL Disposal

UNIT V BUSINESS DYNAMICS – ENGINEERING SERVICES INDUSTRY 9

The Industry - Engineering Services Industry - Product Development in Industry versus Academia –The IPD Essentials - Introduction to Vertical Specific Product Development processes - Manufacturing/Purchase and Assembly of Systems - Integration of Mechanical, Embedded and Software Systems – Product Development Trade-offs - Intellectual Property Rights and Confidentiality – Security and Configuration Management.

TOTAL L45 = 45

TEXTBOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Karl T Ulrich and Stephen D Eppinger	Product Design and Development	Tata McGraw Hill	2011
2	John W Newstorm and Keith Davis	Organizational Behavior	Tata McGraw Hill	2005

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Hiriyappa B	Corporate Strategy – Managing the Business	Author House	2013
2.	Peter F Drucker	People and Performance", Butterworth – Heinemann	Oxford	2004
3.	Vinod Kumar Garg & Venkita Krishnan N K	Enterprise Resource Planning – Concepts	Prentice Hall	2003
4.	Mark S Sanders and Ernest J McCormick	Human Factors in Engineering and Design	McGraw Hill	2013

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19RAE20 MAINTENANCE AND SAFETY ENGINEERING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To impart knowledge in maintenance
- To know about the fundamentals of maintenance and to implement it.
- To study about safety engineering practices.
- To analyze the hazards in protection.
- To know about the safety in machine operation.

COURSE OUTCOMES

19RAE20.CO1: Maintain the industry without any risk in its operation
19RAE20.CO2: Improve the production
19RAE20.CO3: Analyze the hazards in maintenance and to solve it.
19RAE20.CO4: Identify and prevent chemical, environmental mechanical, fire hazard through analysis
19RAE20.CO5: Apply proper safety techniques on safety engineering and management.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE20.CO1	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE20.CO2	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE20.CO3	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE20.CO4	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-
19RAE20.CO5	X	-	-	-	-	-	X	X	X	X	X	X	X	-	-

UNIT I MAINTENANCE: **6**

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

UNIT II TOTAL PRODUCTIVE MAINTENANCE: **12**

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

UNIT III SAFETY SYSTEMS ANALYSIS: **6**

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

UNIT IV HAZARD ANALYSIS: **10**

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

UNIT V SAFETY IN MACHINE OPERATION: **10**

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

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John Ridley	Safety at Work	Butter Worth Publisher, Oxford	1997
2	Robinson C J and Ginder A P	Implementing TPM	Productivity Press, USA	1995

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Dhillon B S	Maintainability, Maintenance and Reliability for Engineers	CRC Press	2006
2	National Safety Council	Personal Protective Equipment	Bombay	1998
3	Heinrich H W	Industrial Accident Prevention	National Safety Council, Chicago	1998

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19RAE21 **NEURAL NETWORKS AND FUZZY SYSTEMS** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To learn the various soft computing frame works
- To be familiar with design of various neural networks
- To be exposed to fuzzy logic
- To learn genetic programming
- To be exposed to hybrid systems

COURSE OUTCOMES

19RAE21.CO1 : Upon completion of the course, the student should be able to:
19RAE21.CO2 : Apply various soft computing frame works
19RAE21.CO3 : Design of various neural networks
19RAE21.CO4 : Use fuzzy logic
19RAE21.CO5 : Apply genetic programming

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE21.CO1	X	X	X	-	X	X	-	-	-	-	-	X	X	-	-
19RAE21.CO2	X	X	X	X	X	-	-	-	-	-	-	X	X	-	-
19RAE21.CO3	X	X	X	X	X	-	-	-	-	-	-	X	X	-	-
19RAE21.CO4	X	X	X	X	X	-	-	-	-	-	-	X	X	-	-
19RAE21.CO5	X	X	X	X	X	-	-	-	-	-	-	X	X	-	-

UNIT I INTRODUCTION TO NEURAL NETWORKS **7**

Differences between Biological and Artificial Neural Networks - Typical Architecture, Common Activation Functions, McCulloch - Pitts Neuron, Simple Neural Nets for Pattern Classification, Linear Separability - Hebb Net, Perceptron, Adaline, Madaline - Architecture, algorithm, and Simple Applications.

UNIT II PATTERN ASSOCIATION **7**

Training Algorithms for Pattern Association - Hebb rule and Delta rule, Heteroassociative, Autoassociative and Iterative Auto associative Net, Bidirectional Associative Memory - Architecture, Algorithm, and Simple Applications.

UNIT III COMPETITION, ADAPTIVE RESONANCE AND BACK PROPAGATION NEURAL NETWORKS **13**

Kohonen Self Organising Maps, Learning Vector Quantization, Counter Propagation - Architecture, Algorithm and Applications - ART1 and ART2 - Basic Operation and Algorithm, Standard Backpropagation Architecture, derivation of Learning Rules, Boltzmann Machine Learning - Architecture, Algorithm and Simple Applications.

UNIT IV CLASSICAL AND FUZZY SETS AND RELATIONS **6**

Properties and Operations on Classical and Fuzzy Sets, Crisp and Fuzzy Relations - Cardinality, Properties and Operations, Composition, Tolerance and Equivalence Relations, Simple Problems.

UNIT V MEMBERSHIP FUNCTIONS **15**

Features of membership function, Standard forms and Boundaries, fuzzification, membership value assignments, Fuzzy to Crisp Conversions, Lambda Cuts for fuzzy sets and relations, Defuzzification methods.

APPLICATIONS: Neural Networks: Robotics, Image compression, Control systems - Fuzzy Logic: Mobile robot navigation, Autotuning a PID Controller.

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Sivanandam S N, Sumathi S, Deepa S N	Introduction to Neural Networks using Mat lab 6.0	Tata McGraw Hill Publications New Delhi	2006
2	Timothy Ross	Fuzzy Logic with Engineering Applications	McGraw Hill, Singapore	2002

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John Yen and Rezalangari	Fuzzy Logic, Intelligence, Control and Information	Pearson Education	2007
2	Mohammad H Hassoun	Fundamentals of Neural Networks	Prentice hall of India	2002

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19RAE22 INDUSTRIAL ROBOTICS AND MATERIAL HANDLING SYSTEMS

L T P C
3 0 0 3

COURSE OBJECTIVES

- To introduce the basic concepts, parts of robots and types of robots.
- To make the student familiar with the various drive systems for robot, sensors and their applications in robots and programming of robots.
- To select the robots according to its usage.
- To discuss about the various applications of robots, justification and implementation of robot.
- To know about material handling in a system.

COURSE OUTCOMES

19RAE22.CO1: Learn about the basic concepts, parts of robots and types of robots.
19RAE22.CO2: To design automatic manufacturing cells with robotic control using the principle behind robotic drive system, end effectors, sensor, machine vision robot kinematics and programming.
19RAE22.CO3: Ability in selecting the required robot
19RAE22.CO4: Know various applications of robots
19RAE22.CO5: Apply their knowledge in handling the materials.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE22.CO1	X	-	-	-	X	X	-	X	-	-	-	X	X	-	-
19RAE22.CO2	X	-	-	X	X	-	-	X	-	-	-	X	X	-	-
19RAE22.CO3	X	-	-	X	X	-	-	X	-	-	-	X	X	-	-
19RAE22.CO4	X	-	-	X	X	-	-	X	-	-	-	X	X	-	-
19RAE22.CO5	X	-	-	X	X	-	-	X	-	-	-	X	X	-	-

UNIT I INTRODUCTION 6

Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.

UNIT II ROBOTS FOR INSPECTION 8

Robotic vision systems, image representation, object recognition and categorization, depth measurement, image data compression, visual inspection, software considerations.

UNIT III OTHER APPLICATIONS 8

Application of Robots in continuous arc welding, Spot welding, Spray painting, assembly operation, cleaning, robot for underwater applications.

UNIT IV END EFFECTORS 11

Gripper force analysis and gripper design, design of multiple degrees of freedom, active and passive grippers. SELECTION OF ROBOT: Factors influencing the choice of a robot, robot performance testing, economics of robotisation, Impact of robot on industry and society.

UNIT V MATERIAL HANDLING 12

Concepts of material handling, principles and considerations in material handling systems design, conventional material handling systems - industrial trucks, monorails, rail guided vehicles, conveyor systems, cranes and hoists, advanced material handling systems, automated guided vehicle systems,

automated storage and retrieval systems(ASRS), bar code technology, radio frequency identification technology.

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Richaerd D Klafter, Thomas Achmielewski and Mickael Negin	Robotic Engineering – An integrated Approach	Prentice HallIndia, New Delhi	2001
2	Mikell P. Groover	Automation, Production Systems, and Computer Integrated Manufacturing	John Wiley & sons	2007

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	James A Rehg	Introduction to Robotics in CIM Systems	Prentice Hall of India	2002
2	Deb S R	Robotics Technology and Flexible Automation	Tata McGraw Hill, New Delhi	1994

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19RAE23 **TOTALLY INTEGRATED AUTOMATION** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To gain knowledge in automation in industries.
- To gain knowledge in various electrical and electronic programmable automations and their applications.
- To know about the basic in SCADA and DCS systems.
- To gain knowledge in communication protocols in an integrated system
- To know about the advanced in automation industries

COURSE OUTCOMES

19RAE23.CO1: Knowledge of PLC & PAC automation
19RAE23.CO2: Knowledge in HMI systems and to integrate it with other systems.
19RAE23.CO3: Apply SCADA and usage of C programming for report generation
19RAE23.CO4: Acquire information's on communication protocols in automation systems
19RAE23.CO5: Design and develop automatic control system using distributed control systems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE23.CO1	X	-	-	X	X	-	X	-	-	X	-	X	X	-	-
19RAE23.CO2	X	-	-	X	X	-	X	-	-	X	-	X	X	X	X
19RAE23.CO3	X	-	-	X	X	-	X	-	-	X	-	X	X	X	X
19RAE23.CO4	X	-	-	X	X	-	X	-	-	X	-	X	X	X	X
19RAE23.CO5	X	-	-	X	X	-	X	-	-	X	-	X	X	-	-

UNIT I TOTALLY INTEGRATED AUTOMATION: **9**

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

UNIT II HMI SYSTEMS: **9**

Necessity and Role in Industrial Automation, Need for HMI systems. Types of HMI- Text display - operator panels - Touch panels - Panel PCs - Integrated displays (PLC & HMI). Check with PLC 502 and remove

UNIT III SUPERVISORY CONTROL AND DATA ACQUISITION (SCADA) **9**

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

UNIT IV COMMUNICATION PROTOCOLS of SCADA **9**

Proprietary and open Protocols – OLE/OPC – DDE – Server/Client Configuration – Messaging – Recipe – User administration – Interfacing of SCADA with PLC, drive, and other field device

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

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

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	John.W.Webb & Ronald A. Reis	Programmable logic controllers: Principles and Applications	Prentice Hall India	2003
2	Michael P. Lukas	Distributed Control systems	Van Nostrand Reinfold Company	1995

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Win C C	Software Manual	Siemens	2003
2	CIMPLICITY	SCADA Packages Manual	Fanuc India Ltd	2004

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAE24 **EMBEDDED SYSTEM DESIGN** **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To provide the overview of embedded system design principles
- To understand the concepts of real time operating systems
- To provide exposure to embedded system development tools with hands on experience in using basic programming techniques.
- To provide knowledge on PIC micro controller.
- To provide knowledge on I/O systems used in embedded systems

COURSE OUTCOMES

19RAE24.CO1: Explain the need of embedded systems and their development procedures.
19RAE24.CO2: Summaries the concepts involved in Real time operating systems.
19RAE24.CO3: Use various tools for developing embedded applications.
19RAE24.CO4: Explain the construction, addressing modes and instructions sets of PIC micro controller.
19RAE24.CO5: Conduct experiments with I/O systems used in embedded systems.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE24.CO1	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-
19RAE24.CO2	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAE24.CO3	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAE24.CO4	X	-	-	X	X	-	-	-	-	-	-	X	X	X	-
19RAE24.CO5	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-

UNIT I INTRODUCTION TO EMBEDDED SYSTEMS **7**

Overview of embedded systems, embedded system design process, challenges - common design metrics and optimizing them. Hardware - Software code sign embedded product development.

UNIT II REAL TIME OPERATING SYSTEM **7**

Real time operating systems Architecture - Tasks and Task states - Tasks and Data - Semaphone and shared data - Message queues, mail boxes and pipes - Encapsulating semaphores and queues - interrupt routines in an RTOS Environment. Introduction to Vx works, RT Linux.

UNIT III PIC MICROCONTROLLER **9**

Architecture - Instruction set - Addressing modes - Timers - Interrupt logic - CCP modules - ADC.

UNIT IV EMBEDDED NETWORKING **7**

Introduction - CAN BUS - I^2C - GSM - GPRS - Zig bee.

UNIT V EMBEDDED PROGRAMMING **30**

I/O Programming, Interrupts and Timer application Interfacing Keypad Interfacing LCD Interfacing ADC/DAC

TOTAL L45 = 45

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TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Frank Vahid, Tony John Givargis	Embedded System Design: A Unified Hardware/ Software Introduction	Wiley & Sons	2002
2	Rajkamal	Embedded System – Architecture, Programming, Design'	Tata Mc Graw Hill	2011
3	John B. Peatman	Design with PIC Microcontrollers	Prentice Hall	2003

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Steve Heath	Embedded System Design	Elsevier	2003
2	David E. Simon	An embedded software primer	Addison Wesley	2009
	Robert Foludi	Building Wireless Sensor Networks	O'Reilly	2011

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19RAE25 WIRELESS SENSORS NETWORKS FOR ROBOTICS **L T P C**
3 0 0 3

COURSE OBJECTIVES

- To know the basic knowledge about wireless sensor networks
- To impart knowledge in networking using sensors
- To know about the tools used in networking
- To understand the basic in wireless architecture
- To know about the different techniques used in networking

COURSE OUTCOMES

19RAE25.CO1: Explain about the different techniques used in networking
19RAE25.CO2: Expose basic knowledge about wireless sensor networks
19RAE25.CO3: Familiarize the tools in networking
19RAE25.CO4: Understand the basic in wireless architecture
19RAE25.CO5: Apply protocols used in networking conapts.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE25.CO1	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-
19RAE25.CO2	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAE25.CO3	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAE25.CO4	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAE25.CO5	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-

UNIT I OVERVIEW OF WIRELESS SENSOR NETWORKS **8**

Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.

UNIT II ARCHITECTURES **9**

Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.

UNIT III NETWORKING SENSORS **10**

Physical Layer and Transceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Routing Protocols- Energy-Efficient Routing, Geographic Routing.

UNIT IV INFRASTRUCTURE ESTABLISHMENT **9**

Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.

UNIT V SENSOR NETWORK PLATFORMS AND TOOLS **9**

Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.

TOTAL L45 = 45

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TEXTBOOKS

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Holger Karl & Andreas Willig	Protocols And Architectures for Wireless Sensor Networks	John Wiley	2005
2	Feng Zhao & Leonidas J. Guibas	Wireless Sensor Networks- An Information Processing Approach	Elsevier	2007

REFERENCES

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	KazemSohraby, Daniel Minoli, &TaiebZnati	Wireless Sensor Networks- Technology, Protocols, And Applications	John Wiley	2007
2	Anna Hac	Wireless Sensor Network Designs	John Wiley	2003

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19RAE26 MEMS

L T P C
3 0 0 3

COURSE OBJECTIVES

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

COURSE OUTCOMES

19RAE26.CO1: Describe new applications and directions of modern engineering
19RAE26.CO2: Understand the sensors and actuators-I.
19RAE26.CO3: Explain working principles of sensors and actuators-II.
19RAE26.CO4: Analysis the Microsystems and Micromachining technology for technical feasibility as well as practicality.
19RAE26.CO5: Explain the principles on Polymers and Optical MEMS

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE26.CO1	X	-	-	X	X	-	X	X	-	X	-	X	X	-	-
19RAE26.CO2	X	-	-	X	X	-	X	X	-	X	-	X	X	X	-
19RAE26.CO3	X	-	-	X	X	-	X	X	-	X	-	X	X	X	-
19RAE26.CO4	X	-	-	X	X	-	X	X	-	X	-	X	X	X	-
19RAE26.CO5	X	-	-	X	X	-	X	X	-	X	-	X	X	-	-

UNIT I: INTRODUCTION TO PROCESS PLANNING 9

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

UNIT II: SENSORS AND ACTUATORS-I 9

Electrostatic sensors-Parallel plate capacitors-Applications-Interdigitated Finger capacitor-Comb drive devices-Micro Grippers-Micro Motors-Themal Sensing and actuation- Thermal expansion-Thermal couples-Thermal resistors-Thermal Bimorph-Applications-Magnetic Actuators-Micromagnetic components

UNIT III: SENSORS AND ACTUATORS-II 9

Piezoresistive sensors-Piezoresistive sensor materials-Stress analysis mechanical elements-Applications to inertia, Pressure, Tactile and Flow sensors-Piezoelectric sensors and actuators-piezoelectric effects-piezoelectric materials-Application to inertia,Acoustic, Tactile and Flow sensors

UNIT IV: MICROMACHINING 9

Silicon Anisotropic Etching-Anisotrophic Wet Etching-Dry Etching of Silicon-Plasma Etching-Deep Reaction Ion Etching(DRIE)-Isotropic Wet Etching-Gas Phase Etchants-Case studies-Basic surface micro machining processes-Structural and Sacrificial Materials-Acceleration of Sacrificial Etch-Assembly of 3D MEMS-Foundary process

UNIT V: POLYMER AND OPTICAL MEMS 9

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

TOTAL: L: 45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Chang Liu	Foundations of MEMS	Pearson Education	2006
2.	Stephen D Senturia	Microsystem Design	Springer	2000

REFERENCE BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Nadim Maluf	An Introduction to Micro Electro Mechanical System Design	Artech House	2000
2.	Mohamed Gad-el-Hal	The MEMS Handbook	CRC press Baco Raton	2000
3	Tai Ran Hsu	MEMS&Micro systems Design and Manufacture	Tata McGraw Hill	2002
4	E. H. Tay, Francis and W. O. Choong	Micrfluids and Bio MEMS applications	Springer	2002
5	Gardner, W. Julian, K. Varadan Vijay and O. Awadelkarim, Osama	Micro sensors MEMS and Smart Devices	Jhon Wiley & Sons Ltd	2001

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19RAE27 INTERNET TOOLS AND JAVA PROGRAMMING **L T P C**
3 0 0 3

COURSE OBJECTIVES

- Learn about the various tools used in internet
- Learn Java Programming.
- Understand different Internet Technologies and the way to handle it.
- Be familiar with client – side programming and server – side programming.
- Learn to develop web applications.

COURSE OUTCOMES

19RAE27.CO1: Implement Java programs and to create a basic website using HTML and Cascading Style Sheets.
19RAE27.CO2: Design and implement dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.
19RAE27.CO3: Design rich client presentation using AJAX.
19RAE27.CO4: Design and implement simple web page in PHP, and to present data in XML format.
19RAE27.CO5: Design and implement server side programs using Servlets and JSP.

Course Outcomes	Program Outcomes												PSOs		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
19RAE27.CO1	X	-	-	X	X	-	-	-	-	-	-	X	X	-	-
19RAE27.CO2	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAE27.CO3	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAE27.CO4	X	X	X	X	X	-	-	-	-	-	-	X	X	X	-
19RAE27.CO5	X	X	X	X	X	-	-	-	-	-	-	X	X	-	-

UNIT I INTERNET TOOLS 11

Major Internet Services – Net Telephony – Internet Relay Chat – Newsgroups – File Transfer Protocol (FTP) – Remote Login – Telnet, Gopher, and Veronica Clients OBJECT ORIENTATION IN JAVA: Introduction - Data Types - Operators - Declarations - Control Structures - Arrays and Strings - Input/Ouput.-Java Classes - Fundamentals - Methods - Constructors - Scope rules - this keyword - object based Vs oriented programming.- -Inheritance-Reusability - Composing class.

UNIT II ABSTRACT FUNCTIONS AND PACKAGES 6

Abstract classes - Abstract Functions – Method Overloading and Method Overriding- Wrapper Classes. Packages - Access protection - Importing packages - Interface - Defining and Implementing Interface - Applying Interface - Variables in Interfaces.

UNIT III EXCEPTION HANDLING 9

Fundamentals - Exception types - Uncaught Exception - Using Try and Catch - Multiple catch clauses - Nested Try statements - Throw - Throws - Java Built-in Exception - Creating your own subclasses. MULTI THREADED PROGRAMMING: Java thread model - Priorities - Synchronization - Messaging - Thread class and runnable Interface - Main thread - Creating the Thread - Synchronization - Interthread Communication - Deadlock.

UNIT IV I/O, APPLETS **12**

I/O basics - Stream - Stream Classes - Predefined stream - Reading/Writing console input - Applet fundamentals - Native methods.- GUI Components - Applets - Java Scripts – AWT / Swings.

UNIT V INTRODUCTION TO NETWORK PROGRAMMING **9**

Fundamentals - Internet Addresses - Internet Protocols - DNS - Internet Services - Socket programming, UDP, TCP. JAVA DATABASE PROGRAMMING: JDBC –Database Connection and Table Creation – Execution of Embedded SQL Statements - ResultSet and ResultSetMetaData – Examples.

TOTAL L45 = 45

TEXT BOOKS:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	Patrick Naughton	JAVA - The Complete	Tata McGraw Hill	1997
2.	Deitel and Deitel	JAVA - How to	Prentice Hall	2003

REFERENCES:

Sl.No	Author(s)	Title of the Book	Publisher	Year of Publication
1.	William Stanek and Peter Norton	Peter Norton's Guide to Java Programming	Tech Media Publications	1997
2.	Mark Grand	JAVA Language Reference	O'Reilly & Associates Inc	1997
3.	Horstmann and Cornell	Core Java	Pearson Education	2001
4.	Kennath Litwak	Pure Java 2: A Code-Intensive Premium	Tech Media Publications	2000
5.	James K L	The Internet: A Users Guide	Prentice Hall of India	2003

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Programme Code & Name: RA & B.E-Robotics and Automation

Employability Enhancement Courses (EEC)

For

Robotics and Automation

Programme Code & Name: RA & B.E-Robotics and Automation

19RAS01	PROJECT WORK PHASE -I	L T P C 0 0 6 3

COURSE OBJECTIVES

- To achieve integrated mechanical design of a product through parts design, assembly and preparation of manufacturing drawings

COURSE OUTCOMES

19RAS01.CO1: Choose an engineering problem in a current industrial scenario.
19RAS01.CO2: Do related literature review
19RAS01.CO3: Do intensive literature review
19RAS01.CO4: Decide the working methodology of the project
19RAS01.CO5: Make an analysis and produce a report over it

Students are asked to form a team which consists of 4 members, maximum. Each team has to work under a project supervisor. Based on the current industrial scenario, any relevant problem should be selected for the project with the consultation of the supervisor. Literature review should be done related to the problem considered. The working methodology of the project work for the phase II should be decided. These activities should be registered in a report and submitted by the student which will be reviewed and evaluated for internal assessment by a Committee constituted by the Head of the Department. At the end of the semester examination the project work is evaluated based on oral presentation and the project report, jointly by external and internal examiners.

TOTAL: P: 90 = 90

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19RAS02	PROJECT WORK PHASE -II	L T P C 0 0 20 10

COURSE OBJECTIVES

- To develop the ability to solve a specific problem right from its identification and literature review till the successful solution of the same.
- To train the students in preparing project reports and to face reviews and viva voce examination.

COURSE OUTCOMES

19RAS02.CO1: Apply knowledge and demonstrate to manage project in multi-disciplinary.
19RAS02.CO2: Design and conduct experiments to interpret data pertaining to engineering problems
19RAS02.CO3: Apply contextual knowledge to assess social, health and cultural issues and endue to professional engineering practice.
19RAS02.CO4: Prepare documentation and presentation for engineering activities for society
19RAS02.CO5: Perform effectively as leader in multi-disciplinary terms.

Based on the work methodology decided in the Phase I, the project is further developed. Necessary modeling and analysis is done using required software. The project is fabricated. The analytical results and the experimental results are validated. Three reviews will be conducted periodically by a committee constituted by the Head of the Department. A project report to be prepared by the students along with which the project has to be submitted for the final viva voce examination

TOTAL: P: 300 = 300

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAS03 VALUE ADDED COURSE /INTERNSHIP

L T P C
0 0 2 1

COURSE OBJECTIVES

- To provide students an understanding of the expectations of industry.
- To improve employability skills
- To bridge the skill gaps and make students industry ready.
- To provide an opportunity to develop inter-disciplinary skills.

COURSE OUTCOMES

19RAS03.CO1: Understand the expectations of industry.
19RAS03.CO2: To apply employability skills.
19RAS03.CO3: To apply the skill industry ready.
19RAS03.CO4: To use inter-disciplinary skills.

Value Added Courses

- Fusion 360
- Modeling Software
- Analysis Software
- GRE/ GATE
- DFMA
- 3D Printing
- PLC
- Optimization

Internship Training

- Inplant Training in Industry.
- Training from Industry.
- Solve the Problems from Industry.
- Do the Project in Industry.

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19RAS04 **INTERDISCIPLINARY PROJECT** **L T P C**
0 0 3 1

COURSE OBJECTIVE

To help the students look into the functioning of simple to complex devices and systems
- To enable the students to design and build simple systems on their own
- To help experiment with innovative ideas in design and team work
- To create an engaging and challenging environment in the engineering lab

The course will offer the students with an opportunity to gain a basic understanding of electronic devices and apply the concepts to design and build simple to complex devices. As a practical project-based course, the students will be taught the concepts in theory. While the course will start with formal instruction on hardware, programming and applications, the major portion of the course will provide the students with ample opportunity to be innovative in designing and building a range of products from Agriculture, medical and defense and etc. Students will focus primarily on IOT using Arduino and Raspberry pi-based controllers with Python programming.

TOTAL: T: 45 = 45

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19RAS05 CONSTITUTION OF INDIA AND PROFESSIONAL ETHICS

L	T	P	C
0	0	3	0

COURSE OBJECTIVES

- To create an awareness on Engineering Ethics and Human Values.
- To instill Moral and Social Values and Loyalty.
- To create awareness among engineers about their social responsibilities
- To Appreciate the Ethical issues
- To Know the Human rights and concept of women empowerment
- To know features of our constitution.

COURSE OUTCOMES

19RAS05.CO1: Practice the moral values that ought to guide the Engineering profession.
19RAS04.CO2: Discover of the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them to concrete situations
19RAS04.CO3: Know the definitions of risk and safety also discover different factors that affect the perception of risk
19RAS04.CO4: Appreciate the Ethical issues and Know the code of ethics adopted in various professional body's and industries
19RAS04.CO5: Justify the need for protection of human rights and to know about concept of women empowerment and Know the successful functioning of democracy in India.

UNITI: HUMAN VALUES 9

Professional Ethics-Objectives of study of professional ethics-Human values- Definition of Morals and Ethics-Difference between Morality and Ethics-Values-Definition-Types of values Definition of Integrity- Concept of Work Ethic- Service Learning- Definition Virtues-Definition Civic Virtue-Duties and Rights - Respect for Others – Attitude and values, opinions-changing attitude-beliefs-Reliability-Living Peacefully-Means to be adopted for leaving peacefully-Caring Sharing-Honesty-Valuing Time- Co-operation- Commitment- Empathy- Self-Confidence Spirituality.

UNTII: ENGINEERING ETHICS 8

Engineering ethics-Definition-Approach-Senses of Engineering Ethics-variety of moral issues–Inquiry-Types-Moral Dilemmas-Steps to solve dilemma-Moral autonomy –Definition-consensus & controversy –Profession-Definition–Ethical Theories-Theories about right action Personality– Self-control- Self-interest –Self-respect.

UNITIII: SAFETY, RESPONSIBILITIES OF ENGINEERS 6

Safety and risk-definition- - assessment of safety and risk - risk benefit analysis and reducing risk –Personal Risk-Public Risk-Reducing Risk-Voluntary Risk-Collegiality and loyalty– Authority Types- collective bargaining -occupational crime – Responsibility of engineers – Types – Social responsibility- Professional responsibility-confidentiality-conflicts of interest-liability.

UNIT IV: ETHICAL ISSUES IN ENGINEERING PRACTICE 6

Ethical issues–Industrial standards-Environmental ethics –Plastic waste disposal-E-Waste Disposal-Semiconductor waste Disposal-Industrial waste disposal-Human centered environmental ethics- computer ethics –Types of issues-Computer as the Instrument and Object of Unethical Acts -Engineers as managers-Codes of ethics-Sample code of Ethics like -Institution of Engineers(India)-Institute of Electrical & Electronics engineers- Institute of Electronics & Telecommunication Engineers - Indian Institute of Materials Management.

UNIT V: HUMAN RIGHTS 8

Human Rights-Definition-constitutional provisions-right to life and liberty-Human Rights of Women-Discrimination against women- steps that are to be taken to eliminate discrimination against women in Education, employment, health care, Economic and social life, Women in rural areas- Status of Women in India - Constitutional Safeguards - Dowry Prohibition

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act 1961- Domestic violence act 2005- Sexual harassment at work place bill 2006-Human Rights of Children- Who is a child-list the Rights of the Child- Right to education--Protection of Children from Sexual Offences Act(POCSO)-2012- National Human Rights Commission- Constitution Powers and function of the Commission-Employee rights- Provisions made-Contractual-Non contractual employee rights-Whistle blowing-definition-Aspects-Intellectual Property Rights (IPR)–Meaning-Need for protection- Briefly description of concept of patents, Copy right, Trade mark.

UNIT VI: INDIAN CONSTITUTION **8**

Introduction to constitution of India-Formation and Composition of the Constituent Assembly Salient features of the Constitution-Preamble to the Indian Constitution Fundamental Rights Fundamental Duties-Directive principles of state policy. Parliamentary system of governance- Structure of Parliament- Lokhasabha and Rajyasabha -Functions of parliament-Legislative, Executive, Financial Function, Powers of Loksabha and Rajya Sabha- Procedure followed in parliament in making law-Structure of union executive Power and position of President, Vice President, Prime minister and council of ministers. Structure of the judiciary: Jurisdiction and functions of Supreme Court, high court, and subordinate courts Federalism in the Indian constitution, Division of Powers- Union list, State list and concurrent list, Structure of state legislation, Legislative assembly and Legislative council, Functions of state legislature, Structure of state executive-Powers and positions of Governor, Speaker, Deputy Speaker, Chief Minister and council of minister. Local self-government-meaning-Threetiersystem-Villagepanchayath-TalukpanchayathZillapanchayath-Local bodies-Municipalities and Corporations, Bruhath mahanagara Palike. Functions of Election commission, UPSC, KPSC.

TOTAL: T: 45 = 45

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Programme Code & Name: RA & B.E-Robotics and Automation

19RAS06	ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE	L T P C 3 0 0 0

COURSE OBJECTIVES

- The course aims at imparting basic principles of thought process, reasoning and inferencing.
- Sustainability is at the core of Indian Traditional Knowledge Systems connecting society and nature.
- Holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
- The course focuses on introduction to Indian Knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.

COURSE OUTCOMES

19RAS06.CO1: To understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective.

Syllabus

Basic Structure of Indian Knowledge System - Modern Science and Indian Knowledge System - Yoga and Holistic Health care - Case Studies.

TOTAL: T: 45 = 45