Maharashtra State Board Of Technical Education, Mumbai

Learning and Assessment Scheme for Post S.S.C Diploma Courses

Programme Name	**: Diploma In Digital Electronics / Electronics & Tele-communication Engg. / Electronics & Communication Engg. / Electronics Engineering / Industrial Electronics / Medical Electronics**		
Programme Code	**: DE / EJ / ET / EX / IE / MU**	**With Effect From Academic Year**	**: 2023-24**
Duration Of Programme	**: 6 Semester**	**Duration**	**: 16 WEEKS**
Semester	**: Second** **NCrF Entry Level : 3.0**	**Scheme**	**: K**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme												
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory				Based on LL & TL				Based on Self Learning		Total Marks
																	Practical						
						CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
(All Compulsory)																								
1	APPLIED MATHEMATICS	AMS	AEC	312301	2	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100
2	BASIC ELECTRONICS	BEL	AEC	312314	0	4	-	4	-	8	4	3	30	70	100	40	50	20	25@	10	-	-	175
3	ELEMENTS OF ELECTRICAL ENGINEERING	EEE	SEC	312315	0	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175
4	ELECTRONIC MATERIALS & COMPONENTS	EMC	DSC	312316	0	3	-	2	1	6	3	1.5	30	70*#	100	40	25	10	-	-	25	10	150
5	PROGRAMMING IN 'C' LANGUAGE	CPR	SEC	312009	0	2	-	2	2	6	3	-	-	-	-	-	25	10	25@	10	25	10	75
6	PROFESSIONAL COMMUNICATION	PCO	SEC	312002	0	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50
7	SOCIAL AND LIFE SKILLS	SFS	VEC	312003		-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50
8	ELECTRONICS WORKSHOP PRACTICE	EWP	SEC	312008		-	-	4	2	6	3	-	-	-	-	-	25	10	25@	10	25	10	75
Total					**2**	**15**	**1**	**16**	**8**	**40**	**20**		**120**	**280**	**400**		**175**		**125**		**150**		**850**

Sr No	Course Title	Abbrevation	Course Type	Course Code	Total IKS Hrs for Sem.	Learning Scheme					Credits	Assessment Scheme											
						Actual Contact Hrs./Week			Self Learning (Activity/ Assignment /Micro Project)	Notional Learning Hrs /Week		Paper Duration (hrs.)	Theory			Based on LL & TL				Based on Self Learning		Total Marks
																Practical						
						CL	TL	LL					FA-TH	SA-TH	Total	FA-PR		SA-PR		SLA		
													Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	

Abbreviations : CL- Classroom Learning , TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment,SA -Summative Assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends : @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

Course Category : Discipline Specific Course Core (DSC) : 1, Discipline Specific Elective (DSE) : 0, Value Education Course (VEC) : 1, Intern./Apprenti./Project./Community (INP) : 0, AbilityEnhancement Course (AEC) : 2, Skill Enhancement Course (SEC) : 4, GenericElective (GE) : 0

PROFESSIONAL COMMUNICATION **Course Code : 312002**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: PROFESSIONAL COMMUNICATION**
Course Code	**: 312002**

I. RATIONALE

Communication is key to smooth and efficient functioning of any industry or business . Professional communication is the need of every organization to maintain ethics, quality and standards. The efficacy of business communication skills are essential for engineering professionals to instruct, guide and motivate peers/ subordinates to achieve desired goals at work place. Strong Communication skills are highly valued in the professional world and contribute to career growth and opportunities. Thus, this course has been designed to enhance the professional communication skills for effective presentation both in written and oral forms at workplace.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

1. Communicate effectively at workplace. 2. Issues can be identified and resolved by brainstorming solutions 3. Effective communication ensures strong decision making

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Communicate effectively (oral / spoken and Written) in various formal and informal situations minimizing the barriers.
- CO2 - Develop listening skills through active listening and note taking.
- CO3 - Write circulars, notices and minutes of the meeting.
- CO4 - Draft inquiry letter, complaint letter , Job application with resume / CV, Compose effective E - mails .

PROFESSIONAL COMMUNICATION **Course Code : 312002**

- CO5 - Write Industrial reports.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312002	PROFESSIONAL COMMUNICATION	PCO	SEC	-	-	2	-	2	1	-	-	-	-	-	25	10	25@	10	-	-	50

Total IKS Hrs for Sem. : 0 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

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4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the importance of professional communication in given situations TLO 1.2 Identify the types of communication barriers in given situations and suggestive remedies TLO 1.3 Use different types of verbal and non–verbal communication for the given situation	**Unit - I Professional Communication : An Overview** 1.1 Definition of professional communication- Importance, relevance, Elements and process of communication 1.2 7 C's of Professional Communication (Clarity, Conciseness, correctness, Coherent, concrete, courteous and Complete) 1.3 Types –Verbal (Oral-Written),Formal, Informal (Grapevine), Vertical 1.4 Barriers to communication,Types of barriers (Linguistic, Psychological, Technological)	Language lab Role plays Chalk board Reference books Case studies

PROFESSIONAL COMMUNICATION **Course Code : 312002**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Identify the difference between listening and hearing TLO 2.2 Differentiate the types of listening in various situations TLO 2.3 Take notes during lectures, seminars . Make use of types of note taking and note making for different subjects / topics	**Unit - II Listening & Note Taking** 2.1 Difference between listening & Hearing 2.2 Types of listening a)Active listening b)Passive listening c)Selective listening 2.3 Techniques of Note taking , Types of note taking (Outline notes, Mind Mapping, Flowcharts)	Language Lab Classroom learning NPTEL Role Play
3	TLO 3.1 Prepare notices / agenda for the given type of meeting / information TLO 3.2 Prepare minutes of meeting/s TLO 3.3 Draft a circular for a particular information/ event	**Unit - III Office Drafting** 3.1 Format of Notice and Circular 3.2 Drafting Agenda 3.3 Preparing Minutes of meeting	white board Language Lab Reference books Classroom learning
4	TLO 4.1 Compose cover letter and CV / Resume for jobs TLO 4.2 Apply E- mail Etiquette for professional purposes TLO 4.3 Compose E- mails for different official purposes	**Unit - IV Writing Skills for Professional Communication** 4.1 Job Application with Resume / CV 4.2 E-Mail Etiquettes 4.3 Writing official E- Mails to communicate intended purposes 4.4 Drafting Enquiry letter and Complaint letter	Language lab Classroom learning NPTEL Reference books
5	TLO 5.1 Compose technical reports TLO 5.2 Draft accident / Investigation/ Daily reports	**Unit - V Report Writing** 5.1 Introduction to report writing 5.2 Accident Report 5.3 Investigation Report 5.4 Daily Report	Chalk and talk Language Lab Collaborative learning Classroom learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Draw communication cycle using real life examples and explain process of communication.	1	*Communication Process and Cycle	2	CO1
LLO 2.1 Undertake the Role play / Group discussion to illustrate types / barriers to communication	2	Role plays and Group Discussion	2	CO1
LLO 3.1 Listen to audios in the language lab and make notes of it.	3	*Active Listening	2	CO2
LLO 4.1 Give a presentation / Seminar using 7 C's of Communication.	4	*Presentations / Seminars	2	CO1
LLO 5.1 Explain the types of note taking with examples and make notes on any one topic related to your curriculum.	5	*Note taking and Note Making	2	CO2
LLO 6.1 Prepare agenda for meeting and draft minutes of the meeting.	6	*Agenda and Minutes of the meeting	2	CO3
LLO 7.1 Draft circulars for the given situation .	7	*Office Drafting	2	CO3

PROFESSIONAL COMMUNICATION **Course Code : 312002**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 8.1 Respond to job advertisements referring newspapers, LinkedIn. Write cover letter with resume /CV.	8	*Type Job Application with Resume / CV	2	CO4
LLO 9.1 Type Four (formal) E-mails using ethics and etiquette.	9	* E- Mail writing	2	CO4
LLO 10.1 Write a detailed report on Accident/ Investigation .	10	*Technical Report writing	2	CO5
LLO 11.1 Prepare a case study related to linguistic barriers : language ,pronunciation, punctuation, technical jargon and suggest remedies for the same.	11	*Barriers to Communication	2	CO1
LLO 12.1 Draft complaint / enquiry letter for various situations	12	Complaint and Enquiry letter	2	CO4
LLO 13.1 List psychological barriers to communication LLO 13.2 Prepare case studies on any two psychological barriers and suggest remedies to overcome the barriers	13	Psychological barriers to Communication	2	CO1
LLO 14.1 Draw flow chart and mind mapping for any topic related to the curriculum.	14	*Listening Skills	2	CO2
LLO 15.1 Face mock interview arranged by your teacher.	15	* Typed Job Application , Resume / CV/ formal dressing and Interview	2	CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Conduct an interview of any person and follow the procedure (interview questions, photo with the interviewee etc.)
- Listening and Speaking are life long learnings . Explain with appropriate examples and real life case studies.
- Collect (four to five) emails with technical jargons, barriers, make required corrections and keep a record of both the mails (original and Corrected one)
- Complete any one certification course of (Two Weeks duration) from (MOOC/ NPTEL/ Coursera/ any other source)related to Communication Skills / Personality Development.
- Prepare a report on aspects of body language
- Prepare a case study on Technological /Psychological barriers to communication

Reading for vocabulary and sentence structure

- Read any motivational book and present a review of the book

PROFESSIONAL COMMUNICATION **Course Code : 312002**

Note :

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. S/he ought to submit it by the end of the semester to develop the industry oriented COs. Each micro-project should encompass two or more COs. The micro-project could be industry application based, internet-based, workshop-based, laboratory-based or field-based. Each student will have to maintain dated work diary consisting of individual contribution in the project work and give a seminar presentation of it before submission. The total duration of the micro-project should not be less than 15 (fifteen) student engagement hours during the course. In the first four semesters, the micro-project could be group-based. However, in higher semesters, it should be individually undertaken to build up the skill and confidence in every student to become problem solver so that s/he contributes to the projects of the industry. A suggestive list is given here. Similar micro-projects could be added by the concerned faculty.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Language Lab with software and internet facility	All
2	LCD Projector	All
3	Smart Board with networking	All
4	Printer	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Term Work, Micro Project

Summative Assessment (Assessment of Learning)

- Practical Exam of 25 marks using language lab

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	1	1	1		1	3	1			
CO2	1	1				3	1			
CO3	1					3	1			
CO4		1				3	1			
CO5		1	1			3	1			

PROFESSIONAL COMMUNICATION **Course Code : 312002**

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	M Ashraf Rizvi	Effective Communication Skills	Tata McGraw-Hill Publication-ISBN 0070599521, 9780070599529
2	Sanjay Kumar and Pushp Lata	Communication Skills	Oxford University Press ISBN 9780199457069
3	MSBTE Textbook	Communication Skills	MSBTE
4	Robert King	Effective communication Skills	Audio Book -ISBN 978181667009742
5	N P Sudharshana , C Savitha	English for Technical Communication	Cambridge-ISBN 978-13-16640-08-1
6	C. Murlikrishna , Sunita Mishra	Communication Skills for Engineers	Pearson - ISBN 978-81-317-3384-4
7	Meenakshi Raman, Sangeeta Sharma	Technical Communication, Principles and Practice	Oxford University Press -ISBN 978-13-16640-08-1
8	K. K. Sinha	Business Communication	Galgotiya Publishing company, New Delhi - ISBN 9789356227064
9	Rajendra Pal, J.S. Korlahalli	Essentials of Business Communication	Sultan Chand & Sons, New Delhi ISBN 9788180547294

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.britishcouncil.in	conversations
2	https://www.coursera.org	certification courses
3	https://www.udemy.com	Communication skills training courses
4	http://www.makeuseof.com	Dale Carnegie's free resources

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Food Technology/ Computer Hardware & Maintenance/ Hotel Management & Catering Technology/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Laboratory Technology/ Medical Electronics/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MU/ PG/ PN/ PO/ SC/ TC/ TE/ TR/ TX**
Semester	**: Second**
Course Title	**: SOCIAL AND LIFE SKILLS**
Course Code	**: 312003**

I. RATIONALE

Rationale : Life skills can be defined as abilities that enable humans to deal effectively with the demands and challenges of life. Social skills are a subset of life skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. They help regulate our emotions effectively and develop enduring, supportive relationships, we’re happier and healthier. This is why developing life skills and eventually social skills is key not only to being successful in life, it’s key for our health and well-being. Thus, Teaching of Social and life skills provide students with essentials of knowing , understanding attitudes, values, morals ,social skills and better equip them to handle stress and build their self efficacy, self esteem and self confidence.

Note : The course offers four different alternatives(modules) for achieving above outcomes . Students must complete any one module from the following given options.

a. MODULE-I : Unnat Maharashtra Abhiyan (UMA)
b. MODULE-II : National Service Scheme (NSS)

c. MODULE-III : Unniversal Human Values
d. MODULE-IV: Value Education (Unnati Foundation)
e. MODULE-V : Financial Literacy (NABARD)

The institute can choose to offer any one MODULE to the groups of the students by taking into consideration the resources required and resources available in the institute . Different group of students maybe offered different MODULE based on their choices .

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Exhibit psychosocial competencies, workplace ethics, resilience, positive attitude , integrity and self-confidence

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop ability to adapt to new challenges.
- CO2 - Manage emotions effectively.
- CO3 - Follow workplace ethics and practices
- CO4 - Manage time Effectively.
- CO5 - Increased self confidence to handle stress.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312003	SOCIAL AND LIFE SKILLS	SFS	VEC	-	-	-	2	2	1	-	-	-	-	-	-	-	-	-	50	20	50

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

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3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain developmental needs and connection of various stakeholders TLO 1.2 Enlist the local problems TLO 1.3 Design a methodology for fieldwork TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation TLO 1.5 Measure & quantify the quantities / systems parameters TLO 1.6 Write a report using information collected tStudy the data collected from fieldwork and conclude the observations	**Unit - I MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA)** 1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention 1.2 Multidisciplinary approach-linkages of academia, society and technology 1.3 Stakeholders' involvement 1.4 Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc 1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal) 1.6 Key attributes of measurement 1.7 Various instruments used for data collection - survey templates, simple measuring equipments 1.8 Format for measurement of identified attributes/ survey form and piloting of the same 1.9 Fieldwork : Measurement and quantifications of local systems such as agriculture produce, rainfall, Road network, production in local industries, Produce /service which moves from A to B 1.10 Analysis and Report writing Report writing containing- 1. Introduction of the topic 2. Data collected in various formats such as table, pie chart, bar graph etc 3. Observations of field visits and data collected.	Implementation Methodology: Considering the nature of the course designed, following points shall be considered while implementing the course. i) Regroup in the batches of 5-6 students for conducting the fieldwork from the bigger group. ii) Assign a few batches of the students for this course to all the faculty members. iii) A group of course teachers will visit local governance bodies such as Municipal Corporations, Village Panchayats, Zilla Parishads, Panchayat Samitis to assess the small technological / engineering needs in their area of work. iv) The group of course teachers will carry out initial field visits to evaluate the various possibilities of field visits / various scenarios wherein students can conduct field work to measure / quantify the parameters / attributes. v) The course will be implemented in eight sessions and fieldwork. a) Session I - Introduction to development paradigm, fieldwork and case study as pedagogy b) Session II - VII - Society,

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
			stakeholders and value creation, measurements, rudimentary analysis and reporting c) Session VIII - Final closure session feedback and assessment d) Field work - 1. Pilot Visit - Pilot of survey instrument 2. Survey Visit 1 - Data gathering / Information Collection 3. Survey Visit 2 - Data gathering 4. Summary Visit - Closure after analysis
2	TLO 2.1 Adoption of Village or Slum TLO 2.2 Survey and Problem Identification TLO 2.3 Conduct Project / Programs in the selected village / slum TLO 2.4 Undertake Special Camping Programme	**Unit - II MODULE II : National Service Scheme (NSS)** 2.1 Contacting Village/Area Leaders 2.2 Primary socio economic survey of few villages in the vicinity of the institute. 2.3 Selection of the village for adoption - conduct of activities 2.4 Comprehensive Socio Economic Survey of the Village/Area 2.5 Identification of Problem(s) 2.6 Dissemination of information about the latest developments in agriculture, watershed management, wastelands development, non-conventional energy, low cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, government schemes, legal aid, consumer protection and allied fields. 2.7 A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.	(i) The teachers should visit the village / slum before adopting it for NSS activities. (ii) The selected area should be compact. (iii) The community people should be receptive to the ideas of improving their living standard. They should also be ready to coordinate and involve in the projects undertaken by the NSS for their upliftment; (iv) The areas where political conflicts are likely to arise should be avoided by the NSS units. (v) The area should be easily accessible to the NSS volunteers to undertake frequent visits to slums;

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Love and Compassion (Prem and Karuna) TLO 3.2 Truth (Satya) TLO 3.3 Non-Violence (Ahimsa) TLO 3.4 Righteousness (Dharma) TLO 3.5 Peace (Shanti) TLO 3.6 Service (Seva) TLO 3.7 Renunciation (Sacrifice) Tyaga TLO 3.8 Gender Equality and Sensitivity	**Unit - III MODULE-III : Universal Human Values** 3.1 Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna) 3.2 Truth (Satya) : Introduction, Practicing Truth (Satya) 3.3 Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa) 3.4 Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma) 3.5 Peace (Shanti) : Introduction, Practicing Peace (Shanti) 3.6 Service (Seva) : Introduction, Practicing Service (Seva) 3.7 Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga 3.8 Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity	i) Lectures ii) Demonstration iii) Case Study iv) Role Play v) Observations vi) Portfolio Writing vii) Simulation viii) Motivational talks by Practitioners ix) Site/Industry Visit

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
4	TLO 4.1 Puntuality TLO 4.2 Cleanliness, Hygiene and Orderliness TLO 4.3 Responsibility TLO 4.4 Gratitude and Appreciations TLO 4.5 Determination & Persistence TLO 4.6 Respect TLO 4.7 Team Spirit TLO 4.8 Caring & Sharing TLO 4.9 Honesty TLO 4.10 Forgive and Forget	**Unit - IV MODULE-IV: Value Education (Unnati Foundation)** 4.1 Punctuality, Icebreaker and Simple Greeting, Understanding & Managing Emotions, Introducing Self, The power of a Positive Attitude, Talking about one's Family, Talking about one's Family, Making a Positive Impression, Give word list for a Word based 4.2 Cleanliness , Hygiene and Orderliness , Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills , Greeting gestures, Gender Equality and Sensitivity 4.3 Responsibility, OCSEM- Visual Comprehension and Word Based Learning, Goal Setting – Make it happen, Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter Introducing Others, Time Management, Talking about the daily routine, Money Management 4.4 Gratitude and Appreciation , Asking Simple Questions & Asking for the price , Stress Management, Student Referral process ,Comprehending & Paraphrasing Information, A Plate of Rice and Dignity of Labour, Topics for Public Speaking, Placement Process , OCSEM-E-Newspaper, Critical Thinking to overcome challenges 4.5 Determination and Persistence, Guiding and Giving Directions, Language Etiquette & Mannerism, . Unnati Philosophy , b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Simple instructions to follow procedures, Assertiveness, Give topics for Debate, Describing a person/Objects, Refusal Skills, Word List for Word based Learning 4.6 Respect, Comparing , OCSEM - Public Speaking, Student referral process,	i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Cooperative Learning vii) Chalk-Board

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
		Attending a phone call, Being a Good Team Player , Placement Process, At a Restaurant, Workplace ethics 4.7 Team Spirit, Inviting someone, OCSEM - Picture Reading & Word, a. Unnati Philosophy & b. Unnati Branding - Follow, Like & Share Unnati Social Media - Facebook / Instagram/ Twitter, Apologizing, Apologizing, Dealing effectively with Criticism, Introduce Importance of Self Learning and upskilling 4.8 Caring and Sharing , Handling Customer queries, Flexibility & Adaptibility, Student referral process, Writing a Resume, OCSEM-Public Speaking, Placement Process, Meditation/ Affirmation & OCSEM-Debate, Introduce Certif-ID, how to create Certif-ID Project , 4.9 Honesty, Email etiquette & Official Email communication, Alcohol & Substance use & abuse, Describing a known place , Leadership Skills, Describing an event, OSCEM-Picture Reading & Visual Comprehension 4.10 Forgive and Forget, Facing and Interview, OSCEM-Public Speaking , Attending a telephonic/Video interview & Mock Interview , Affirmation , Pat-a-Back & Closure (Valediction , Unnati Branding, Student Testimonials), Meditation/ Affirmation & Sponsor connect (Speak to UNXT HO)	

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Literacy About Savings and Investments TLO 5.2 Literacy About Financial Planning TLO 5.3 Literacy About Transactions TLO 5.4 Literacy About Income, expenditure and budgeting TLO 5.5 Literacy About Inflation TLO 5.6 Literacy About Loans TLO 5.7 Literacy About the Importance of Insurance TLO 5.8 Literacy About the Dos and Donts in finances	**Unit - V MODULE-V : Financial Literacy** 5.1 Introduction - Life Goals and financial goals 5.2 Savings and Investments - Three pillars of investments, Popular asset classes, Government schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments 5.3 Retirement planning 5.4 Cashless transactions 5.5 Income, expenditure and budgeting – Concepts and Importance 5.6 Inflation- Concept, effect on financial planning of an individual 5.7 Loans – Types, Management of loans, Tax benefits 5.8 Insurance – Types, Advantages, selection 5.9 Dos and Donts in Financial planning and Transactions	i) Online/Offline Mode of Instructions ii) Video Demonstrations iii) Presentations iv) Case Study v) Chalk-Board vi) Collaborative learning

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Suggestive list of activities during Regular as well as Special Camping (NSS Activities)

- Following list is only an illustrative list of the type of activities that can be undertaken. Under the programme it would be open to each NSS Unit to undertake one of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at the integrated development of the area selected for its operation which could be a village or a slum. It has also to be ensured that at least a part of the programme does involve manual work.

(a) Environment Enrichment and Conservation:
The activities under this sub-theme would inter-alia, include:
(i) plantation of trees, their preservation and upkeep
(ii) Construction & maintenance of village streets, drains
(iii) Cleaning of village ponds and wells;
(iv) Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
(v) Disposal of garbage & composting;

(vi) Prevention of soil erosion and work for soil conservation,
(vii) Watershed management and wasteland development
(viii) Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.

(b) Health, Family Welfare and Nutrition Programme:

(i) Programme of mass immunization;
(ii) Working with people in nutrition programmes with the help of Home Science and medical college students;
(iii) Provision of safe and clean drinking water;
(iv) Integrated child development programmes;
(v) Health education, AIDS Awareness and preliminary health care.
(vi) Population education and family welfare programme;
(vii) Lifestyle education centres and counselling centres.
© Programmes aimed at creating an awareness for improvement of the status of women: (i) programmes of educating people and making them aware of women's rights both constitutional and legal;
(ii) creating consciousness among women that they too contributed to economic and social well-being of the community;
(iii) creating awareness among women that there is no occupation or vocation which is not open to them provided they acquire the requisite skills; and
(iv) imparting training to women in sewing, embroidery, knitting and other skills wherever possible.

(d) Social Service Programmes:

(i) work in hospitals, for example, serving as ward visitors to cheer the patients, help the patients, arranging occupational or hobby activities for long term patients; guidance service for out-door-patients including guiding visitors about hospital's procedures, letter writing and reading for the patients admitted in the hospital; follow up of patients discharged from the hospital by making home visits and places of work, assistance in running dispensaries etc.
(ii) work with the organisations of child welfare;
(iii) work in institutions meant for physically and mentally handicapped;
(iv) organising blood donation, eye pledge programmes;
(v) work in Cheshire homes, orphanages, homes for the aged etc.;
(vi) work in welfare organisations of women;
(vii) prevention of slums through social education and community action;

(e) Production Oriented Programmes:

(i) working with people and explaining and teaching improved agricultural practices;
(ii) rodent control land pest control practices;
(iii) weed control;
(iv) soil-testing, soil health care and soil conservation;
(v) assistance in repair of agriculture machinery;
(vi) work for the promotion and strengthening of cooperative societies in villages;
(vii) assistance and guidance in poultry farming, animal husbandry, care of animal health etc.;
(viii) popularisation of small savings and assistance in procuring bank loans

(f) Relief & Rehabilitation work during Natural Calamities:

(i) assisting the authorities in distribution of rations, medicine, clothes etc.;
(ii) assisting the health authorities in inoculation and immunisation, supply of medicine etc.;
(iii) working with the local people in reconstruction of their huts, cleaning of wells, building roads etc.;
(iv) assisting and working with local authorities in relief and rescue operation;
(v) collection of clothes and other materials, and sending the same to the affected areas;

(g) Education and Recreations: Activities in this field could include:

(i) adult education (short-duration programmes);
(ii) pre-school education programmes;
(iii) programmes of continuing education of school drop outs, remedial coaching of students from weaker sections;
(iv) work in crèches;
(v) participatory cultural and recreation programmes for the community including the use of mass media for instruction and recreation, programmes of community singing, dancing etc.;
(vi) organisation of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;
(vii) programmes including discussions on eradications of social evils like communalism, castism, regionalism, untouchability, drug abuse etc.;
(viii) non- formal education for rural youth and
(ix) legal literacy, consumer awareness.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Simple engineering measurement devices GPS data collection tools GIS open source softwares- Google Earth and QGIS MS office suite	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Formative assessment (Assessment for Learning) Report and presentation of fieldwork activities, Self-Learning (Assignment)

Summative Assessment (Assessment of Learning)

XI. SUGGESTED COS - POS MATRIX FORM : NOT APPLICABLE

XII. SUGGESTED LEARNING MATERIALS / BOOKS

SOCIAL AND LIFE SKILLS **Course Code : 312003**

Sr.No	Author	Title	Publisher with ISBN Number
1	IRAP, Hyderabad, CTARA, IIT Bombay and UNICEF, Mumbai	Compendium of Training Materials for the Capacity Building of the Faculty and Students of Engineering Colleges on 'IMPROVING THE PERFORMANCE OF RURAL WATER SUPPLY AND SANITATION SECTOR IN MAHARASHTRA' Districts Economic survey reports	UNICEF
2	Central Public Health and Environmental Engineering Organisation	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi
3	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
4	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra
5	Local college students, UMA staffs	Sample Case Studies on UMA website	IITB-UMA team

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201601131501523808.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan
2	https://gr.maharashtra.gov.in/Site/Upload/Government%20Resolutions/English/201606151454073708.pdf	Government Resolution of Government of Maharashtra regarding Unnat Maharashtra Abhiyan Guidelines
3	https://censusindia.gov.in/census.website/	A Website of Census of India
4	https://gsda.maharashtra.gov.in/english/	A Website of Groundwater Survey and Development Agency, GoM
5	https://mrsac.gov.in/MRSAC/map/map	A Website where district-wise maps showcasing different attributes developed by Maharashtra Remote Sensing Applications Centre.
6	https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx	A Website of Jal Jivan Mission, Government of India
7	https://cpcb.nic.in/	A Website of Central Pollution Control Board, Government of India

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Sr.No	Link / Portal	Description
8	http://www.mahapwd.com/#	A Website of Public Works Department, GoM
9	http://tutorial.communitygis.net/	A Website for GIS data sets developed by Unnat Maharashtra Abhiyan
10	https://youtu.be/G71maumVZ1A?si=TzDTxKUpLYaRos7U	A video record of lecture by Prof. Milind Sohoni, IIT Bombay, on Engineering, Development and Society
11	https://youtu.be/TUcPNwtdKyE?si=wnSWrhGc9dJTC-ac	A keynote talk by Prof. Milind Sohoni, IIT Bombay, on Interdisciplinary Engineering: The Road Ahead
12	https://youtu.be/mKJj6j_1gWg?si=ajE8s4lfB2OM63Ng	A TED talk by Prof. Milind Sohoni, IIT Bombay, on Vernacular Science: The Science of Delivery
13	https://www.ugc.gov.in/pdfnews/4371304_LifeSKill_JeevanKaushal_2023.pdf	UHV: UGC Course on life skils. Unit 4 i.e. Course 4 is to be referred
14	https://nss.gov.in/	NSS : Know about the NSS Scheme and details

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AO/ DE/ EJ/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Second**
Course Title	**: ELECTRONICS WORKSHOP PRACTICE**
Course Code	**: 312008**

I. RATIONALE

Engineering Diploma holders in Electronics and Allied branches expected to identify and test various Components, Switches, Relays, Connectors, Cables, Network cables and must be able to Solder and De solder SMD components.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences: Identification and Testing of various electronic components.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Use ESD accessories and safety systems for electronic equipment
- CO2 - Test various electronic components using relevant equipment
- CO3 - Identify various parts of SMPS, UPS, perform soldering and desoldering of SMD components
- CO4 - Identify various types of Switches, Relays, Connectors, Cables, Network and Data cables
- CO5 - Use of sensors for various parameters,

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA			
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min		
312008	ELECTRONICS WORKSHOP PRACTICE	EWP	SEC	-	-	4	2	6	3	-	-	-	-	-	25	10	25@	10	25	10	75	

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Follow safety practices TLO 1.2 Use of ESD Accessories TLO 1.3 List various protection devices	**Unit - I Safety Measures** 1.1 Electro Static Discharge (ESD): Introduction, Causes 1.2 ESD Accessories 1.3 Types of Fuses, rating of fuses 1.4 Introduction and Use of: MCB, ELCB, MCCB	Teacher input Demonstrartion in laboratory and using videos
2	TLO 2.1 Describe the use of Front panel controls on CRO/DSO TLO 2.2 Describe the use of Front panel controls on Function Generator TLO 2.3 Plot the Characteristics of Multicolor LED TLO 2.4 State the need of Q factor TLO 2.5 Explain the procedure of Testing of PCB and Transformer TLO 2.6 State the need of Optocoupler TLO 2.7 List Various Tools involved in testing	**Unit - II Electronic Component Testing** 2.1 CRO/DSO: Various Controls on Front panel, Use for Testing of components 2.2 Function Generator: Various Controls on Front panel, Generation of different waveforms 2.3 LEDs: Multicolor LED testing 2.4 LCR Q meter: Introduction, Need of Q factor , Determination of Q factor 2.5 Testing: PCB connectivity, Transformer, Pulse Transformer 2.6 Introduction to Opto coupler, Fiber Optic Cable: Connectivity test 2.7 Various Tools: Wire cutter, wire stripper, screwdrivers, testers, IC plucker	Teacher input Demonstration in laboratory

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Describe the block diagram of SMPS TLO 3.2 List the types of UPS TLO 3.3 Use of Temperature controlled soldering iron for SMD components	**Unit - III SMPS, UPS and Soldering Desoldering** 3.1 SMPS: Introduction, Various Blocks, observe waveforms at output of each block 3.2 UPS: Introduction, Types- offline, online, UPS ratings, relation between KVA rating and battery backup 3.3 SMD Soldering: Introduction, Soldering of SMD components 3.4 DeSoldering of SMD components	Teacher input Hands on practice Demonstration video
4	TLO 4.1 Classify the various types of connectors TLO 4.2 List the various types of relays TLO 4.3 List the applications of various types of switches TLO 4.4 Explain the procedure of setting up a network using network cables	**Unit - IV Connectors, Relays, Switches and Network cables** 4.1 Connectors: Need, Types and Identification 4.2 Relays: Need, Types and Identification 4.3 Switches: Need, Types and Identification 4.4 Cables: Need, Types and Identification 4.5 Network cables: Types and connection	Teacher input Hands on practice Demonstration video
5	TLO 5.1 Classify various types of Sensors TLO 5.2 Describe the operation of LDR TLO 5.3 Describe the operation of Hygrometer TLO 5.4 Describe the operation of temp sensor IC	**Unit - V Sensors** 5.1 Sensors: Introduction, Temperature sensors, Motion sensors, Proximity sensors, LDR, Humidity sensor [Hygrometer] 5.2 LDR Operation and specifications 5.3 Humidity sensor Hygrometer Operation and selection factors 5.4 Temperature sensor IC characteristics	Teacher input Hands on practice Demonstration video

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identification of various ESD safety accessories and their applications	1	* Use various ESD safety accessories	2	CO1
LLO 2.1 Identify various types of fuses, fuse carriers, MCB, ELCB and MCCB with ratings	2	* Use various types of protection devices	2	CO1
LLO 3.1 Operate the CRO and use various controls on front panel	3	* Identify the controls of CRO/DSO	2	CO2
LLO 4.1 Operate CRO/DSO in component testing mode LLO 4.2 Test the passive components R , L and C using CRO/DSO LLO 4.3 Test the active components Diode , Transistor using CRO/DSO	4	*Component testing using CRO	2	CO2
LLO 5.1 Operate the function generator and use various controls on front panel	5	Identify the controls of function generator	2	CO2
LLO 6.1 Generate square/sine/triangular wave of specified frequency and amplitude and observe on CRO/DSO	6	* Generate the different types of waveform by using function generator on CRO/DSO	2	CO2

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Identify the single colour and multi colour LED. LLO 7.2 Test multicolor LED using DMM and D C power supply.	7	* Testing of multi colour LEDS	2	CO2
LLO 8.1 Set LCR Q meter for Quality factor measurement LLO 8.2 Measure Q of given L using LCR Q meter LLO 8.3 Measure Q of given C using LCR Q meter	8	*Determine Q factor of given component by using LCR Q meter	2	CO2
LLO 9.1 Test the continuity of printed track on a PCB using multi- meter	9	* Use of continuity tester	2	CO2
LLO 10.1 Measure the input and output voltage of transformer	10	Testing of transformer	2	CO2
LLO 11.1 Identify the various types of capacitors LLO 11.2 Determine its value of capacitor by color code LLO 11.3 Interpret the value of capacitor by reading information printed on it.	11	Determine the value of capacitor .	2	CO2
LLO 12.1 Observe input output wave forms of given pulse transformer	12	*Testing of pulse transformer	2	CO2
LLO 13.1 Identify opto electronic devices LLO 13.2 Plot transfer transfer characteristics of the Optocoupler	13	Opto electronic devices	2	CO2
LLO 14.1 Identify type of fiber optic cable LLO 14.2 Set up analog link to test optic cable connectivity	14	*Optical Fiber analog link	2	CO2
LLO 15.1 Identify the various tools: wire cutter, wire stripper, screwdrivers, testers, IC plucker used in electronics laboratories LLO 15.2 Use appropriate tool for given application	15	* Electronic workshop tools	2	CO2
LLO 16.1 Identify various parts of SMPS LLO 16.2 Measure output voltage of SMPS	16	* Switch Mode Power Supply (SMPS).	2	CO3
LLO 17.1 Identify various types of UPS LLO 17.2 Measure the output voltage of UPS	17	Uninterrutable power supply (UPS).	2	CO3
LLO 18.1 Use of temperature controlled soldering iron for SMD components soldering	18	* Soldering the SMD component on the PCB	2	CO3
LLO 19.1 Use of appropriate desoldering tool for desoldering of SMD components from PCB	19	* Desolder the SMD component from the PCB	2	CO3
LLO 20.1 Find out various tools available with PCB layout software LLO 20.2 Prepare PCB layout for given discrete component circuit by using relevant PCB layout software	20	* Use of PCB layout software	2	CO3
LLO 21.1 Identify various types of connectors: USB type A, B, C, Lightning type, USB mini and micro connectors	21	* USB connectors	2	CO4

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 22.1 Identify various types of relays: Rotary, Reed, Solid state, Remote control and voltage stabilizer relays LLO 22.2 Select relay for given application	22	* Types of relays	2	CO4
LLO 23.1 Identify various types of switches: Toggle, Rotary, Slider, Lever, Micro switches, Thumbwheel, Piano, Tactile switches LLO 23.2 Select appropriate switch for given application.	23	*Types of switches.	2	CO4
LLO 24.1 Identify type of cables: RCA, HDMI, display port cable LLO 24.2 Select appropriate cable for given applications	24	* Types of cables	2	CO4
LLO 25.1 Identify the computer network cable LLO 25.2 Test network cable: CAT5, CAT6 Cable, using cable tester LLO 25.3 Prepare cable for network connection using crimping tools,	25	* Computer Networking Cables	4	CO4
LLO 26.1 Identify various temperature sensors such as RTD, Thermocouple, Thermistor and IC based temperature sensors, LLO 26.2 Plot the characteristics of temperature sensor IC LM335	26	* Temperature sensor	2	CO5
LLO 27.1 Use of hair hygrometer to measure humidity or use any other sensor (related to program) and measure the parameter	27	Use of hair hygrometer / other sensor	2	CO5
LLO 28.1 Configure local and network printer	28	Install local and network printer by applying various types of configuration settings	2	CO5
LLO 29.1 Take a print of a signal from DSO by connecting it to a printer.	29	* Interface DSO to a printer	2	CO5
LLO 30.1 Configure the scanner and printer LLO 30.2 Identify various faults of printers	30	Configure scanner and Printer	4	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Assemble switch board with two switches
- Build a BJT based amplifier circuit and observe the output waveform
- Design a PCB layout by using relevant software for discrete or IC based components
- Design a relay based circuit to turn ON and OFF the LED

Assignment

- Prepare a report on various ESD and safety accessories by visiting a nearby industry
- Prepare a comparative chart for different types of printers
- Prepare report on electronic system maintenance tools

Note :

A suggestive list of micro project and assignment is given here. Similar activities could be added by the course teacher . For this course 2 hr per week are allocated in L A scheme. By considering 30 hr self learning work course teacher has to allocate one or two task may be combination of assignments and / or micro projects. Micro project is expected to complete as a group activity.Course teacher can assign specific learning or any other skill development task . According to task assign , course teacher can set rubrics for continuous (formative) type assessment. SLA marks shall be awarded as per continuous assessment record.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	ESD equipment: ESD Table Mat Color: BLUE Material: antistatic Thickness: 2mm Mat Size: Can be provide as per requirement Pattern: Plain Length: 2M X 15M Shape: Roll 2m X 15m,can be provided in As per requirement Usage: ESD protection	1,2
2	CRO: Dual Channel, 4 Trace CRT / TFT based Bandwidth 20 MHz/30 MHz X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Readout , USB interface	3,4,6
3	Digital Storage Oscilloscope: 25MHz/60MHz/70MHz/100MHz Dual Channel, 4 Trace CRT / TFT based X10 magnification 20 nS max sweep rate, Alternate triggering Component tester and with optional features such as Digital Read out, USB interface. Any other Oscilloscope with additional features is also suitable with magnifying probe at least two probes, if possible isolated probe	3,4,6,29
4	Function Generator: Frequency range 0.1Hz to 30 MHz sine, square, triangular, ramp and pulse generator, Output amplitude 20V open circuited, Output impedance 50 ohms. Facility to indicate output frequency and amplitude on display	5,6
5	Digital Multimeter: Minimum 3 ½ digit 4 ½ digit display, multimeter measures Vac, Vdc (1000V max), Adc, Aac (10-amp max), Resistance (0-100 M?), diode and transistor testing mode	8,10
6	LCR Q Meter: Parameter L-Q, C-D, R-Q and Z-Q Frequency 00 Hz, 120 Hz and 1 KHz Accuracy Basic Accuracy : 0.3% Display 5 digits display for both primary and secondary parameters L 100 Hz, 120 Hz 1 mH - 9999 H 1 KHz 0.1 mH - 999.9 H Measurement C 100 Hz, 120Hz 1 pF – 9999 mF Range 1 KHz 0.1 pF - 999.9 mF R, |Z| 0.0001V- 999.9 MV D, Q 0.0001 – 9999 D% 0.0001% - 9999% Test Level 120 Hz 0.3 Vrms (1 ±15%) (Range Auto 1 KHz and Open 100 Hz 0.42 Vrms (1±15%) Circuit) Ranging Mod Auto and Hold Equ	8
7	Pulse transformer: core volume of 2.57x10 -4 m 3 average gap between layers of 0.002 m, 14 turns primary circuit, 108 turns secondary, 30 kV of secondary voltage, 1.5 k output impedance level	12
8	Opto Coupler : Test voltage for Isolation is 5000VRMS Max collector current allowed by a transistor is 100mA I/O coupling capacitance is below 0.5pF Current Transfer Ration/CTR is 10% I/O isolation voltage is 500VRMS Typical Rise & Fall Time: 3us Forward Voltage of an IR LED ranges from 1.2V to 1.5V Max voltage across C&E terminals of a phototransistor is70V The Forward Current of an IR LED ranges from 10mA to 80mA Max Reverse Current of IR LED is 10uA Max Reverse Voltage of IR LED i	13

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
9	opto-isolators : withstand input-to-output voltages up to 10 kV and voltage transients with speeds up to 25 kV/?s	13
10	SMPS: Electrical Characteristics 12V, 20A 1. Input Voltage 100 - 270V AC 2. Output Voltage 12 V DC 3. Output Current 20A 4. Leakage Current @ 230 V ac < 2mA 5. Line regulation < 1% 6. Load regulation < 1% 7. Ripple content 150mV p-p 8. Dielectric strength: Between Input & Output 2 kV AC Between Input & Earth 1.5kV AC Between Output & Earth 1.5kV AC	16
11	UPS Specifications : UPS mode Mains AC LOW Cut 170+/- 5V Mains AC LOW Cut recovery 175+/- 5V Mains AC HIGH Cut 265+/- 5V Mains AC LOW Cut recovery 260+/- 5V INVERTER mode Mains AC LOW Cut 120+/- 5 V Mains AC LOW Cut recovery 125+/- 5 V Mains AC HIGH Cut 285+/- 5 V Mains AC HIGH Cut recovery 280+/- 5 V	17
12	Temperature controlled soldering Gun: Accurate and advanced temperature Control with micro controller technology User-friendly operation. Set / Read of temperature Increase and Decrease of keys to set temperature once set the read temperature will display after two seconds by default. Temperature control accuracy ± 1°C Last set value of temperature is stored in memory Power consumption 60 W Input voltage 170 to 270 V Temperature range 180 to 270 V (180 to 480 °C). Temp stability ± 10°C Tem	18,19
13	Computer System: Intel processor core i3 or i7 or latest with mother board Intel chipset 41/61/latest with 4 USB,1 serial port, 1 LPT port,2GB RAM DDR III,500 GB Sata Hard disk, 16” or 18.5” LCD/LED monitor, ATX cabinet with SMPS and lock system, DVD writer, Keyboard, USB mouse,1 Gigabit Network card/ latest configuration or Latest configuration (or higher version) 24	24,25,28,29,30
14	LM 335: Local sensor accuracy (max)6Operating temperature range (°C)-40 to 100Supply voltage (min) (V)5Supply voltage (max) (V)3.04Supply current (max) (µA)400 Interface type: Analog output Sensor gain (mV/°C)10RatingCatalog	26
15	Printer Type: LaserJet; Functionality – Single Function (Print only); Printer Output – Black & White only Connectivity – USB, Power: Input voltage 110 to 127 VAC (+/- 10%), 50/60 Hz (+/- 2 Hz), 3.5 amps; 220 to 240 VAC (+/- 10%), 50/60 Hz (+/- 2 Hz), 2 amps” ; “Compatible Operating Systems: Windows 2000; Windows 7; Windows 10 Pages per minute – 14 pages ; Ideal usage – Enterprise/Business, Frequent users (for fast, high quality printing) Page size supported – A4, A5, A6, B5, C5, DL, postcar	28,29
16	Scanner type: Portable scanner Photoelectric device, 600 dpi Color CIS with 10368 pixels Effective pixels 5,100 × 8,400 pixels at 600 dpi Document size Max: 216 × 356 mm (8.5 × 14.0 inches) Min: 52 × 73.7 mm (2.0 × 2.9 inches) (Portrait) 85.6 × 54 mm (3.4 × 2.1 inches) (Landscape) Paper input, Face-down loading, Paper output, Face-down ejection Paper capacity, Single sheet of paper at 35 to 270 g/m2 Scanning resolution: 600 dpi (main scan), 600 dpi (sub scan) Output resolution:	30
17	PCB layout software: Circuitmaker	20
18	Clamp meters: AC current (50/60 Hz) real effective value Sector / accuracy 200 AAC / ±2.5% + 8 digits DC current Sector / accuracy 200 ADC / ±2.0% + 5 digits Testing AC voltage (50/60Hz) real effective value 600 VAC ±(1.5% + 8 digits) Testing DC voltage 600 VDC ±(1.5% + 2 digits) Ohms 999.9 ? ±(1.5% + 8 digits) Illumination of measurement point white LEDs Diameter of the conductor maximum of 18mm Display backlit LCD with 3 2/3 positions Power 2 AAA batteries	12,16,17

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table) : NOT APPLICABLE

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product

Summative Assessment (Assessment of Learning)

- End of the term assessment, Viva-voce, Workshop performance

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	-	3	-	1	3			
CO2	3	3	3	2	-	2	3			
CO3	2	2	2	2	1	2	3			
CO4	2	-	-	3	-	2	3			
CO5	2	2	2	3	2	1	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Raghuwanshi B.S.	A Course in Workshop Technology	Dhanpat Rai & Sons, New Delhi, 2017 or latest edition
2	Sarathe A.K.	Engineering Workshop Practice	Khanna Book Publishing Co.(P) Ltd. , New Delhi; 2021 or latest edition ISBN: 978-9391505516
3	Jones, Thomas H	Electronic Components Handbook	Reston Publishing, Virginia, US, latest edition, ISBN: 978-0879092221
4	Mehta V.K., Mehta Rohit	Principles of Electronics	S. Chand and Co., New Delhi-110 055, 2014, ISBN: 978-8121924504
5	Abraham Pressman , Keith Billings, Taylor Morey	Switching Power Supply Design	McGraw Hill Edition 3, April 16, 2009 ISBN: 978-0071482721
6	Susan S Mathew Saji T Chacko	Fundamentals of Electrical and Electronics Engineering	Khanna Book Publishing Co (P) Ltd. New Delhi 978-93-91505-59-2

XIII . LEARNING WEBSITES & PORTALS

ELECTRONICS WORKSHOP PRACTICE **Course Code : 312008**

Sr.No	Link / Portal	Description
1	https://www.boschrexroth.com/en/in/products/product-groups/assembly-technology/topics/manual-product	ESD Protection
2	https://electricalnotebook.com/lcr-q-meter/	LCR Q meter to measure the Q factor
3	https://nptel.ac.in/courses/108105180	SMPS Working
4	https://instrumentationtools.com/multi-color-led-works/	Multicolor LED Working
5	https://www.youtube.com/watch?v=AdaIpyOdd0w	Pulse Transformer
6	geeksforgeeks.org/how-to-set-up-a-LAN-	Network Reading material about Process to set a LAN
7	https://www.youtube.com/watch?v=cc2fyg-B5WE	Video about setting a LAN
8	https://circuitmaker.com	PCB Circuit Maker
9	https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_is_list_by_category_id/5	IS for electrical safety and appliances

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Programme Name/s	**: Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: DE/ EJ/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Second**
Course Title	**: PROGRAMMING IN 'C' LANGUAGE**
Course Code	**: 312009**

I. RATIONALE

C language is basic programming language for enhancing logical and problem solving ability of student . This course enhances and builds confidence in programming skills of diploma students. This course will enable students to inculcate programming concepts and methodology to solve engineering problems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain the following industry employer expected outcome through various teaching learning experiences - Develop ‘C’ programs to solve wide-reaching electronic engineering related problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Develop C program using input/output and arithmetic expressions.
- CO2 - Develop C program using decision making statements and loops.
- CO3 - Use predefined and user defined functions to develop C program.
- CO4 - Develop C programs using arrays and strings.
- CO5 - Implement the basics of structures and pointers to enhance the performance of the program.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312009	PROGRAMMING IN 'C' LANGUAGE	CPR	SEC	2	-	2	2	6	3	-	-	-	-	-	25	10	25@	10	25	10	75

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Write the basic structure of C program. TLO 1.2 Differentiate between keywords and identifiers. TLO 1.3 Use relevant data types as per the given situation. TLO 1.4 Construct algorithm and draw flowchart for the given problem. TLO 1.5 Use different types of operators in given situations.	**Unit - I Basics of C Programming** 1.1 Algorithms and Flow Charts: 1.1.1 Steps for writing algorithm 1.1.2 Notations of flow charts. 1.2 Structure of C program , Introduction of Assembler, Linker, Compiler, Interpreter. 1.3 Character set, Keywords, identifiers , constants, Variables 1.4 Data Types: 1.4.1 Predefined Data types :integer-unsigned, signed, long, float, double, character, single ,octal, hexadecimal 1.4.2 User defined Data Types: Arrays, Structures . 1.5 Operators and expressions: 1.5.1 Formatted input and output statements 1.5.2 Types of Operators: Arithmetic, logical, relational, increment and decrement, bitwise, special operators: unary, ternary operators, 1.5.3 Precedence, Associativity of Operators	Chalk-Board Hands-on

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Implement branching and looping. TLO 2.2 Demonstrate control statements using “if-else”. TLO 2.3 Apply different types of loops as per the given problem.	**Unit - II Decision Control & Looping** 2.1 Introduction to decision control, branching and looping 2.2 Decision Control statements: if, if-else, if-else-if ladder, switch case, 2.3 Looping and branching Statements: 2.3.1 while Loop, 2.3.2 for Loop, nested for loop 2.3.3 do-while loop, break, continue 2.3.4 Goto statement	Chalk-Board Demonstration Hands-on
3	TLO 3.1 Use functions for implementing C program. TLO 3.2 Write ‘C’ program to pass values between the functions. TLO 3.3 Use library functions for the given problem. TLO 3.4 Develop a recursive function for the given problem.	**Unit - III Functions** 3.1 Concept and Need of a Function. 3.1.1 Declaration ,definition and calling of functions 3.2 Passing Values between Functions: call by value ,call by reference, Scope Rule of Functions. 3.3 Using Library Functions: 3.3.1 math functions like : mod(),sqrt(),pow(),exp(),sum(), round(), 3.3.2 Character Functions like islower(),isupper(),isdigit(),tolower() 3.4 Recursive function.	Chalk-Board Demonstration Hands-on
4	TLO 4.1 List down the steps to declare, initialize and display array elements. TLO 4.2 Write a C program to handle Two dimensional arrays. TLO 4.3 Write steps to declare, initialize and display the strings in C program. TLO 4.4 Apply relevant string library functions as per the given problem.	**Unit - IV Arrays And Strings** 4.1 Concept and need of Arrays, 4.1.1 Declaration, Initialization, Storing Array Elements in Memory, Displaying array elements 4.2 Two-Dimensional Arrays 4.2.1 Initializing a Two-Dimensional Array 4.2.2 Adding elements to 2-D Array 4.2.3 Display elements of 2-D Array 4.3 Introduction of Strings 4.3.1 Declaration, Initialization and Display of string 4.4 Standard Library String Functions 4.4.1 strlen(),strcpy(), strcat( ), strcmp( )	Chalk-Board Demonstration Hands-on
5	TLO 5.1 Develop a program to declare , access and display structures in C. TLO 5.2 Use pointers to access memory and perform pointer arithmetic.	**Unit - V Structures & Pointers.** 5.1 Introduction to structures: 5.1.1 Declaring a Structure 5.1.2 Accessing Structure elements 5.1.3 Displaying Structure elements 5.2 Concept of pointer 5.2.1 Pointer notation 5.2.2 Pointer variables, declaration of pointer 5.2.3 Pointer arithmetic like increment and decrement operation.	Chalk-Board Demonstration Hands-on

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Implement format specifiers available in C language.	1	(*) Write a 'C'program to display hexadecimal, decimal, octal format of entered number using %d, %c. %i. %f, %g, %u, %o ,%s, %x, %n, %%,	2	CO1
LLO 2.1 Implement basic/input output statement of C language. LLO 2.2 Apply logical and bitwise operators on given data	2	(*) Write a program to perform following operations. (a) Display the message "Hello World", name. address, date of birth and email id using print( ) function. (b) Logical operations: And(&) , | (OR) for given values , Bitwise operations :<< (LEFT SHIFT), >> (RIGHT SHIFT) for given values	2	CO1
LLO 3.1 Use header files to perform specific task. LLO 3.2 Determine equivalent value of parallel resister using a C program.	3	(*) 1) Write a program to display current time and date using **time.h** header file. 2) Write a program to obtain the equivalent value for parallel resistor by assuming resistor values.	2	CO1
LLO 4.1 Determine the bandwidth of amplifier using a C program.	4	(*) Write a program to Calculate bandwidth of given amplifier having higher 3 dB cutoff frequency at 20 KHz and lower 3dB cutoff frequency 50Hz .Display the bandwidth in KHz.	2	CO1
LLO 5.1 Implement If-else, if-else-if ladder for solving given task.	5	(*) 1) Write a program to check whether given number is even or odd. 2) Write a program to determine leap year using "if-else-if" ladder	2	CO2

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Implement post tested loop using do-while loop	6	Write a program to reverse a given number using do-while loop	2	CO2
LLO 7.1 Apply switch-case statement for implementing menu driven program.	7	(*) Write a C menu driven program to perform arithmetic operations using switch statement.	2	CO2
LLO 8.1 Use for loop to implement iteration.	8	(*) Write a program to print table of given number using for loop.	2	CO2
LLO 9.1 Apply Goto statement for implementing branching operation in C.	9	Write a program to implement goto statement	2	CO2
LLO 10.1 Use user defined functions to solve given task.	10	(*) Write a user defined function power (a, b) to calculate the value of a raised to b.	2	CO3
LLO 11.1 Implement call by value and call by reference	11	(*) Write a program to implement swapping of two integer by using following methods i) call by value ii) call by reference	2	CO3
LLO 12.1 Implement inbuilt math functions to perform mathematical operations.	12	(*) Write a program to implement following math functions i) mod() ii) sqrt() iii)pow() iv)exp() v)sum() vi) round()	2	CO3
LLO 13.1 Implement inbuilt character functions to perform operations on character data type.	13	Write a program to implement following character function in C. i) islower() ii) isupper() iii) isxdigit() iv) tolower() v) toupper()	2	CO3

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Write a program to implement One -Dimensional array. LLO 14.2 Apply 2-Dimnesional array to perform matrix operations	14	(*) 1) Write a program to store 10 numbers in an array and find sum of 10 numbers. 2) Write a program to perform following matrix operations using 2-D array • Addition • Subtraction • Transpose • Sum of digonal of matrix	2	CO4
LLO 15.1 Perform string operations using standard library functions	15	Write a program to implement following Standard Library String Functions. i) strlen() ii) strcpy() iii) strcat( ) iv) strcmp( ) v) strrev()	2	CO4
LLO 16.1 Use structures to store multiple data types.	16	(*) Declare a structure Student consisting of following members: • rollno • name • address • percentage Write a program to take data of three students and display the same.	2	CO5
LLO 17.1 Create a C program for implementing pointers	17	Write C program to create, initialize, assign and access a pointer variable	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Virtual Labs

- Students are encouraged to solve IIT Virtual Labs assignment on any selected topic. Link for Virtual Labs: https://cse02-iiith.vlabs.ac.in/Introduction.html

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Micro project

- Unit Convertor: Each batch will prepare a menu driven program to perform different operations unit conversion.
- Patterns: Each batch will prepare a program to display different number patterns
- Basic Mathematical Functions: Each batch will prepare a menu driven program to perform following operations: i) Pascal triangle ii) Armstrong No. iii) Floyd's triangle iv) HCF and LCM.
- Number Conversion System: Each batch will prepare a menu driven program to convert decimal number system to i) binary ii) Octal iii) Hexadecimal number system
- a) Bus Reservation System: Each batch will prepare a menu driven program to following operations i) Book a Ticket ii) List the information of all the tickets booked.

Note :

Microproject topics are suggestive topics, faculty can design the microproject topics as per the CO. The microproject has to be application based, laboratory-based or field-based as suggested by Teacher. Similar micro-projects can be added by concerned faculty. For this course 2 hr per week are allocated for SL (Self Learning) in learning scheme. By considering 30 hr self learning work course teacher has to allocate one or two task may be combination of assignments and / or micro projects . Micro project is expected to complete as a group activity. Course teacher can assign specific learning or any other skill development task . According to task assign , course teacher can set rubrics for continuous (formative) type assessment. SLA marks shall be awarded as per continuous assessment record.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Hardware : Personal Computer , RAM minimum 2 GB onwards. Operating System : Windows 10 onwards / Linux Software : Turbo C / GCC / Visual Studio Code or any relevant C compiler.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of C Programming	CO1	8	0	0	0	0
2	II	Decision Control & Looping	CO2	6	0	0	0	0
3	III	Functions	CO3	6	0	0	0	0
4	IV	Arrays And Strings	CO4	5	0	0	0	0
5	V	Structures & Pointers.	CO5	5	0	0	0	0
Grand Total				**30**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Continuous assessment based on process and product related performance indicators.Each practical will be assessed considering 60% weightage to process and 40% weightage to product.t

Summative Assessment (Assessment of Learning)

- End of term examination (Lab performance)viva voce

XI. SUGGESTED COS - POS MATRIX FORM

PROGRAMMING IN 'C' LANGUAGE **Course Code : 312009**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	2	2	3	-	-	1			
CO2	3	2	3	3	-	-	1			
CO3	2	2	3	3	-	-	2			
CO4	2	2	3	3	-	-	2			
CO5	2	2	3	3	-	-	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Yashwant Kanetkar	Let Us 'C'	BPB Publication New Delhi ISBN: 978818331630
2	E Balaguruswamy	Programming in 'C'	Tata McGrawHill New Delhi ISBN: 978-1-25-900461-2
3	Brian W. Kernighan / Dennis Ritchie	The C Programming Language 2e	Pearson Publication ISBN : 10. 0131103628
4	Herbert Schildt	C: The Complete Reference	McGraw Hill ISBN: 978-0070411838

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	www.tutorialpoint.com	Basics of C programming
2	www.cprogramming.com	Cprogramming.com covers both C in-depth, with both beginner-friendly tutorials, more advanced artic
3	www.sourcecodeworld.com	C programming made easier
4	www.programmiz.com	Website provides easy to learn study material with online compiler to learn C programming
5	www.indiastudycente.com	Online portal to study C programming
6	www.c4learn.com	Website provides easy to learn study material with online compiler to learn C programming

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

APPLIED MATHEMATICS **Course Code : 312301**

Programme Name/s	**: Architecture Assistantship/ Automobile Engineering./ Artificial Intelligence/ Agricultural Engineering/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Architecture/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Instrumentation & Control/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Instrumentation/ Interior Design & Decoration/ Interior Design/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Medical Electronics/ Production Engineering/ Electronics & Computer Engg./**
Programme Code	**: AA/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EP/ ET/ EX/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MU/ PG/ TE/**
Semester	**: Second**
Course Title	**: APPLIED MATHEMATICS**
Course Code	**: 312301**

I. RATIONALE

An Applied Mathematics course, covering integration, definite integration, differential equations, numerical methods, and probability distribution, equips engineering students with essential problem-solving tools. It enables them to model and analyze complex systems, make informed decisions and address real-world engineering challenges effectively.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Engineers applying Mathematics should proficiently solve complex real-world problems, enhancing decision-making, design and innovation with precision and efficiency.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Solve the broad-based engineering problems of integration using suitable methods.
- CO2 - Use definite integration to solve given engineering related problems.
- CO3 - Apply the concept of differential equation to find the solutions of given engineering problems.
- CO4 - Employ numerical methods to solve programme specific problems.
- CO5 - Use probability distributions to solve elementary engineering problems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

APPLIED MATHEMATICS **Course Code : 312301**

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312301	APPLIED MATHEMATICS	AMS	AEC	3	1	-	-	4	2	3	30	70	100	40	-	-	-	-	-	-	100

Total IKS Hrs for Sem. : 2 Hrs

Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment

Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination

Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Solve the given simple problem(s) based on rules of integration. TLO 1.2 Evaluate the given simple integral(s) using substitution method. TLO 1.3 Integrate given simple functions using the integration by parts. TLO 1.4 Solve the given simple integral by partial fractions.	**Unit - I Indefinite Integration** 1.1 Simple Integration: Rules of integration and integration of standard functions 1.2 Integration by substitution. 1.3 Integration by parts. 1.4 Integration by partial fractions (only linear non repeated factors at denominator of proper fraction).	Improved Lecture Demonstration Chalk-Board Presentations Video Demonstrations
2	TLO 2.1 Solve given examples based on Definite Integration. TLO 2.2 Use properties of definite integration to solve given problems.	**Unit - II Definite Integration** 2.1 Definite Integration: Definition, rules of definite integration with simple examples. 2.2 Properties of definite integral (without proof) and simple examples.	Video Simulation Chalk-Board Improved Lecture Presentations

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Find the order and degree of given differential equations. TLO 3.2 Form simple differential equation for given elementary engineering problems. TLO 3.3 Solve given differential equations using the methods of Variable separable and Exact Differential Equation(Introduce the concept of partial differential equation). TLO 3.4 Solve given Linear Differential Equation.	**Unit - III Differential Equation** 3.1 Concept of Differential Equation. 3.2 Order, degree and formation of Differential equations 3.3 Methods of solving differential equations: Variable separable form, Exact Differential Equation, Linear Differential Equation.	Video Demonstrations Presentations Chalk-Board Improved Lecture Flipped Classroom
4	TLO 4.1 Find roots of algebraic equations by using appropriate methods. TLO 4.2 Solve the system of equations in three unknowns by iterative methods. TLO 4.3 Solve problems using Bakhshali iterative method for finding approximate square root. (IKS)	**Unit - IV Numerical Methods** 4.1 Solution of algebraic equations: Bisection method, Regula falsi method and Newton –Raphson method. 4.2 Solution of simultaneous equations containing three Unknowns by iterative methods: Gauss Seidal and Jacobi's method. 4.3 Bakhshali iterative method for finding approximate square root. (IKS)	Video SCILAB Spreadsheet Chalk-Board Flipped Classroom Presentations
5	TLO 5.1 Solve given problems based on repeated trials using Binomial distribution. TLO 5.2 Solve given problems when number of trials are large and probability is very small. TLO 5.3 Utilize the concept of normal distribution to solve related engineering problems.	**Unit - V Probability Distribution** 5.1 Binomial distribution. 5.2 Poisson's distribution. 5.3 Normal distribution.	Video ORANGE Chalk-Board Improved Lecture Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Solve simple problems of Integration by substitution	1	*Integration by substitution	1	CO1
LLO 2.1 Solve integration using by parts	2	*Integration by parts	1	CO1
LLO 3.1 Solve integration by partial fractions(only linear non repeated factors at denominator of proper fraction).	3	Integration by partial fractions.	1	CO1
LLO 4.1 Solve examples on Definite Integral based on given methods.	4	Definite Integral based on given methods.	1	CO2
LLO 5.1 Solve problems on properties of definite integral.	5	*Properties of definite integral	1	CO2

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Solve given problems for finding the area under the curve and volume of revolution.	6	* #Area under the curve and volume of revolution.(Only for Civil and Mechanical Engineering Group)	1	CO2
LLO 7.1 Solve examples on mean value and root mean square value.	7	* #Mean value and root mean square value. (Only for Computer, Electrical and Electronics Engineering Group)	1	CO2
LLO 8.1 Solve examples on order, degree and formation of differential equation.	8	Order, degree and formation of differential equation.	1	CO3
LLO 9.1 Solve first order first degree differential equation using variable separable method.	9	Variable separable method.	1	CO3
LLO 10.1 Solve first order first degree differential equation using exact differential equation and linear differential equation.	10	*Exact differential equation and linear differential equation.	1	CO3
LLO 11.1 Solve engineering application problems using differential equation.	11	*Applications of differential equations.(Take programme specific problems)	1	CO3
LLO 12.1 Solve problems on Bisection method and Regula falsi method.	12	*Bisection method and Regula falsi method.	1	CO4
LLO 13.1 Solve problems on Newton-Raphson method.	13	Newton- Raphson method.	1	CO4
LLO 14.1 Solve problems on Jacobi's method and Gauss Seidal Method.	14	Jacobi's method and Gauss Seidal Method.	1	CO4
LLO 15.1 Use Bakhshali iterative methods for finding approximate value of square root. (IKS)	15	*Bakhshali iterative methods for finding approximate value of square root. (IKS)	1	CO4
LLO 16.1 Solve engineering problems using Binomial distribution.	16	*Binomial Distribution	1	CO5
LLO 17.1 Solve engineering problems using Poisson distribution.	17	*Poisson Distribution	1	CO5
LLO 18.1 Solve engineering problems using Normal distribution.	18	Normal Distribution	1	CO5
LLO 19.1 Solve problems on Laplace transform and properties of Laplace transform.	19	* # Laplace transform and properties of Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2
LLO 20.1 Solve problems on Inverse Laplace transform and properties of Inverse Laplace transform.	20	* # Inverse Laplace transform and properties of Inverse Laplace transform.(Only for Electrical and Electronics Engineering Group)	1	CO2

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING /

APPLIED MATHEMATICS **Course Code : 312301**

SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- NA

Assignment

- NA

Note :
NA

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Open-source software like wolfram alpha, SageMaths, MATHS3D, GeoGebra, Graph, DPLOT, and Graphing Calculator (Graph Eq2.13), ORANGE can be used for Algebra, Calculus, Trigonometry and Statistics respectively.	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Indefinite Integration	CO1	15	2	6	12	20
2	II	Definite Integration	CO2	8	2	4	6	12
3	III	Differential Equation	CO3	8	2	4	6	12
4	IV	Numerical Methods	CO4	6	2	4	8	14
5	V	Probability Distribution	CO5	8	2	4	6	12
Grand Total				**45**	**10**	**22**	**38**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Tests

Summative Assessment (Assessment of Learning)

- End Term Exam

XI. SUGGESTED COS - POS MATRIX FORM

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Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	3	1	-	-	1	-	1			
CO2	3	1	-	-	1	-	1			
CO3	3	2	1	1	1	1	1			
CO4	2	3	2	2	1	1	1			
CO5	2	2	1	1	2	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Grewal B. S.	Higher Engineering Mathematics	Khanna publication New Delhi, 2013 ISBN: 8174091955
2	Dutta. D	A text book of Engineering Mathematics	New age publication New Delhi, 2006 ISBN: 978- 81-224-1689-3
3	Kreysizg, Ervin	Advance Engineering Mathematics	Wiley publication New Delhi 2016 ISBN: 978-81- 265-5423-2
4	Das H.K.	Advance Engineering Mathematics	S Chand publication New Delhi 2008 ISBN: 9788121903455
5	S. S. Sastry	Introductory Methods of Numerical Analysis	PHI Learning Private Limited, New Delhi. ISBN-978-81-203-4592-8
6	C. S. Seshadri	Studies in the History of Indian Mathematics	Hindustan Book Agency (lndia) P 19 Green Park Extension New Delhi. ISBN 978-93-80250-06-9
7	Marvin L. Bittinger David J.Ellenbogen Scott A. Surgent	Calculus and Its Applications	Addison-Wesley 10th Edition ISBN-13: 978-0-321-69433-1
8	Gareth James, Daniela Witten,Trevor Hastie Robert andTibshirani	An Introduction to StatisticalLearning with Applications in R	Springer New York Heidelberg Dordrecht LondonISBN 978-1-4614-7137-0 ISBN 978-1-4614-7138-7 (eBook)

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://nptel.ac.in/courses/106102064/1	Online Learning Initiatives by IITs and IISc
2	https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaddHoPig	Concept of Mathematics through video lectures and notes
3	https://www.wolframalpha.com/	Solving mathematical problems, performing calculations, and visualizing mathematical concepts.

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Sr.No	Link / Portal	Description
4	http://www.sosmath.com/	Free resources and tutorials
5	http://mathworld.wolfram.com/	Extensive math encyclopedia with detailed explanations of mathematical concepts
6	https://www.mathsisfun.com/	Explanations and interactive lessons covering various math topics, from basic arithmetic to advanced
7	http://tutorial.math.lamar.edu/	Comprehensive set of notes and tutorials covering a wide range of mathematics topics.
8	https://www.purplemath.com/	Purplemath is a great resource for students seeking help with algebra and other foundational mathematics to improve learning.
9	https://www.brilliant.org/	Interactive learning in Mathematics
10	https://www.edx.org/	Offers a variety of courses
11	https://www.coursera.org/	Coursera offers online courses in applied mathematics from universities and institutions around the globe.
12	https://ocw.mit.edu/index.htm	The Massachusetts Institute of Technology (MIT) offers free access to course materials for a wide range of mathematical courses.

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

BASIC ELECTRONICS **Course Code : 312314**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AO/ DE/ EJ/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Second**
Course Title	**: BASIC ELECTRONICS**
Course Code	**: 312314**

I. RATIONALE

Diploma engineers must deal with the various electronic components while maintaining various electronic equipment/systems. The use of basic electronics components and handling of various electronics systems will help them troubleshoot electronics equipment used in industry or in the consumer market etc. This course is developed to empower the students to apply their knowledge to solve broad electronic engineering application problems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry identified competency through various teaching learning experiences: • Maintain electronic equipment/systems comprising of discrete electronic components.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Use relevant diode in electronics circuits.
- CO2 - Use BJT in electronics circuits .
- CO3 - Use of BJT as amplifier and switch ..
- CO4 - Use FET and MOSFET in electronics circuits..
- CO5 - Maintain DC regulated power supply.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											Total Marks
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312314	BASIC ELECTRONICS	BEL	AEC	4	-	4	-	8	4	3	30	70	100	40	50	20	25@	10	-	-	175

BASIC ELECTRONICS **Course Code : 312314**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe working principle, characteristics, and application of the given type of diode. TLO 1.2 Describe the working of given type of rectifier. TLO 1.3 Calculate ripple factor, PIV, and efficiency of the given type of filter. TLO 1.4 Describe the need and working of rectifier filter circuit.	**Unit - I Applications of Diode** 1.1 Different types of diodes and their materials: Construction, Symbol, working principle, applications, Forward and reverse biasing and V-I characteristics of following diodes: P-N junction diode, Zener diode, LED, Photo diode, Schottky diode, 1.2 Diode as rectifier: Types of Rectifiers, Half wave, Full wave (bridge rectifier and center tapped), circuit operation, Input- output waveform for voltage and current, Parameters of rectifier: Average DC value, value of current and voltage, ripple factor, ripple frequency, PIV of diode, TUF, efficiency of rectifier. 1.3 Types of Filters: Shunt capacitor, Series inductor, LC and CLC filter. 1.4 Rectifier IC – KBU 808 IC pin diagram and application .	Chalk-Board Video Demonstrations

BASIC ELECTRONICS **Course Code : 312314**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Describe the working principle of the given type of transistor. TLO 2.2 Calculate current gain for given configuration of BJT TLO 2.3 Compare configuration of transistors. TLO 2.4 Justify the need of biasing method. TLO 2.5 Describe the procedure to minimize the thermal runaway effect.	**Unit - II Bipolar Junction Transistor** 2.1 Current operating device. 2.2 Different types of transistors: PNP, NPN. 2.3 Transistor configurations: CB, CE, CC Transistor characteristics (input, and output) in different transistor configuration. Relation between alpha ,beta, gama. Comparison between CB, CC and CE. 2.4 4 BJT biasing: Need of DC load Line, Operating point, stabilization, thermal runaway, heat sink. Types of biasing: fixed biasing, base bias with emitter feedback, voltage divider.	Chalk-Board Video Demonstrations
3	TLO 3.1 Explain with sketches the working principle of the given type of amplifier. TLO 3.2 Describe working of Single Stage Transistor Amplifier. TLO 3.3 Calculate Voltage gain and bandwidth TLO 3.4 Describe working of Multistage amplifiers TLO 3.5 Describe working of BJT as a Switch	**Unit - III BJT Amplifiers** 3.1 Classification of amplifier, BJT as an amplifier. 3.2 Single Stage Amplifier: Working , various currents (Ib, Ic,Ie), Voltage gain of CE amplifier (no derivations required), Frequency response of CE amplifier. Simple numericals. 3.3 Multistage amplifiers: General Multistage BJT based amplifiers 3.4 Types of BJT amplifier coupling: Circuit diagram, operation frequency response and applications of Direct coupled, RC coupled and transformer coupled. 3.5 BJT as a Switch	Chalk-Board Video Demonstrations
4	TLO 4.1 Explain the working of given type of FET TLO 4.2 Explain the given type of FET biasing method. TLO 4.3 Describe working of FET Amplifier. TLO 4.4 Explain working of given type of MOSFET. TLO 4.5 Differentiate working principle of FET and MOSFET on the basis of the given characteristics of curve.	**Unit - IV Field Effect Transistor** 4.1 Voltage operating device, Construction of JFET (N-channel and P- channel), symbol, working principle and characteristics (Drain and Transfer characteristics) , different parameters of FET . FET applications 4.2 FET Biasing: Source self-bias, drain to source bias. 4.3 Common source FET amplifier. 4.4 MOSFET: Construction, working principle and characteristics of Enhancement and depletion MOSFET, MOSFET handling.	Chalk-Board Video Demonstrations

BASIC ELECTRONICS **Course Code : 312314**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Describe the working of the DC regulated power supply. TLO 5.2 Calculate output voltage of the given Zener voltage regulator circuit.. TLO 5.3 Describe the working of 78XX and 79XX fixed voltage IC Regulator. TLO 5.4 Describe the working of IC 723 as Low and High voltage regulator. TLO 5.5 Explain block diagram of Switch Mode Power supply.	**Unit - V Regulators and Power supply** 5.1 Need of Regulated power supply . Basic block diagram of DC regulated power supply and function of each block 5.2 Load and Line regulation. 5.3 Zener diode voltage regulator 5.4 Fixed voltage IC Regulator: Three terminal Pin diagram, working and application of 78XX and 79xx series. 5.5 Variable voltage IC Regulator : IC 723 pin diagram , block diagram, working. Low voltage regulator, High voltage regulator 5.6 Switch Mode Power supply : Need of SMPS , block diagram and functions of blocks.	Chalk-Board Site/Industry Visit

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Test PN junction Diode in forward bias. LLO 1.2 Plot the V-I characteristics of PN junction diode and determine cut in voltage. LLO 1.3 Calculate static and Dynamic resistance of diode.	1	* Test the performance of PN Junction diode	2	CO1
LLO 2.1 Test Zener Diode in reverse bias. LLO 2.2 Plot V-I characteristics of Zener Diode in reverse bias. .	2	* Test the performance of zener diode	2	CO1
LLO 3.1 Build the circuit for Photo Diode . LLO 3.2 Observe the change in current with change in light intensity of the source LLO 3.3 Plot distance VS Photo diode Current	3	* Check the performance of photo diode by varying the light intensity as well as the distance of the light source.	2	CO1
LLO 4.1 Construct the circuit for Half Wave Rectifier using PN junction Diode on. LLO 4.2 Plot Output Waveform for sinusoidal input.	4	* Construct and Test the half wave rectifier.	2	CO1
LLO 5.1 Build the circuit for Half Wave Rectifier with LC filter/ Pi filter using PN junction Diode. LLO 5.2 Obsrve and draw input & output waveforms for sinusoidal wave .	5	* Build and Test the half wave rectifier with LC filter/ π filter	2	CO1

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 6.1 Prepare the circuit for Full Wave Centre Tapped Rectifier using PN junction Diode. LLO 6.2 Observe and draw input & output waveform for sinusoidal wave.	6	* Prepare and Test the full wave rectifier using two diodes.	2	CO1
LLO 7.1 Build the circuit for Full Wave Bridge Rectifier using PN junction Diode LLO 7.2 Observe and draw input & output waveform for sinusoidal wave.	7	* Build and Test the full wave Bridge rectifier on bread board using two diodes.	2	CO1
LLO 8.1 Build the circuit for Full Wave Rectifier using PN junction Diode with LC/Pi filter. LLO 8.2 Calculate ripple factor for given setup.	8	* Use LC/ π filter with full wave rectifier to measure ripple factor	2	CO1
LLO 9.1 Construct the circuit for full wave rectifier using IC KBU 808 with filter LLO 9.2 Observe and draw input & output waveform for sinusoidal wave.	9	* Construct and Test the full wave rectifier on bread board using IC KBU 808 with filter.	2	CO1
LLO 10.1 Build the circuit for 7 Segment LED display FND 507/508. LLO 10.2 Observe numeric output for 0-9	10	Bulid and Test the performance parameters of 7 Segment LED display FND 507/508.	2	CO1
LLO 11.1 Identify the terminals of the PNP and NPN transistor for TO-5, TO-220, TO-66 LLO 11.2 Select of transistor for different max. voltage, current and switching speed	11	* Identify and select transistors using datasheets	2	CO2
LLO 12.1 Build the circuit for BJT in common base configuration. LLO 12.2 Plot input and output characteristics of common base configuration.	12	Build and Test the performance of BJT working in CB mode.	2	CO2
LLO 13.1 Select the specific transistor for different max. voltage, current and switchingspeed LLO 13.2 Prepare the circuit for BJT in common emitter configuration.	13	* Prepare and Test the performance of BJT working in CE mode	2	CO2
LLO 14.1 Build the circuit for BJT voltage divider bias circuit. LLO 14.2 Locate Q point on Load line.	14	* Build and Test the BJT voltage divider bias circuit for given input	2	CO2
LLO 15.1 Test the performance parameters of BJT as Switch LLO 15.2 Identify Cutoff and saturation regions	15	* Construct and Test the performance parameters of BJT as Switch.	2	CO2

BASIC ELECTRONICS **Course Code : 312314**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Build single stage Common emitter amplifier. LLO 16.2 Plot frequency response for Common emitter amplifier.	16	* Build and Test the performance of single stage Low Power Common emitter amplifier	2	CO3
LLO 17.1 Build the circuit for BJT common emitter (CE) amplifier using simulation software (like SPICE/Multisim) LLO 17.2 Plot Output Waveform for sinusoidal input. LLO 17.3 Plot frequncy response curve .	17	Simulate and Test output waveform and frequency response of single stage common emitter (CE) amplifier using simulation software (like SPICE / Multisim)	2	CO3
LLO 18.1 Build the circuit for BJT two stage RC coupled common emitter (CE) amplifier. LLO 18.2 Plot frequency response	18	* Build and Test the performance of RC coupled two stage amplifier.	2	CO3
LLO 19.1 Build the circuit for FET in common source configuration. LLO 19.2 Plot characteristics for drain to source voltage VDS verses drain current ID for different Values of VGS	19	* Test the performance of FET drain characteristics	2	CO4
LLO 20.1 Build the circuit for FET in common source configuration. LLO 20.2 Plot characteristics for Gate to source voltage VGS verses drain current ID LLO 20.3 Calculate transconductance.	20	* Check the performance of FET transfer characteristics and calculate transconductance	2	CO4
LLO 21.1 Build the circuit for FET in common source configuration. LLO 21.2 Plot characteristics for Gate to source voltage VGS verses drain current ID	21	* Build and Test the performance of common source FET amplifier	2	CO4
LLO 22.1 Test the voltages &waveforms at various Test points of regulated dc power supply.	22	Test the various blocks of regulated dc power supply.	2	CO5
LLO 23.1 Identify the various faults in the Regulated DC power supply.	23	* Find out faults at different stages of regulated dc power supply.	2	CO5
LLO 24.1 Rectify the various faults in the Regulated DC power supply	24	* Trouble shoot given DC regulated power supply.	2	CO5
LLO 25.1 Construct Zener voltage regulator for given voltage. LLO 25.2 Calculate load and line regulation.	25	Construct and test the performance of Zener voltage regulator for given voltage.	2	CO5
LLO 26.1 Build the circuit for Positive voltage regulator using 78XX IC. LLO 26.2 Calculate load and line regulation.	26	* Build and Test the performance of Positive voltage regulator using 78XX , three terminal IC for given voltage.	2	CO5

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 27.1 Build the circuit for Negative voltage regulator using 78XX IC. LLO 27.2 Calculate load and line regulation.	27	Build and Test the performance of Negative voltage regulator using 79XX, three terminal IC for given voltage.	2	CO5
LLO 28.1 Construct the circuit for Dual voltage regulator using 78XX and 79XX IC. LLO 28.2 Calculate load and Line regulation.	28	* Construct and test the performance of Dual voltage regulator using 78XX and 79XX ,three terminal IC for given voltage	2	CO5
LLO 29.1 Build LOW voltage regulator circuit using IC LM723 (2V-7V). LLO 29.2 Calculate load and line regulation.	29	* Build and Test the performance of LOW voltage regulator using IC LM723 for given voltage.(2 V-7V)	2	CO5
LLO 30.1 Build High voltage regulator circuit using IC LM723 (7V-30V) LLO 30.2 Calculate load and line regulation.	30	Build and Test the performance of HIGH voltage regulator using IC LM723 for given voltage.(7V-30V)	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Build Audio amplifier using BJT.
- Build the circuit for 3v battery charger.
- Build Clap switch Using transistor.
- Build audio amplifier using IC LM386.
- Build power supply using LM317.
- Prepare a chart of different types of Rectifiers showing their specifications and applications

Assignment

- Study working of OLED display.
- study of different Audio amplifier ICs (min 4).
- Study working of MOSFET as variable capacitor.
- select specific FET and Study datasheet for same.

Note :
A suggestive list of micro-projects and assignment is given here. Similar micro-projects could be added by the concerned faculty.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

BASIC ELECTRONICS **Course Code : 312314**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Analog multimeter& Digital multimeter	All
2	CRO 20/30/100 MHz Frequency Dual Channel External Trigger CT mode facility or any other better specifications	4,5,6,7,8,9,16,22,18
3	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude	4,5,6,7,8,9,16,22,18
4	Different types of cables and connectors	All
5	Variable DC Power supply 0-30V with display for voltage and current, 2Amp SC protection	1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,19,20,22,23,24
6	LT Spice /Lab view/H Spice /P Spice /HS Spice / Multisim/ Proteus/Octeva or any other relevant open source software	17
7	DSO 30/50/100 MHz Frequency Digital read out USB interface	4,5,6,7,8,9,16,22
8	Computer System with advanced Configuration Hardware requirement as per selected software	17

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Applications of Diode	CO1	12	4	4	6	14
2	II	Bipolar Junction Transistor	CO2	12	4	4	6	14
3	III	BJT Amplifiers	CO3	14	4	6	6	16
4	IV	Field Effect Transistor	CO4	12	4	6	4	14
5	V	Regulators and Power supply	CO5	10	4	4	4	12
Grand Total				**60**	**20**	**24**	**26**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Progrssive test ,Assignment, Microproject , Termwork
- Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product
- Continuous assessment based on process and product related performance indicators, laboratory experience.

Summative Assessment (Assessment of Learning)

- End of Term Examination, Laboratory performance.

XI. SUGGESTED COS - POS MATRIX FORM

BASIC ELECTRONICS **Course Code : 312314**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	1	1	1	1			
CO2	2	2	1	1	1	1	1			
CO3	2	2	1	1	1	1	1			
CO4	2	2	1	1	1	1	1			
CO5	2	2	2	1	2	2	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Mehta, V.K. Mehta, Rohit Mehta	Principles of Electronics	S.Chand New Delhi, edition-2008 ISBN-13: 978- 8121927833
2	Sedha, R.S.	A Text book of Applied Electronics	S.Chand (G/L) & Company Ltd; ISBN-13 978-8121904209
3	P.Ramesh Babu	Electronics Device and Circuits	Scitech Publications (India) Pvt Ltd ,ISBN-13 978-8183712156
4	Theraja B.L. (Author), Sedha R.S. (Author)	Principles of Electronic Devices and Circuits (Analog and Digital)	S Chand & Company,ISBN-13 978-8121921992
5	B.L.Theraja	Basic Electronics (solid State)	S Chand;ISBN-13 978-8121925556
6	Albert P. Malvino, David J. Bates	Electronic Principles	McGraw Hill; ISBN-13 978-9354602399
7	D. P. Kothari , I. J. Nagrath	Basic Electronics	McGraw Hill Education,ISBN-13 978-9352606467
8	Roberrt L.Boylestead	Electronics Circuit and Circuit theory	Pearson Education India, ISBN-13 978-9332542600

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://nptel.ac.in/courses/122106025	Basic Electronics and Lab, IIT Madras Prof. T.S. Natarajan
2	https://archive.nptel.ac.in/courses/108/101/108101091/	Basic Electronics, IIT Bombay
3	4. https://learn.sparkfun.com/tutorials/transistors	Transistor basics
4	https://www.multisim.com/	online multisim live software/ free student evalution software download for limited time
5	https://alternativeto.net/software/multisim/	alernative softwares to multisim
6	https://www.labcenter.com/	demo version of Proteus software
7	https://learn.sparkfun.com/tutorials/transistors	Simulation

BASIC ELECTRONICS **Course Code : 312314**

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Instrumentation & Control/ Industrial Electronics/ Instrumentation/ Medical Electronics/ Electronics & Computer Engg.**
Programme Code	**: AO/ DE/ EJ/ ET/ EX/ IC/ IE/ IS/ MU/ TE**
Semester	**: Second**
Course Title	**: ELEMENTS OF ELECTRICAL ENGINEERING**
Course Code	**: 312315**

I. RATIONALE

A technical person has to deal with the various electrical machines, equipment, and protective devices. In order to increase the technical proficiency, a technician should possess essential knowledge of electrical engineering parameters, basic concepts, and laws of electrical engineering.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use electrical equipment efficiently for different electronic engineering application.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Interpret the magnetic field parameters for the particular magnetic circuits.
- CO2 - Analyze A.C. circuits for single phase and polyphase supply.
- CO3 - Select the transformer and DC motor for the given application.
- CO4 - Select the fractional horse power motor for the given application.
- CO5 - Choose the protective devices for the electrical protection.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical							
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312315	ELEMENTS OF ELECTRICAL ENGINEERING	EEE	SEC	3	-	2	1	6	3	3	30	70	100	40	25	10	25@	10	25	10	175

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the terms related to Magnetic circuit. TLO 1.2 Distinguish between electric and magnetic circuit. TLO 1.3 Interpret magneto motive force in series and parallel magnetic circuit. TLO 1.4 Describe laws related to magnetic circuit. TLO 1.5 Classify the types of induced electromotive force	**Unit - I Magnetic circuits** 1.1 Define and state units of Magnetic flux, Flux density, Magnetomotive force, Magnetic field strength, Permeability. 1.2 Electric circuit and magnetic circuit analogy and differences. 1.3 Series and parallel magnetic circuit. 1.4 Faraday's laws of electro-magnetic induction, Lenz's law, Fleming right hand and left hand rule. 1.5 Dynamically and statically induced emf, self and mutual induced Electromotive force and its inductances.	Presentations Chalk-Board Video Demonstrations Model Demonstration

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Compare AC quantities with DC quantities. TLO 2.2 Describe terminology related to A.C. fundamentals. TLO 2.3 Describe different forms of representation for electrical quantity. TLO 2.4 Analyze A.C. circuits for different types of load. TLO 2.5 Explain generation of three phase induced emf. TLO 2.6 Analyze three phase circuit for star and delta connection.	**Unit - II A.C fundamentals for single phase and polyphase circuits** 2.1 Define A.C. and D.C. quantities, advantages of A.C over DC. 2.2 Single phase sinusoidal A.C. wave: instantaneous value, cycle, amplitude, time period, frequency, angular frequency, R.M.S. value, average value for sinusoidal waveform. 2.3 Vector, polar and complex forms representation of an ac quantity, phase angle, phase difference concept of lagging and leading. 2.4 A.C through pure resistance, inductance and capacitance. Its equation, vector diagram and waveform. 2.5 Define polyphase system and advantages of three phase system over single phase system. 2.6 Generation of three phase induced emf and its waveform. 2.7 Phase and line currents, phase and line voltages in star connected and delta connected balanced load system.	Video Demonstrations Presentations Chalk-Board
3	TLO 3.1 Explain construction and working principle of given type of transformer. TLO 3.2 Select different types of transformer for the particular application. TLO 3.3 Describe construction and the working of DC motor. TLO 3.4 Select the type of DC motor for given application.	**Unit - III Transformers and DC motors** 3.1 Transformer construction and working principle, emf equation, voltage ratio, transformation ratio. 3.2 Auto-transformer, Pulse transformer and Isolation transformer construction, working principle and applications. 3.3 DC motor construction and working principle. 3.4 Different types of DC motors with its schematic diagram. 3.5 Applications of DC motors.	Chalk-Board Model Demonstration Video Demonstrations Presentations
4	TLO 4.1 Explain the construction and working principle of the given type of FHP motor. TLO 4.2 Select relevant FHP motor for the respective application TLO 4.3 Describe the procedure to connect given motor for the given application.	**Unit - IV Fractional horse power motors** 4.1 Construction, working principle and application of split phase single phase AC induction motors. 4.2 Construction, working principle and application of universal motor and reversal of direction of rotation. 4.3 Construction, working principle and application of stepper motor. Only concept of speed control, stepper motor's reversal of direction of rotation 4.4 Construction, working principle, specification and application of linear induction motor	Model Demonstration Presentations Chalk-Board Flipped Classroom

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 Explain general safety rule of electrical system. TLO 5.2 Explain and select the different types of protective devices. TLO 5.3 Draw circuit connection diagram of protective devices. TLO 5.4 Describe earthing system and related terms.	**Unit - V Electrical protective devices** 5.1 Electrical general safety rules, Personal Protective Equipment (PPE), Selection of wires and cable as per application. 5.2 Type of fuses, operation, connection diagram and application of fuses, Miniature Circuit Breaker(MCB), Moulded Case Circuit Breaker (MCCB), Earth Leakage Circuit Breaker(ELCB)operation, connection diagram and general specification 5.3 Draw circuit connection diagram of Protective devices. 5.4 Need of Earthing, methods of earthing, types of earthing and factors affecting earthing as per Indian Electricity rule.	Model Demonstration Video Demonstrations Presentations Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Use Faraday's law of electro-magnetic induction. LLO 1.2 Classify types of induced emf.	1	*Demonstration of Faraday's law of electro-magnetic induction for statically and dynamically induced emf.	2	CO1
LLO 2.1 Use Faraday's law of electro-magnetic induction. LLO 2.2 Observe mutual induced emf in transformer.	2	*Demonstration of Mutually induced EMF by using single-phase transformers.	2	CO1
LLO 3.1 Use cathode ray oscilloscope. LLO 3.2 Identify different parameters on CRO.	3	*Measure frequency, Time period, Peak value, RMS value of sinusoidal AC waveform using CRO.	2	CO2
LLO 4.1 Identify phase angle and phase difference of given quantities. LLO 4.2 Identify the nature of power factor for the respective circuit.	4	Observe the phase difference between voltage and current on CRO for resistive, inductive, and capacitive load and comment on the nature of the power factor (Lagging, Leading, Unity).	2	CO2
LLO 5.1 Connect star connected three phase load. LLO 5.2 verify relationship between line and phase quantities.	5	*Connect three phase star connected balanced load and verify the relationship between line voltage and phase voltage, line current and phase current.	2	CO2
LLO 6.1 Connect delta connected three phase load. LLO 6.2 verify relationship between line and phase quantities.	6	Connect three phase delta connected balanced load and verify the relationship between line voltage and phase voltage, line current and phase current.	2	CO2

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 7.1 Calculate transformation ratio of transformer. LLO 7.2 Connect transformer to given load.	7	*Determine the transformation ratio current ratio of single phase transformer.	2	CO3
LLO 8.1 Identify pin configuration of pulse transformer. LLO 8.2 Check electrical isolation between input and output of pulse transformer.	8	Demonstration of working of pulse transformer by observing input pulse and output pulse of pulse transformer on CRO.	2	CO3
LLO 9.1 Identify different parts DC motor. LLO 9.2 Identify different types of DC motor.	9	Identify different types of DC motor by observing terminal connections and also identify different parts of DC motor.	2	CO3
LLO 10.1 Connect DC motor to DC supply. LLO 10.2 Select particular starter for particular motor starting.	10	*Start any DC motor using corresponding starter and observe speed on tachometer.	2	CO3
LLO 11.1 Connect single phase induction motor to the supply. LLO 11.2 Change the direction of rotation of single phase induction.	11	*Start single phase induction motor and reverse the direction of rotation of it.	2	CO4
LLO 12.1 Connect the universal motor to the supply. LLO 12.2 Change the direction of rotation of universal motor.	12	Start universal motor and reverse the direction of rotation of it.	2	CO4
LLO 13.1 Connect the linear induction motor to the supply. LLO 13.2 Observe linear motion of induction motor.	13	Identify different parts of linear induction motor and start it.	2	CO4
LLO 14.1 Select fuse for particular application. LLO 14.2 Select circuit breaker for particular application.	14	*Identify different types of fuses and circuit breakers. State their specification for suitable application.	2	CO5
LLO 15.1 Explain connection of earthing for domestics application. LLO 15.2 Test available of earthing for given switch board.	15	Testing of earthing using a test lamp and comment on it.	2	CO5

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- 1) Search the different types of applications in which a transformer is required and prepare a report on it.

2) Prepare a report on different types of applications of single-phase motors. State the types of motors with their particular applications.
3) Prepare a PowerPoint presentation or animation to show the working of the DC motor.
4) Observe the different types of switchgear used at home and write a report on their types, ratings and applications.

To build a simple electrical circuit

- 1) Construct a closed circuit using,

one dry cell battery, one small light bulb holder, one small light bulb, small wire stripper tape (scotch, masking, or electrical)
Answer the following questions:
a) What is the difference between an open and a closed circuit?
b) What is voltage?
c) How many connections to the battery are necessary for the light bulb to light up?
2) Prepare a switchboard to control one lamp, one socket with protection and indication.

Micro project

- **1) Magnetic circuits**: Collect the information for different types of magnetic materials and draw a B-H curve for the respective material.

2) A.C. Fundamentals: Visit a nearby industry and observe the different parameters such as frequency, voltage, current, power and prepare a report based on it.
3) Polyphase circuits: Observe the three-phase power distribution panel in their institute and prepare a report on it.
4) Transformer: Collect information regarding different types of transformers available in the laboratory and prepare a report on it.
5) Fractional horsepower motor: Visit the local market or use the internet and prepare a report based on i) Manufacturers ii) Technical specifications iii) Earthing arrangement iv)Price range.
6) Visit your institute workshop and prepare a report on the different types of machines used, their specifications and manufacturers, different types of motors used.

Note :

A suggestive list of micro project , assignment and industrial visit is given here. Similar activities could be added by the course teacher . For this course 1 hr per week is allocated for SL (Self Learning) in learning scheme. By considering 15 hr self learning work course teacher has to allocate one or two task may be combination of assignments and / or micro projects and / or Industrial visit. Microproject is expected to complete as a group activity. Course teacher can assign specific learning or any other skill development task . According to task assign , course teacher can set rubrics for continuous (formative) type assessment. SLA marks shall be awarded as per continuous assessment record.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Single Phase 230/115 V, 50Hz, 1 or 5 kVA Transformer	2,7
2	Single Phase 0-270V, 50Hz, 10A Auto-transformer	2,7,11
3	Cathode Ray Oscilloscope (CRO) 20MHz, Dual channel	3,4,8
4	Single phase 230V, 10A Resistive Load bank	4,5,6
5	Single phase 230V, 50Hz, 2A Inductive Load bank	4
6	Single phase 230V, 50Hz, 2A Capacitive Load bank	4
7	Pulse transformer 1:1:1 4503 or 1:1 4502	8
8	Different types of DC motor	9,10
9	Single phase 230V, 50Hz, 1Hp Induction motor	11
10	Single phase 230V, 50Hz, 1/4Hp Universal motor	12
11	Single or three phase linear induction motor	13

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Magnetic circuits	CO1	8	4	4	4	12
2	II	A.C fundamentals for single phase and polyphase circuits	CO2	11	4	6	8	18
3	III	Transformers and DC motors	CO3	8	6	4	4	14
4	IV	Fractional horse power motors	CO4	10	4	4	6	14
5	V	Electrical protective devices	CO5	8	4	4	4	12
Grand Total				**45**	**22**	**22**	**26**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product Continuous assessment based on process and product related performance indicators, laboratory experience.

Summative Assessment (Assessment of Learning)

- End of semester exam based on observations and recording of the particular experiments

XI. SUGGESTED COS - POS MATRIX FORM

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	3	3	1	2	-	2			
CO2	2	3	2	-	2	3	2			
CO3	3	2	3	2	2	-	2			
CO4	2	2	3	3	2	2	2			
CO5	3	3	2	2	3	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Theraja B.L.	Electrical Technology Vol-I	S.Chand and Co., new Delhi, ISBN:9788121924405
2	Theraja B.L.	Electrical Technology Vol-II	S.Chand and Co., new Delhi, ISBN:9788121924375
3	V. N. Mittle and Arvind Mittal	Basic Electrical Engineering	McGraw Hill, New Delhi, ISBN:978-0070593572
4	U.A.Bakshi	Basic Electrical Engineering	Technical Publications, ISBN:9789333220392
5	DP Kothari and I J Nagrath	Basic Electrical Engineering	Mc Graw Hill, New Delhi, ISBN: 978-9353165727
6	J.B. Gupta	A Course in Electrical Installation Estimating & Costing	S.K. Kataria & Sons, ISBN: 978-93-5014-279-0
7	K. B. Raina and S. K. Bhattacharya	Electrical design, estimation and costing, Second edition	New age international limited publisher, New Delhi, ISBN:978-8122443585

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://nptel.ac.in/courses/108105112	NPTEL study materials
2	https://www.electrical4U.com	All about electrical circuits
3	https://instrumentationtools.com/category/electrical-animation/	Animation of basic electrical engineering quantities
4	https://www.udemy.com/course/crash-course-electric-circuits-for-electrical-engineering/	Flip classroom learning material
5	http://www.ece.umn.edu/users/riaz/animations/listanimations.html	Animation of electrical machines

ELEMENTS OF ELECTRICAL ENGINEERING **Course Code : 312315**

Sr.No	Link / Portal	Description
6	https://www.services.bis.gov.in/php/BIS_2.0/bisconnect/get_is_list_by_category_id/5	IS standard

MSBTE Approval Dt. 29/11/2023 **Semester - 2, K Scheme**

ELECTRONIC MATERIALS & COMPONENTS **Course Code : 312316**

Programme Name/s	**: Digital Electronics/ Electronics & Tele-communication Engg./ Electronics & Communication Engg./ Electronics Engineering/ Industrial Electronics/ Medical Electronics**
Programme Code	**: DE/ EJ/ ET/ EX/ IE/ MU**
Semester	**: Second**
Course Title	**: ELECTRONIC MATERIALS & COMPONENTS**
Course Code	**: 312316**

I. RATIONALE

This course is intended to help the students of Diploma Engineering to get idea of various Electronic Materials and Components employed in electronic industries. It will make the students familiar with the suitability of various electronic materials and components for different applications. This course is intended to develop skills of testing components that will be needed for the project and setting up of many experiments in basic and applied technology courses.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified outcome through various teaching learning experiences: Use of various Electronic Materials and Components for relevant electronic applications

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify the relevant material for the Electronic Applications.
- CO2 - Suggest relevant electronic component(s) for the given application.
- CO3 - Identify the Surface Mount Devices for specific applications.
- CO4 - Develop the PCB for the given application.
- CO5 - Use specific components for roof top Solar Energy Systems

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
312316	ELECTRONIC MATERIALS & COMPONENTS	EMC	DSC	3	-	2	1	6	3	1.5	30	70*#	100	40	25	10	-	-	25	10	150

ELECTRONIC MATERIALS & COMPONENTS **Course Code : 312316**

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 15 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain the effect of the given factor on the resistivity of electrical material. TLO 1.2 Describe the characteristics of the given semiconductor material. TLO 1.3 Describe the properties of the given Photo emissive material. TLO 1.4 Explain the phenomenon of dielectric material. TLO 1.5 Select the dielectric material for the given application. TLO 1.6 Classify the magnetic material on the basis of given magnetic properties.	**Unit - I Electronic Materials** 1.1 Factors affecting the resistivity of material like temperature, area of cross-section, length (or distance) of the element. 1.2 Semiconductor materials: Intrinsic, extrinsic, charge carriers, P type and N Type, applications 1.3 Photo emissive materials: Properties, applications 1.4 Dielectric Materials: Types, Properties, Effect of frequency on performance of dielectric materials 1.5 Magnetic Materials: Properties, classification: Permanent magnetic dipole, diamagnetism, paramagnetism, ferromagnetism. 1.6 Soldering materials: Alloys and fluxes.	Chalk-Board Video Demonstrations Hands-on

ELECTRONIC MATERIALS & COMPONENTS **Course Code : 312316**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
2	TLO 2.1 Describe the property of passive component for the given parameter. TLO 2.2 Classify the active components TLO 2.3 Suggest the relevant combination of materials for the LED of the given color TLO 2.4 Describe the given type of IC and its package. TLO 2.5 Differentiate between the given types of ICs. TLO 2.6 Identify the relevant micro devices for the given application/s	**Unit - II Electronic Components** 2.1 Passive Components: Concepts of Resistance, Capacitance , Inductance . Specifications, type and applications Voltage Dependent Resistor(VDR), Temperature Dependent Resistor(TDR), Light Dependent Resistor(LDR). 2.2 Electronic Materials and doping level for PN junction diode, Zener diode, LEDs, PNP and NPN transistor, 2.3 Construction, working principle and applications of OLED 2.4 Integrated Circuit: Introduction to Monolithic IC, thick & thin film IC, Hybrid IC, Linear IC, Digital IC and IC packages (SIP, TO5, Flat, DIP), Pin , Device Identification, Temperature ranges. 2.5 Types and applications of micro electronic components: Micro motors, Micro relay, Micro switches	Chalk-Board Hands-on Model Demonstration Video Demonstrations
3	TLO 3.1 Explain SMT and SMD. TLO 3.2 Describe the steps involved in the assembly technique in the SMT. TLO 3.3 Differentiate between the given type of the soldering/desoldering in SMT. TLO 3.4 Identify the need of SMT with respect to its advantages. TLO 3.5 Classify the SMD packages with respect to the given type of components.	**Unit - III Surface Mount Devices** 3.1 Introduction to Surface Mount Technology(SMT) and Surface mount Devices (SMD). 3.2 Assembly and rework techniques: Contact and noncontact types of soldering and de-soldering 3.3 Advantages and Disadvantages of SMT 3.4 SMD packages : Two terminal package for passive and active components, Three or four terminal packages, five or six terminal packages, More than six terminal packages; Examples of each 3.5 Automatic component insertion technique	Chalk-Board Model Demonstration Video Demonstrations Hands-on
4	TLO 4.1 Describe the constructional features of the given type of PCB. TLO 4.2 Compare the constructional features of the given type of PCB. TLO 4.3 Identify the types of the PCB with respect to applications. TLO 4.4 Describe the given method of PCB printing. TLO 4.5 Describe Electronic Waste Management.	**Unit - IV Printed Circuit Board** 4.1 Introduction to PCB, Advantages, disadvantages of PCB, Types of PCB and applications 4.2 Constructional features of PCB 4.3 Flexible PCB, Multilayer PCB, plated through hole (PTH) 4.4 Screen printing, photo-printing methods 4.5 Soldering Techniques: Dip, wave.reflow 4.6 PCB testing 4.7 Need of Electronic waste management , E-Waste Recycling,	Chalk-Board Model Demonstration Video Demonstrations Hands-on

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Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
5	TLO 5.1 State the basic principle of Photovoltaic Cell for the given application TLO 5.2 Illustrate construction of solar panel. TLO 5.3 List the different types of solar energy storage system for the given specifications TLO 5.4 Explain use of battery bank for solar power system . TLO 5.5 Choose the suitable battery for a solar energy system.	**Unit - V Solar system components** 5.1 Photovoltaic materials ,properties and applications 5.2 Solar Cell: Working Principle and Construction 5.3 Materials used in a Solar Panel 5.4 Energy storage system used in solar panel, its ratings and selection factors 5.5 Terminologies used in energy storage system like capacity, power ratings, depth of discharge (DoD), round-trip efficiency, warranty and life span	Chalk-Board Model Demonstration Video Demonstrations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Determine resistivity for a given length of wire keeping area constant	1	Determination of resistivity	2	CO1
LLO 2.1 Use photo electric cell to study I-V characteristics .	2	*Determination of photoelectric cell characteristics	2	CO1
LLO 3.1 Plot the charging and discharging curve of two different capacitors each having different dielectric material	3	Charging and discharging curve of two different capacitors	2	CO1
LLO 4.1 Identify various active and passive components in the given circuit.	4	*Identification of various electronic components in the given circuit.	2	CO2
LLO 5.1 Test the performance of Light Dependent Resistor (LDR) as a dark sensor	5	*LDR as a Dark Sensor	2	CO2
LLO 6.1 Plot reverse bias characteristic of Photo-diode for different intensity of incident light on it.	6	Reverse Bias Characteristic of Photo-Diode	2	CO2
LLO 7.1 Test the identified analog IC’s, digital IC’s.	7	Testing of different IC	2	CO2
LLO 8.1 Determine SMD component value (Resistor, Capacitor and Inductor) using their nomenclature.	8	*Determination of SMD component value	2	CO3
LLO 9.1 Soldering of Surface Mounted Devices (SMD).	9	Soldering of SMD	2	CO3
LLO 10.1 Identify given SMD according to package type.	10	*Identification of given SMD	2	CO3
LLO 11.1 Test any small electronic circuit/system assembled on general purpose PCB and test it.	11	*Test any small electronic circuit/system	2	CO4
LLO 12.1 Use of open source PCB design simulation software and tools like eagle, Kicad, PCB, Dip trace, DesignSparkPCB	12	*Use of open source PCB design simulation software and tools.	2	CO4
LLO 13.1 Identification of types of PCB.	13	Identify types of PCB.	2	CO4

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 14.1 Plot V-I Characteristics of the solar cell.	14	*Characteristics of the solar cell.	2	CO5
LLO 15.1 Use a Solar Panel (Small panel approx- 4.5 V output) to drive any small load	15	Use of Solar Panel) to drive any small load	2	CO5
LLO 16.1 Measure voltage and current by connecting three batteries first in series and then parallel each having rating of 6V,2A	16	Voltage and current measurement using series and parallel connection of batteries	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Record values of different parameters (Direction, tilt angle, distance between pedestal, connection of solar panel)during installation of a solar panel by watching animation video
- Collect resistors of different values and make a chart for the specification and application of the same.
- Collect different samples of conducting material and prepare chart of their applications.
- Collect capacitors of different values and make a chart for the specification and application of the same.
- Test half wave rectifier circuit assembled on bread board
- Collect samples of zero PCB , blank PCB and general-purpose PCB
- Describe the solar panel installation process for residential purpose

Industrial Visit

- Visit any electronic industry note all the industry policies , work schedules latest trends and technology used in the industry .
- Visit any electronic manufacturing process industry observe all the operations, workstations, plants, machines, assembly lines, and management of industry and meet experienced professionals,make industrial visit report.
- Visit any electronic manufacturing process industry,watch all the processes and make industrial visit report.
- Visit a place where the solar panel is installed and note all specification of installation

Assignment

- Compare single-sided and double-sided PCB on the basis of different base.
- Make a chart showing a comparative study of commonly used cables in the lab.
- Explain with flow diagram the IC fabrication process
- Compare simple and SMD resistors
- Compare simple and SMD capacitors
- Describe how solar panel is made using solar cells

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Note :

-Note : A suggestive list of micro project , assignment and industrial visit is given here. Similar activities could be added by the course teacher . For this course 1 hr per week are allocated for SL (Self Learning) in learning scheme. By considering 15 hr self learning work course teacher has to allocate one or two task may be combination of assignments and / or micro projects and / or Industrial visit. Microproject is expected to complete as a group activity. Course teacher can assign specific learning or any other skill development task . According to task assign , course teacher can set rubrics for continuous (formative) type assessment. SLA marks shall be awarded as per continuous assessment record.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Voltmeter - 0-10V, Ammeter 0-1A, Battery 0-12V, metal wire- 40cm,50cm,60cm,70cm,80cm,90cm or as available, Resistance Box: 4 decade ranges from 1 ohm to 1K,accuracy 0.1 % - 1 %	1
2	Variable power supply 0-12V,500mA Microammeter 0-100µA Voltmeter/Multimeter 0 to 10V Photoelectric cell setup	2
3	Resistor, Capacitor, Voltmeter/Multimeter, Ammeter/Multimeter, Power Supply, Stop watch, Switch	3
4	Different passive components like resistors, capacitors, inductors, potentiometer, preset. Different active components like pn junction diode, Zener diode, LED, Transistor, FET, UJT	4
5	LDR ,LED, 1K ohm Resistor ,50K ohm Resistor ,BC547– BJT ,9V battery ,Breadboard	5
6	Photo-diode, voltmeter (0-10volt), microammeter, variable DC source(0-20 volt),wires/leads, resistor	6
7	IC tester, TTL IC's, CMOS IC's	7
8	Different values of SMD resistor, SMD capacitor and SMD Inductor	8
9	Soldering iron with soldering station(use 15,18 W iron), 63/27 flux cord solder wire, surface mounted components, magnifying glass	9
10	SMD of different packages like transistor SOT23 pack, transistor SOT89 Pack, IC SO8 Pack, IC SO14 pack	10
11	General purpose PCB, soldering iron, flux, soldering material, electronic circuit/system components, wire	11
12	Any Open source PCB design simulation software like eagle, Kicad, PCB, Dip trace, DesignSparkPCB, PC installed with software	12
13	Samples of given or any other smaller size of : 3X2 inches Phenolic Single Sided Plain Copper Clad Board (PCB), 5x7 cm Double Sided Universal PCB Prototype Board, 5x7cm Single Side Prototype Board, Flexible PCB,	13
14	A solar panel, a voltmeter, a micro-ammeter, a variable resistor and a 100 W lamp.	14
15	Solar panel (output 4.5V) cell and any load that it can drive	15
16	Solar Cells Potentiometer Voltage Meter Current Meter	16

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Electronic Materials	CO1	10	4	4	8	16
2	II	Electronic Components	CO2	12	6	4	8	18

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Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
3	III	Surface Mount Devices	CO3	7	4	4	4	12
4	IV	Printed Circuit Board	CO4	8	4	4	4	12
5	V	Solar system components	CO5	8	4	4	4	12
Grand Total				**45**	**22**	**20**	**28**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- For laboratory learning 25 marks
- Each practical will be assessed considering - - 60% weightage to process and - 40% weightage to product
- Two formative assessment t tests of MCQ type for 30 marks and average of two unit tests.

Summative Assessment (Assessment of Learning)

- End semester assessment of 25 marks for laboratory learning
- End semester assessment of 70 marks

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	-	-	1	2			
CO2	2	2	2	2	2	1	2			
CO3	2	2	2	2	1	1	2			
CO4	2	2	2	2	2	1	2			
CO5	2	2	2	2	2	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Milton Kaufman , Arthur H. Seidman , Perry J Sheneman	Handbook for Electronics Engineering Technicians Hardcover	McGraw-Hill ,SBN-13 978-0070334083
2	Charles A. Harper	Electronic Assembly Fabrication: Chips, Circuit Boards, Packages, and Components (ELECTRONICS)	McGraw-Hill Professional ,SBN-13 978-0071378826
3	Rathore	Fundamentals Of Renewable Energy Sources	Himanshu Publications: eISBN no.9781003245643

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Sr.No	Author	Title	Publisher with ISBN Number
4	Walter ,Bosshart	Printed Circuit Boards	Tata McGraw Hill ISBN-13 978-0074515495
5	Grover & Jamwal	Electronic Components and Materials	Dhanpat Rai & Sons, ISBN-13 5551234023845
6	Dhir S M	Electronic Components and Materials	Tata McGraw Hill ISBN: 9780074630822
7	Madhuri Joshi	Electronic Components and Materials	Shroff Publishers & Distributors private ltd. ISBN-13: 978-8173669002

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.electronics-tutorials.ws/resistor/res_1.html	Resistors
2	https://www.greenmatch.co.uk/blog/2014/12/how-are-solar-panels-made	Solar panels
3	https://www.britannica.com/technology/integrated-circuit/Fabricating-ICs	IC fabrication
4	https://resources.pcb.cadence.com/blog/2023-ic-fabrication-process-flow-chart	IC fabrication process
5	https://en.wikipedia.org/wiki/Electronic_component	Different electronic components
6	https://www.seeedstudio.com/blog/2017/12/28/difference-between-smt-and-smd/	SMT and SMD
7	https://www.literoflightusa.org/how-are-solar-panels-made/	Solar cell and solar panel
8	https://www.google.com/search?q=practicle+on+solar+cell+experiment&sca_esv=573057508&rlz=1C1YTUH_enI	Solar cell characteristics
9	https://www.google.com/search?q=installation+process+of+solar+panels+animation&sca_esv=573067372&rlz	Installation of solar panel
10	https://renewablelab.niu.edu/experiments/seriesParallelSolarCells	Solar cell in sries and parallel
11	https://www.geeksforgeeks.org/intrinsic-semiconductors-and-extrinsic-semiconductors/	Types of semiconductor
12	https://www.electronicsandyou.com/blog/category/soldering	Soldering methods
13	https://www.electronicsandyou.com/blog/electronic-components	For electronic Components,SMT,PCB
14	https://www.electroniclinic.com/types-of-integrated-circuits-classification-of-ics-by-structure/	For Integrated Cicuits
15	https://www.electronicsandyou.com/blog/types-of-pcb-different-types-of-printed-circuit-board-pcb.html	Types of PCB
16	https://www.electronics-notes.com/articles/electronic_components/fet-field-effect-transistor/what-is-a-fet-types-overview.php	Types of FET
17	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2963874/	E -waste management
18	https://www.ewaste1.com/how-are-electronics-recycled/	E -waste recycle