

PROFESSIONAL COMMUNICATION**Course Code : 312002**

Programme Name/s	: Architecture Assistantship/ Architecture and Interior Design/ 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 Software Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ 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/ Manufacturing Technology/ Medical Electronics/ Metallurgical Engineering/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures/
Programme Code	: AA/ AD/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ FC/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MRT/ MU/ MY/ PG/ PN/ PO/ SC/ SE/ 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

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- 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 .
- CO5 - Write Industrial reports.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme				Credits	Paper Duration	Assessment Scheme						Total Marks		
				Actual Contact Hrs./Week			SLH	NLH		Theory			Based on LL & TL		Based on SL			
				CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR				
				Max	Max	Max	Min	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 :

- FA-TH represents average of two class tests of 30 marks each conducted during the semester.
- 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.
- 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.
- Notional Learning hours for the semester are $(CL+LL+TL+SL)$ hrs.* 15 Weeks
- 1 credit is equivalent to 30 Notional hrs.
- * Self learning hours shall not be reflected in the Time Table.
- * 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

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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.
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

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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

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

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

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CO4		1				3	1			
CO5		1	1			3	1			
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

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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	: Architecture Assistantship/ Architecture and Interior Design/ 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 Software Technology/ Computer Science & Engineering/ Fashion & Clothing Technology/ Dress Designing & Garment Manufacturing/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ 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/ Manufacturing Technology/ Medical Electronics/ Metallurgical Engineering/ Production Engineering/ Printing Technology/ Polymer Technology/ Surface Coating Technology/ Computer Science/ Textile Technology/ Electronics & Computer Engg./ Travel and Tourism/ Textile Manufactures
Programme Name/s	: AA/ AD/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DC/ DD/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ FC/ HA/ HM/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ ML/ MRT/ MU/ MY/ PG/ PN/ PO/ SC/ SE/ 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 five different alternatives(modules) for achieving above outcomes . Students must complete any one module from the following given options.

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

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- c. MODULE-III : Universal 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

Demonstrate critical social and life skills ethics, resilience, positive attitude , integrity and self-confidence at workplace and society at large.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Enhance the ability to be fully self-aware and take challenges by overcoming all fears and insecurities and grow fully.
- CO2 - Increase self-knowledge and awareness of emotional skills and emotional intelligence at the place of study/work.
- CO3 - Provide the opportunity to realizing self-potential through practical experience while working individually or in group.
- CO4 - Develop interpersonal skills and adopt good leadership behaviour for self-empowerment and empowerment of others.
- CO5 - Set appropriate life goals with managing stress and time effectively.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

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				CL	TL	LL			Practical			FA-TH	SA-TH	Total	FA-PR	SA-PR		
312003	SOCIAL AND LIFE SKILLS	SFS	VEC	-	-	-	2	2	1	-	-	-	-	-	-	50 20 50		

Total IKS Hrs for Sem. : Hrs

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V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

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1	<p>TLO 1.1 Explain developmental needs and connection of various stakeholders</p> <p>TLO 1.2 Enlist the local problems</p> <p>TLO 1.3 Design a methodology for fieldwork</p> <p>TLO 1.4 Select the attributes of engineering and social system for measurement, quantification, and documentation</p> <p>TLO 1.5 Measure & quantify the quantities / systems parameters</p> <p>TLO 1.6 Write a report using information collected tStudy the data collected from fieldwork and conclude the observations</p>	<p>MODULE I : Activities Under Unnat Maharashtra Abhiyan (UMA)</p> <p>1.1 Introduction to Societal Needs and respective stakeholders : Regional societal issues that need engineering intervention</p> <p>1.2 Multidisciplinary approach-linkages of academia, society and technology</p> <p>1.3 Stakeholders' involvement</p> <p>1.4 Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc</p> <p>1.5 Problem Outline and stakeholders : Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal)</p> <p>1.6 Key attributes of measurement</p> <p>1.7 Various instruments used for data collection - survey templates, simple measuring equipments</p> <p>1.8 Format for measurement of identified attributes/ survey form and piloting of the same</p> <p>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</p> <p>1.10 Analysis and Report writing Report writing containing-</p> <ol style="list-style-type: none"> 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. 	<p>i) Group discussion ii) Role play iii) Case study iv) Seminar and presentation</p> <p><u>Implementation guidelines suggested</u></p> <p>The course will be implemented in eight sessions and fieldwork:</p> <ol style="list-style-type: none"> a) Session I - Introduction to development paradigm, fieldwork and case study as pedagogy b) Session II - VII - Society, stakeholders and value creation, measurements, rudimentary analysis and reporting c) Session VIII - Final closure session feedback and assessment d) Field work - <ol style="list-style-type: none"> 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 <p>Methodology: Considering the nature of the course designed, following points shall be considered while implementing the course.</p> <ol style="list-style-type: none"> 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

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			<p>Panchayats, Zilla Parishads, Panchayat Samitis to assess the small technological / engineering needs in their area of work.</p> <p>iv) The group of course teachers will carry out initial field visits to evaluate the various possibilities of field visits / various scenarios where in students can conduct field work to measure / quantify the parameters / attributes.</p>
2	<p>TLO 2.1 Adopt a Village or Slum for providing needed services to the community</p> <p>TLO 2.2 Carry out Survey to identify the problems of village community</p> <p>TLO 2.3 Undertake Special camping about developmental programs</p> <p>TLO 2.4 Establish the liaisons between government and other developmental agencies for the implementations of various development schemes of Government</p>	<p>MODULE II : National Service Scheme (NSS)</p> <p>2.1 Contacting Village/Area Leaders</p> <p>2.2 Primary socio economic survey of few villages in the vicinity of the institute.</p> <p>2.3 Selection of the village for adoption - conduct of activities</p> <p>2.4 Comprehensive Socio Economic Survey of the Village/Area</p> <p>2.5 Identification of Problem(s)</p> <p>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.</p> <p>2.7 A liaison between government and other development agencies for the implementation of various development schemes in the selected village / slum.</p>	<p>(i) The teachers should visit the village / slum before adopting it for NSS activities.</p> <p>(ii) The selected area should be compact.</p> <p>(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.</p> <p>(iv) The areas where political conflicts are likely to arise should be avoided by the NSS units.</p> <p>(v) The area should be easily accessible to the NSS volunteers to undertake frequent visits to slums.</p>

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3	TLO 3.1 Demonstrate Love and Compassion (Prem and Karuna) in the society TLO 3.2 Follow the path of Truth (Satya) TLO 3.3 Practice Non-Violence (Ahimsa) TLO 3.4 Follow the Righteousness (Dharma) TLO 3.5 Attain Peace (Shanti) in Life TLO 3.6 Provide Service (Seva) to the needy person/community. TLO 3.7 Demonstrate Renunciation (Sacrifice) Tyaga TLO 3.8 Practice Gender Equality and Sensitivity	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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4	<p>TLO 4.1 Demonstrate Punctuality appropriately</p> <p>TLO 4.2 Practice Cleanliness, Hygiene and Orderliness for self and others</p> <p>TLO 4.3 Take Responsibility and Calculated Risks</p> <p>TLO 4.4 Demonstrate Gratitude and Appreciations</p> <p>TLO 4.5 Show Determination & Persistence about work</p> <p>TLO 4.6 Give Respect as per the social norms and practice</p> <p>TLO 4.7 Respect Team Spirit to the acceptable level</p> <p>TLO 4.8 Practice Caring & Sharing among fellow citizens/community</p> <p>TLO 4.9 Demonstrate Honesty</p> <p>TLO 4.10 Practice for Forgive and Forget</p>	<p>MODULE-IV: Value Education (Unnati Foundation)</p> <p>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</p> <p>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</p> <p>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</p> <p>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</p> <p>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</p> <p>4.6 Respect, Comparing , OCSEM - Public Speaking, Student referral process, Attending a phone call, Being a Good Team Player , Placement Process, At a Restaurant, Workplace ethics</p> <p>4.7 Team Spirit, Inviting someone, OCSEM - Picture Reading & Word, a. Unnati Philosophy & b. Unnati Branding - Follow, Like & Share Unnati Social Media</p>	<ul style="list-style-type: none"> i) Video Demonstrations ii) Flipped Classroom iii) Case Study iv) Role Play v) Collaborative learning vi) Cooperative Learning vii) Chalk-Board

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.
		<ul style="list-style-type: none"> - 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 & Adaptability, 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) 	
5	<p>TLO 5.1 Develop Literacy About Savings and Investments in the community</p> <p>TLO 5.2 Attain Literacy About Financial Planning</p> <p>TLO 5.3 Demonstrate skills about Financial Transactions</p> <p>TLO 5.4 Use Literacy skills About Income, expenditure and budgeting</p> <p>TLO 5.5 Use measures about Inflation in the market.</p> <p>TLO 5.6 Use Literacy/Knowledge About Loans</p> <p>TLO 5.7 Explain the Importance of Insurance</p> <p>TLO 5.8 Follow Dos and Donts about finances</p>	<p>MODULE-V : Financial Literacy</p> <p>5.1 Introduction - Life Goals and financial goals</p> <p>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</p> <p>5.3 Retirement planning</p> <p>5.4 Cashless transactions</p> <p>5.5 Income, expenditure and budgeting – Concepts and Importance</p> <p>5.6 Inflation- Concept, effect on financial planning of an individual</p> <p>5.7 Loans – Types, Management of loans, Tax benefits</p> <p>5.8 Insurance – Types, Advantages, selection</p> <p>5.9 Dos and Donts in Financial planning and Transactions</p>	<ul style="list-style-type: none"> 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:

- plantation of trees, their preservation and upkeep
- Construction & maintenance of village streets, drains
- Cleaning of village ponds and wells;
- Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
- Disposal of garbage & composting;
- Prevention of soil erosion and work for soil conservation,
- Watershed management and wasteland development
- 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:

- Programme of mass immunization;

(ii) Working with people in nutrition programmes with the help of Home Science and medical college students;

- Provision of safe and clean drinking water;

- Integrated child development programmes;

- Health education, AIDS Awareness and preliminary health care.

- Population education and family welfare programme;

- 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;

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- (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 eradication of social evils like communalism, castism, regionalism, untouchability, drug abuse etc.;
- (viii) non-formal education for rural youth and
- (ix) legal literacy, consumer awareness.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicious mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

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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**

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					03	03	03			
CO2					02	02	03			
CO3	01	01	01		03	03	03			
CO4		01	01	01	03	03	03			
CO5		02		01	03	03	03			

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	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

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Sr.No	Author	Title	Publisher with ISBN Number
2	Prepared by each district administration	Districts Economic survey reports	Govt. of Maharashtra
3	Local college students, UMA staffs	Sample Case Studies on UMA website	IITB-UMA team
4	Central Public Health and Environmental Engineering Organisation	Manual on Water Supply and Treatment	Ministry of Urban Development, New Delhi
5	Specifications And Standards Committee	Indian Standards (IS) Codes and Indian Roads Congress (IRC) Codes	Bureau of Indian Standards and The Indian Road Congress
6	RBI	https://www.rbi.org.in/FinancialEducation/content/GUIDE310113_F.pdf	RBI
7	RBI	https://www.rbi.org.in/FinancialEducation/content/Financing%20needs%20of%20Micro%20and%20small%20Enterprises%20-%20A%20guide.pdf	RBI
8	RBI	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf	RBI

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 skills. Unit 4 i.e. Course 4 is to be referred
14	https://nss.gov.in/	NSS : Know about the NSS Scheme and details
15	https://www.rbi.org.in/FinancialEducation/FinancialEnterprise.aspx	Reference for Module V
16	https://www.rbi.org.in/FinancialEducation/content/I%20Can%20Do_RBI.pdf	Reference for Module V
17	https://www.rbi.org.in/FinancialEducation/content/Financing%20needs%20of%20Micro%20and%20small%20Enterprises%20-%20A%20guide.pdf	Reference for Module V
18	https://www.rbi.org.in/FinancialEducation/content/GUIDE310113_F.pdf	Reference for Module V

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

BASIC MECHANICAL ENGINEERING**Course Code : 312006**

Programme Name/s	: Electrical Engineering/ Electrical Power System
Programme Code	: EE/ EP
Semester	: Second
Course Title	: BASIC MECHANICAL ENGINEERING
Course Code	: 312006

I. RATIONALE

Electrical power supply system is needed for operating various mechanical equipment. Electrical engineer has to take care of installation and maintenance of mechanical systems like refrigeration and air conditioning, portable generators, industrial material handling system and power generation plants. This course will help to understand various mechanical systems for identifying different mechanical faults.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Interpret various mechanical faults in industrial mechanical systems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Find faults in Thermal Power Plant using acquired knowledge and skills in a given situation.
- CO2 - Diagnose faults of Material handling system using acquired knowledge and skills.
- CO3 - Identify faults of Hydraulic turbines and Hydraulic pumps in a given situation.
- CO4 - Diagnose faults of given Air compressor and Refrigeration system using acquired knowledge and skills.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme				Credits	Paper Duration	Assessment Scheme													
				Actual Contact Hrs./Week			SLH	NLH		Theory			Based on LL & TL				Total Marks						
				CL	TL	LL				Theory			Practical		FA-TH		SA-TH						
										Max	Max	Max	Min	Max	Min	Max	Min	Max	Min				
312006	BASIC MECHANICAL ENGINEERING	BME	SEC	2	-	2	-	4	2	-	-	-	-	-	50	20	50@	20	-	-	100		

BASIC MECHANICAL ENGINEERING**Course Code : 312006****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 List components of steam boilers and turbines TLO 1.2 Explain working of portable generator TLO 1.3 Identify different faults in different power plant equipment	Unit - I Power plants equipment 1.1 Layout of Thermal Power Plant, Major thermal power plants in India 1.2 Introduction to steam boilers- Babcock-Wilcox boilers, Lamont and Loeffler boilers 1.3 Introduction to steam Turbines- Impulse and reaction turbine 1.4 Layout of Portable Generator, Manufacturers and specifications of portable generator 1.5 Introduction to portable generators: I.C engine 1.6 Mechanical parameters measurement- Introduction to •Pressure measurement: Bourdon tube pressure gauge •Temperature measurement: Optical pyrometer, Thermocouple •Heat measurement: Calorimeter •Speed measurement of rotating elements: Tachometer, Stroboscope 1.7 Preliminary mechanical faults occurred in steam boilers and turbines	Demonstrate various models/Charts of boilers and turbines .

BASIC MECHANICAL ENGINEERING**Course Code : 312006**

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 Use of mechanical components in simple Machines/ equipment TLO 2.2 Select appropriate material handling system. TLO 2.3 Identify faults in Industrial Material handling systems	Unit - II Industrial Material handling systems and components 2.1 Mechanical components for motion and power transmission: Types and uses of <ul style="list-style-type: none"> • Gears • Belt drives • Chain drives • Bearings • Couplings 2.2 Introduction to material handling systems: Manufacturers, specifications, construction and working of <ul style="list-style-type: none"> • Material transfer lifts, • Conveyors, • Overhead cranes 2.3 Preliminary mechanical faults occurred in Industrial Material handling systems	Demonstration of various mechanical components using charts and models
3	TLO 3.1 List different components of hydraulic turbines and Pumps. TLO 3.2 Explain working of hydraulic pumps. TLO 3.3 Identify faults in hydraulic equipment	Unit - III Hydraulic pumps, turbines, and equipment 3.1 Layout of Hydraulic Power Plant, Major hydraulic power plants in India 3.2 Introduction to hydraulic turbines: construction and working of Pelton wheel, Francis turbine, Kaplan turbine 3.3 Introduction to hydraulic pumps: construction and working centrifugal pump, reciprocation pump and submersible pump 3.4 Preliminary mechanical faults occurred in Centrifugal, reciprocating, and submersible pumps	Demonstrate working of Hydraulic power plant /Pumps using Chart/models
4	TLO 4.1 Explain working of air compressor. TLO 4.2 List different components of refrigerator and air conditioner. TLO 4.3 Explain working of refrigerator and air conditioner. TLO 4.4 Identify faults in Refrigeration and air conditioning equipment system	Unit - IV Compressor, Refrigeration and Air conditioning equipment 4.1 Introduction to Compressor- Manufacturers, Specifications, construction and working of reciprocating compressor, screw compressor 4.2 Introduction to Refrigeration and Air conditioning : Vapour compression cycle, Construction and working of simple domestic refrigerator and window air conditioner, Manufacturers and specification 4.3 Preliminary mechanical faults occurred in reciprocating compressor and Refrigeration and air conditioning equipment	Demonstrate air compressor, Refrigeration system and air conditioning system using charts.

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
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BASIC MECHANICAL ENGINEERING**Course Code : 312006**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify different components of Thermal Power Plants	1	*Identify steam boilers using models and charts	2	CO1
LLO 2.1 Observe working of Steam turbine	2	*Demonstrate working of steam turbine	2	CO1
LLO 3.1 Use temperature measuring devices	3	*Measure temperature of different equipment using temperature measuring devices.	2	CO1
LLO 4.1 Use pressure measuring devices	4	*Measure pressure of different equipment using pressure measuring devices	2	CO1
LLO 5.1 Use speed measuring devices	5	Measure speed of different rotating elements using sped measuring devices.	2	CO1
LLO 6.1 Use heat measuring devices	6	Measure heat of given fluid using calorimeter	2	CO1
LLO 7.1 Observe working of portable generator	7	Demonstrate working of portable generator	2	CO1
LLO 8.1 Select different drive system for given application with justification	8	*Identify drive system using models/ actual set up.	2	CO2
LLO 9.1 Calculate velocity ratio of given mechanical system	9	*Calculate Velocity Ratio of given gear/belt drive of suitable mechanical system.	2	CO2
LLO 10.1 Identify different components of material handling system used in Industry	10	Demonstrate working of lift / conveyor used in Industry.	2	CO2
LLO 11.1 Observe working of material handling system used in Industry	11	Demonstrate working of Overhead Crane used in Industry	2	CO2
LLO 12.1 Observe working of Hydraulic power plant.	12	*Demonstrate Working of Hydraulic Power plant using pelton wheel turbine set up or suitable turbine models /set up	2	CO3
LLO 13.1 Use of centrifugal pump for given application	13	*Identify different components of Centrifugal Pump.	2	CO3
LLO 14.1 Use of reciprocating pump for given application	14	Identify different components of Reciprocating Pump	2	CO3
LLO 15.1 Use pressure and temperature measuring devices	15	*Measure pressure, Temperature at different points of Air Compressor.	2	CO4
LLO 16.1 Calculate velocity ratio of given air compressor	16	*Calculate Speed ratio of Belt Drive used in air compressor and Driven Motor.	2	CO2 CO4
LLO 17.1 Identify different components of household refrigerator	17	*Demonstrate working of household refrigerator for identifying different components and type.	2	CO4
LLO 18.1 Identify different components of window air conditioner	18	Demonstrate working of window air conditioner for identifying different components	2	CO4
LLO 19.1 Collect information related to water lifting systems in ancient India.(IKS)	19	*Collect information of water lifting systems in ancient India relation with Hydraulic pumps (IKS)	2	CO1 CO2 CO3 CO4

BASIC MECHANICAL ENGINEERING**Course Code : 312006**

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 -				
<ul style="list-style-type: none"> • '*' 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)**NA**

- NA

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Model of Babcock Wilcox Boiler	1
2	Model of Lamont Boiler	1
3	Model of Loeffler Boiler	1
4	Pelton wheel turbine set up or working models of turbines	13
5	Centrifugal pump -minimum up to single phase 0.5 HP/Reciprocating pump- minimum up to 1 HP	14
6	Air Compressor- Multistage reciprocating, pressure up to 12 bar, Motor- 1 HP	15,16
7	Household refrigerator- minimum up to 165 liter	17
8	Window air conditioner capacity minimum1.5 TR	18
9	Charts of Thermal power Plant, Steam Boilers, Steam turbines	2
10	Mercury/Alcohol Thermometers (Range 0 to 150 °C)	3,15
11	Optical Thermometer/Pyrometer (Range 30 to 400 °C)	3,15
12	Bourdon Tube Pressure Gauge (Range 0 to 15 bar)	4,15
13	Digital Tachometer (Max. speed 10000 rpm)	5,16
14	Stroboscope (Max. speed 10000 rpm)	5,16
15	Tube in Tube type water calorimeter with temperature measuring devices	6
16	Portable generator with load bank minimum capacity 2.2 kVA	7

BASIC MECHANICAL ENGINEERING**Course Code : 312006**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
17	Models of Different gears- Spur, Helical, Bevel, Worm and worm, Rack and Pinion	8,9
18	Models of Belt drive- Open and Cross Flat Belt, V belt	8,9
19	Models of Chain Drive- Sprockets and chain	8,9
20	Deep groove Ball bearings – Single row, self-aligned, Roller	8,9
21	Working model of Belt and Pulley for determining speed ratio	8,9
22	Working model of Gear train for determining speed ratio	8,9

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	Power plants equipment	CO1	8	0	0	0	0
2	II	Industrial Material handling systems and components	CO2	8	0	0	0	0
3	III	Hydraulic pumps, turbines, and equipment	CO3	7	0	0	0	0
4	IV	Compressor, Refrigeration and Air conditioning equipment	CO4	7	0	0	0	0
Grand Total				30	0	0	0	0

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Term work
- "Each practical will be assessed considering 60% weightage to process 40% weightage to product" & other instructions of Assessment.

Summative Assessment (Assessment of Learning)

- Practical
- "Each practical will be assessed considering 60% weightage to process 40% weightage to product" & other instructions of Assessment.

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

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CO1	2	-	-	2	-	-	2			
CO2	2	-	-	2	-	-	2			
CO3	2	-	-	2	-	-	2			
CO4	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	P.K.Nag	Power Plant Engineering	McGraw Hill Education ,ISBN: 978-9339204044
2	R.K. Rajput	Power Plant Engineering	Tata-McGraw Hill Education. ISBN : 9788131802557
3	K. Subramanya	Hydraulic Machines	McGraw Hill Education (India) Private, ISBN, 1259006840, 9781259006845
4	S.S.Rattan	Theory of Machines	Tata-McGraw Hill Education. ISBN, 1283187124, 9781283187121
5	C. P. Arora	Refrigeration and Air conditioning	Tata-McGraw Hill Education ISBN-13: 978-0-07-008390-5
6	Mahadevan B., Bhat Vinayak Rajat, Nagendra Pavana R.N.	Introduction to Indian Knowledge System(iks) : concepts and Applications	PHI Learning Pvt. Ltd., ISBN -2022,9391818218, 9789391818210
7	Siddhartha Ray	Introduction to Materials Handling	New Age International Private Limited; ISBN-9788122440072

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=IdPTuwKEfmA	Steam Power Plant working animation
2	https://www.youtube.com/watch?v=fk3DjD9gSsk	Principle and working of Steam boiler animation
3	https://www.youtube.com/watch?v=dVBoZ4PfZmE	Working of Steam boiler animation
4	https://www.youtube.com/watch?v=SPg7hOxFItI	Working of Steam turbine animation
5	https://www.youtube.com/watch?v=N70vbRbF36A	Mechanical Drive System
6	https://www.youtube.com/watch?v=hhE_2oVIZiI	Manual Material Handling system
7	https://www.youtube.com/watch?v=o_C2XISZ3Uc	Belt conveyor animation
8	https://www.youtube.com/watch?v=-hooifWJ1jY	Hydraulic Power Plant animation
9	https://www.youtube.com/watch?v=BaEHVpKc-1Q	Principle of Centrifugal Pump
10	https://www.youtube.com/watch?v=XpcCUtYzwy0	Centrifugal Pump working animation
11	https://www.youtube.com/watch?v=41vb6T42_Tk	Reciprocating Pump - Construction and working
12	https://www.youtube.com/watch?v=3BCiFeykRzo&t=155s	Water turbine (Francis)
13	https://www.youtube.com/watch?v=7NwxMyqUyJw	Refrigerator system working animation
14	https://www.youtube.com/watch?v=FzydmAmZM54	Window Air Conditioner working animation
15	https://www.youtube.com/watch?v=PjcdqAkP0UA	Vapour compression system construction and working
16	https://www.youtube.com/watch?v=_qyF1yolDgY	Problems & Remedies of Centrifugal Pump

BASIC MECHANICAL ENGINEERING**Course Code : 312006**

Sr.No	Link / Portal	Description
17	https://www.youtube.com/watch?v=k0NOLbZXSNc	Refrigeration - System Troubleshooting
18	https://www.indiawaterportal.org/articles/persian-wheel-water-lifting-device-kolar-karnataka	Information on Persian wheel : The water lifting device in Kolar, Karnataka (IKS)
19	https://www.youtube.com/watch?v=eCNpJ-_iksQ&t=5s	Persian wheel : The water lifting device in Kolar, Karnataka (IKS)
20	https://rezavisblastfromthepast.co.in/2018/04/30/the-early-waterlifting-devices-dhenkli-or-shaduf-and-the-araghatta-noria/	The early waterlifting devices: Dhenkli or shaduf and the araghatta (Noria) (IKS)

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 01/10/2024**Semester - 2, K Scheme**

APPLIED MATHEMATICS**Course Code : 312301**

Programme Name/s	: Architecture Assistantship/ Architecture and Interior Design/ 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 Software Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ 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/ Manufacturing Technology/ Medical Electronics/ Metallurgical Engineering/ Production Engineering/ Computer Science/ Electronics & Computer Engg.
Programme Code	: AA/ AD/ AE/ AI/ AL/ AN/ AO/ AT/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CST/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IC/ IE/ IF/ IH/ IS/ IX/ IZ/ LE/ ME/ MK/ MRT/ MU/ MY/ PG/ SE/ 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	Paper Duration	Assessment Scheme						Total Marks				
				Actual Contact Hrs./Week					Theory			Based on LL & TL		Based on SL					
				CL	TL	LL			Theory		Practical		FA-PR		SA-PR				
				Max	Max	Max			FA-TH	SA-TH	Total	Max	Min	Max	Min	SLA			
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

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

APPLIED MATHEMATICS**Course Code : 312301**

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 / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- NA

Assignment

- NA

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

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)

APPLIED MATHEMATICS**Course Code : 312301**

- End Term Exam

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	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	Kreyszig, 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 (India) 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 and Tibshirani	An Introduction to StatisticalLearning with Applications in R	Springer New York Heidelberg Dordrecht London ISBN 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

APPLIED MATHEMATICS**Course Code : 312301**

Sr.No	Link / Portal	Description
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.
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.

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

APPLIED SCIENCE**Course Code : 312308****Programme Name/s**

: Automobile Engineering./ Agricultural Engineering/ Automation and Robotics/ Civil Engineering/
 Civil & Rural Engineering/ Construction Technology/ Electrical Engineering/ Electrical Power System/
 Instrumentation & Control/ Instrumentation/ Civil & Environmental Engineering/
 Mechanical Engineering/
 Mechatronics/ Manufacturing Technology/ Metallurgical Engineering/ Production Engineering/

Programme Code

: AE/ AL/ AO/ CE/ CR/ CS/ EE/ EP/ IC/ IS/ LE/ ME/ MK/ MRT/ MY/ PG

Semester

: Second

Course Title

: APPLIED SCIENCE

Course Code

: 312308

I. RATIONALE

Diploma engineers have to deal with various processes, materials and machines. The comprehension of concepts and principles of Science like Elasticity, motion, Oscillation, Photoelectricity, X rays ,LASER, Nanomaterials, metals, alloys, water treatment ,fuel and combustion, cells and batteries will help the students to use relevant materials ,processes and methods for various engineering applications .

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attain following industry/ employer expected outcome through various teaching learning experiences. Apply the principles of physics and chemistry to solve broad-based engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Select relevant material in industries by analyzing its physical properties .
- CO2 - Apply the concept of simple harmonic motion , resonance and ultrasonic sound for various engineering applications.
- CO3 - Apply the concept of modern Physics (X-rays, LASER, Photosensors and Nanotechnology) for various engineering applications.
- CO4 - Use the relevant metallurgical processes in different engineering applications.
- CO5 - Use relevant water treatment processes to solve industrial problems.
- CO6 - Use appropriate fuel and electrolyte for engineering applications.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme				Credits	Paper Duration	Assessment Scheme						Total Marks						
				Actual Contact Hrs./Week			SLH			Theory			Based on LL & TL		Based on SL							
				CL	TL	LL				Practical		SLA										
										FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA							
										Max	Max	Max	Min	Max	Min	Max	Min					
312308	APPLIED SCIENCE	ASC	DSC	4	-	4	-	8	4	1.5	30	70*#	100	40	50	20	50@ 20	- - 200				

Total IKS Hrs for Sem. : 4 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.

♦ Candidate remaining absent in practical examination of any one part of Applied Science course i.e. Physics, Chemistry will be declare as Absent in Mark List and has to appear for examination. The marks of the part for which candidate was present will not be processed or carried forward.

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	<p>TLO 1.1 Apply the concept of elasticity and plasticity to select the material for engineering applications.</p> <p>TLO 1.2 Establish relation between given types of moduli of elasticity.</p> <p>TLO 1.3 Predict the behavior of the given metallic wire.</p> <p>TLO 1.4 Explain the relevant Newton's laws of motion for the given moving object.</p> <p>TLO 1.5 Calculate the work, power, energy for the given situation.</p>	<p>Unit - I Properties of matter and kinematics</p> <p>1.1 Deforming Force and Restoring Force, Elasticity, Plasticity, Rigidity.</p> <p>1.2 Stress and Strain and their types, elastic limit and Hooke's law, types of moduli of elasticity.</p> <p>1.3 Stress -Strain diagram, Poisson's ratio, factors affecting elasticity</p> <p>1.4 Newton's laws of motion, and their applications.</p> <p>1.5 Angular displacement, angular velocity, angular acceleration, three equations of angular motion, projectile motion, trajectory, range of projectile angle of projection, time of flight</p> <p>1.6 Work, power and energy: potential energy, kinetic energy, work –energy principle.</p>	<p>Improved lecture Video</p> <p>Demonstrations</p> <p>Model</p> <p>Demonstration</p>

APPLIED SCIENCE**Course Code : 312308**

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	<p>TLO 2.1 Find the parameters required to analyze the given wave motion and simple harmonic motion.</p> <p>TLO 2.2 Explain the concept of resonance and its applications.</p> <p>TLO 2.3 Describe the properties of given ultrasonic waves.</p> <p>TLO 2.4 Explain the given method of production of ultrasonic waves .</p>	<p>Unit - II Waves and Oscillations</p> <p>2.1 Sound waves, amplitude, frequency, time - period, wave-length and velocity of wave, relation between velocity, frequency and time - period of wave.</p> <p>2.2 Simple Harmonic Motion , Uniform Circular Motion as Simple Harmonic Motion, Equation of simple harmonic motion , Phase of Simple Harmonic Motion.</p> <p>2.3 Resonance , Application of resonance.</p> <p>2.4 Resonance concept in prehistoric times, concept of different frequencies (Mantras) used to ignite different chakras in body (IKS).</p> <p>2.5 Ultrasonic waves, properties of ultrasonic waves.</p> <p>2.6 Piezoelectric and Magnetostriction method to produce ultrasonic waves .</p> <p>2.7 Applications of ultrasonic waves.</p>	<p>Improved lecture Demonstration Video Demonstrations</p>
3	<p>TLO 3.1 Explain properties of photon on basis Planck's hypothesis.</p> <p>TLO 3.2 Explain the construction and working of given photoelectric device.</p> <p>TLO 3.3 Explain the method to produce X-Rays with its properties and engineering applications.</p> <p>TLO 3.4 Differentiate between LASER and ordinary light.</p> <p>TLO 3.5 Explain the given terms related to LASER.</p> <p>TLO 3.6 Describe the properties of nanomaterials and its various applications.</p>	<p>Unit - III Modern Physics (Photoelectricity , X rays, LASER and nanotechnology)</p> <p>3.1 Planck's hypothesis, properties of photons.</p> <p>3.2 Photo electric effect: threshold frequency, threshold wavelength, stopping potential, Work function, characteristics of photoelectric effect, Einstein's photoelectric equation</p> <p>3.3 Photoelectric cell and LDR : principle ,Working and applications</p> <p>3.4 Production of X-rays by modern Coolidge tube, properties and engineering applications.</p> <p>3.5 Laser: properties, absorption, spontaneous and stimulated emission,</p> <p>3.6 Population inversion, active medium, optical pumping, three energy level system, He-Ne Laser.</p> <p>3.7 Engineering applications of Laser.</p> <p>3.8 Nanotechnology : Properties of nanomaterials (optical, magnetic and dielectric properties) , applications of nanomaterials, Metallic Bhasma (Ancient Ayurveda, IKS).</p>	<p>Improved lecture Presentations Demonstration Video Demonstrations</p>

APPLIED SCIENCE**Course Code : 312308**

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	<p>TLO 4.1 Describe the extraction process of the ore.</p> <p>TLO 4.2 Explain Mechanical properties of metals.</p> <p>TLO 4.3 State purposes of making alloys.</p> <p>TLO 4.4 Describe methods of preparation of alloys.</p> <p>TLO 4.5 State Composition ,properties and applications of ferrous and nonferrous alloys.</p>	<p>Unit - IV Metals and Alloys</p> <p>4.1 Ancient Indian Metallurgy (IKS)</p> <p>4.2 Metals: Occurrence of metals in free and combined state. Basic concepts : Mineral, ore, gangue, flux and slag, metallurgy.</p> <p>4.3 Metallurgy: Extraction processes of metal from ore</p> <p>Concentration : Gravity separation, electromagnetic separation, froth floatation, calcination and roasting,</p> <p>Reduction : Smelting, aluminothermic process,</p> <p>Refining, poling , electrorefining.</p> <p>4.4 Mechanical properties of metals :Hardness, ductility, malleability, tensile strength, toughness, machinability, weldability, forging, soldering, brazing, castability.</p> <p>4.5 Alloys: Purposes of making alloys with examples.</p> <p>4.6 Preparation methods of alloys : Fusion, compression.</p> <p>4.7 Classification of alloys :Ferrous and non-ferrous alloys</p> <p>Ferrous alloys: Composition ,properties and applications of low carbon, medium carbon, high carbon steels. Non-ferrous alloy:Composition ,properties and applications of Brass, Bronze, Duralumin, Tinman Solder, Woods metal.</p>	Chalk-Board Demonstration Case Study Video Demonstrations
5	<p>TLO 5.1 Explain types of hardness of water.</p> <p>TLO 5.2 List salts causing temporary and permanent hardness to water.</p> <p>TLO 5.3 Describe boiler corrosion and caustic embrittlement.</p> <p>TLO 5.4 Explain the given type of water softening process.</p> <p>TLO 5.5 Describe the Wastewater treatment and potable water treatment.</p> <p>TLO 5.6 Solve numerical based on pH and pOH.</p>	<p>Unit - V Water Treatment</p> <p>5.1 Hard and soft water, causes of hardness, types of hardness</p> <p>5.2 Hard water in boilers and prevention: Boiler corrosion, caustic embrittlement, priming and foaming, scales and sludges, and methods of prevention of boiler corrosion.</p> <p>5.3 Methods of water softening: lime soda process (hot lime soda and cold lime soda process), zeolite process, ion exchange process.</p> <p>5.4 Potable water treatment: Sedimentation, coagulation, filtration and sterilization .</p> <p>5.5 Wastewater treatment: Sewage treatment, BOD and COD of sewage water.</p> <p>5.6 pH and pOH: Concept of pH, pOH, pH Scale, Numerical.</p>	Chalk-Board Demonstration Case Study Video Demonstrations

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.
6	TLO 6.1 Describe the properties of the given type of fuel. TLO 6.2 Describe Proximate analysis and Ultimate analysis of coal samples. TLO 6.3 Calculate the calorific value of the given solid fuel using Bomb calorimeter. TLO 6.4 Describe fractional distillation of crude petroleum. TLO 6.5 Explain properties of liquid fuels. TLO 6.6 Describe composition, properties of given gaseous fuel with their applications. TLO 6.7 Describe production of green hydrogen by electrolysis. TLO 6.8 Describe construction and working of given cells and batteries.	Unit - VI Fuels and Combustion 6.1 Fuel: Calorific value and ignition temperature, classification. 6.2 Solid fuels: Coal, Classification and composition , Proximate analysis, Ultimate analysis, Calorific value of coal by Bomb calorimeter. 6.3 Liquid fuels: Fractional distillation of crude petroleum, boiling range, composition, propertie Knocking, cracking, octane number and cetane number. 6.4 Gaseous fuels: Biogas, LPG, and CNG. Combustion equation of gaseous fuels, mass and volume of air required for complete combustion. 6.5 Green hydrogen: Producing green hydrogen by electrolysis from renewable sources , Advantages and disadvantages of green hydrogen. 6.6 Electrical conductance in metals and electrolytes, specific conductance, equivalent conductance, cell constant 6.7 Cells and batteries :Construction ,working and applications of dry cell, lead acid storage cell H ₂ - O ₂ fuel cell, Ni-Cd battery and Lithium ion battery	Chalk-Board Demonstration Case Study 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 Use Searle's method to determine the Young's modulus of given wire	1	* Determination of Young's modulus of given wire.	2	CO1
LLO 2.1 Compare young's modulii of different materials of wires .	2	Comparison of Young's modulii of given materials of wires.	2	CO1
LLO 3.1 Use of inclined plane to find the downward force.	3	* Determination of relationship between angle of inclination and downward force using inclined plane.	2	CO1
LLO 4.1 Use projectile motion to find the range from initial launch speed and angle	4	*Determination of range of projectile	2	CO1
LLO 5.1 Use helical spring to find force constant .	5	* Determination of force constant using helical spring .	2	CO2
LLO 6.1 Use resonance tube method to determine velocity of sound	6	* Determination of velocity of sound using resonance tube method.	2	CO2
LLO 7.1 Use Simple pendulum to find acceleration due to gravity .	7	* Determination of acceleration due to gravity by using simple pendulum .	2	CO2
LLO 8.1 Use ultrasonic distance – meter to measure distance of object .	8	Determination of distance of object using ultrasonometer.	2	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 9.1 Use ultrasonic interferometer to determine velocity of sound	9	Determination of velocity of ultrasonic sound waves in different liquids using ultrasonic interferometer .	2	CO2
LLO 10.1 Use photo electric cell to find dependence of the stopping potential on the frequency of given light source.	10	Determination of the dependence of the stopping potential on the frequency of given light source .(Virtual Lab)	2	CO3
LLO 11.1 Determine I-V characteristics of the given photo electric cell.	11	* Determination of I-V characteristics of photoelectric cell.	2	CO3
LLO 12.1 Determine I-V characteristics of given light dependent resistor.	12	* Determination of I-V characteristics of LDR.	2	CO3
LLO 13.1 Find divergence of given laser .	13	Determination of the divergence of laser beam.	2	CO3
LLO 14.1 Use LASER beam to find the refractive index of glass plate	14	Determination of refractive index of glass plate using laser beam. (Virtual Lab)	2	CO3
LLO 15.1 Find the wavelength of given laser.	15	Determination of wavelength of helium neon laser (Virtual Lab)	2	CO3
LLO 16.1 Prepare KMnO4 solution. LLO 16.2 Prepare standard oxalic acid. LLO 16.3 Standardize KMnO4 solution.	16	Standardization of KMnO4 solution using standard oxalic acid and preparation of Fe alloy sample.	2	CO4
LLO 17.1 Set up titration Assembly. LLO 17.2 Record the observations. LLO 17.3 Calculate percentage of iron in haematite ore by titration method .	17	* Determination of the percentage of iron present in given Haematite ore by KMnO4 solution.	2	CO4
LLO 18.1 Prepare Cu ore sample. LLO 18.2 Calculate percentage of Cu .	18	* Determination of percentage of copper in given copper ore .	2	CO4
LLO 19.1 Prepare EDTA solution of known concentration. LLO 19.2 Determine total hardness of water by titration.	19	*Calculation of total hardness, temporary hardness and permanent hardness of water sample by EDTA method.	2	CO5
LLO 20.1 Prepare acid solution of known concentration. LLO 20.2 Determine alkalinity of water sample.	20	* Determination of the alkalinity of a given water sample.	2	CO5
LLO 21.1 Determine turbidity by using a Nephelometer or simulation.	21	Determination of turbidity of a given water sample by Nephelometric method by using Nephelometer or simulation.	2	CO5
LLO 22.1 Set up titration Apparatus LLO 22.2 Record the observations. LLO 22.3 Calculate dissolved oxygen.	22	Determination of dissolved oxygen in the given water sample.	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 23.1 Prepare AgNO ₃ Solution of known concentration. LLO 23.2 Calculate chloride content in water sample.	23	Determination of chloride content in the given water sample by Mohr's method.	2	CO5
LLO 24.1 Use universal indicator for PH values. LLO 24.2 Calculate PH value by using PH meter.	24	* Determination of pH value of given solution using pH meter and universal indicator.	2	CO5
LLO 25.1 Use of oven for appropriate temperature settings. LLO 25.2 Calculate moisture and ash content in coal samples.	25	* Determination of the moisture and ash content in a given coal sample using proximate analysis.	2	CO6
LLO 26.1 Set up a Bomb Calorimeter. LLO 26.2 Calculate calorific value.	26	* Determination of calorific value of given solid fuel using Bomb calorimeter.	2	CO6
LLO 27.1 Use gravimetric analysis method LLO 27.2 calculate the percentage of Sulphur.	27	Calculate the percentage of Sulphur in a given coal sample by ultimate analysis. (Gravimetric analysis)	2	CO6
LLO 28.1 Standardize conductivity meter. LLO 28.2 Measure the conductance of given solutions.	28	Determination of conductance of given electrolyte by using a conductivity meter.	2	CO6
LLO 29.1 Set up conductometric titration assembly. LLO 29.2 Record conductance. LLO 29.3 Determine specific conductance and equivalence conductance.	29	* Determination of specific conductance and equivalence conductance of given salt sample solution.	2	CO6
LLO 30.1 Set up conductometric titration assembly. LLO 30.2 Record conductance. LLO 30.3 Determine equivalence point.	30	Determination of equivalence point of acetic acid and ammonium hydroxide using conductivity meter.	2	CO6
Note : Out of above suggestive LLOs -				
<ul style="list-style-type: none"> • '*' 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) : NOT APPLICABLE**VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Searle's apparatus(with slotted mass of 0.5 kg each)	1,2
2	Experimental setup for characteristics of LDR, optical bench .Source of light ,LDR .	11
3	Laser Source (He Ne, diode laser), optical bench , graph paper, glass plate	12,13,14
4	Nephelometer ; Auto-ranging from 20-200 NTU, +/- 2% of reading plus 0.1 NTU, power 220 Volts +/- 10% AC 50 Hz	21

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Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
5	pH meter reading up to pH14; ambient temp. -40 to 700 C.; pH/mV resolution:13 bit	24
6	Electric oven inner size 18" x 18" x 18"; temperature range 100 to 2500 C with the capacity of 40 lt.	25
7	Bomb calorimeter Temperature Resolution:0.001°C Oxygen Filling Automatic /Manual	26
8	Conductivity meter; conductivity range – 0.01 uS /cm to 200 mS/cm, Cell constant – digital 0.1 to 2.00; Temp. range – 0 to 100°C	28,29,30
9	An inclined plane , a trolley or a roller , pan , weight box , spring balance spirit level, strong thread , meter scale .	3
10	Retort stand, helical spring , 6 slotted weight of 50 grams ., scale , stop watch.	4
11	Resonance tube , Tuning forks of different frequencies	5
12	Metallic bob , strong thread , stopwatch .	6
13	Ultrasonometer	7
14	ultrasonic interferometer	8
15	Experimental setup for characteristics of photoelectric cell	9,10
16	Electronic balance, with the scale range of 0.001g to 500g. pan size 100 mm; response time 3-5 sec.; power requirement 90-250 V, 10 watt.	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	Properties of matter and kinematics	CO1	9	3	4	4	11
2	II	Waves and Oscillations	CO2	10	3	5	4	12
3	III	Modern Physics (Photoelectricity , X rays, LASER and nanotechnology)	CO3	11	3	5	4	12
4	IV	Metals and Alloys	CO4	10	2	3	5	10
5	V	Water Treatment	CO5	8	3	4	4	11
6	VI	Fuels and Combustion	CO6	12	3	5	6	14
Grand Total				60	17	26	27	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Two unit tests of 30 marks (Physics 15 marks, Chemistry-15 marks) and average of two unit tests.
- For laboratory learning 50 marks (Physics 25 marks, Chemistry-25 marks).

Summative Assessment (Assessment of Learning)

- End semester assessment of 50 marks for laboratory learning (Physics 25 marks, Chemistry-25 marks).
- End semester assessment of 70 marks through online MCQ examination.

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	3	1	1	1	1	1	2			
CO2	3	1	1	1	1	1	2			
CO3	3	2	1	1	1	1	2			
CO4	3	1	-	1	2	2	1			
CO5	3	2	1	2	2	2	1			
CO6	3	1	-	1	2	2	1			

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	Haliday, David; Resnik, Robert and Walker, Jearl	Fundamentals of Physics	John Wiley & sons, Hoboken, USA, 2014 ISBN : 812650823X.
2	Hussain Jeevakan	Applied Physics II	Publisher: Khanna Book Publishing ISBN: 9789391505578.
3	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part I - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314
4	Narlikar, J.V.;Joshi , A. W.; Ghatak A.K. et al	Physics Textbook Part II - Class XII	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506713
5	Aryabhatta	The Surya Siddhanta	Baptist mission press, Calcutta
6	Jain and Jain	Engineering Chemistry	National Council of Education Research and Training, New Delhi, 2010, ISBN : 8174505083
7	Dara, S. S.	Engineering Chemistry	National Council of Education Research and Training, New Delhi, 2015, ISBN : 8174505660
8	Bagotsky V.S.	Fundamental of electrochemistry	National Council of Education Research and Training, New Delhi, 2013, ISBN : 8174506314.
9	Agnihotri Rajesh	Chemistry for Engineers	Wiley India Pvt. Ltd. New Delhi, 2014, ISBN: 9788126550784.
10	Anju Rawlley, Devdatta V. Saraf	Applied Chemistry with Lab Manual	Khanna Book Publishing Co. (P) Ltd. New Delhi, 2021, ISBN- 978-93-91505-44-8
11	Vairam S.	Engineering Chemistry	Wiley India Pvt. Ltd. New Delhi, 2013, ISBN: 9788126543342

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.iberdrola.com/sustainability/green-hydrogen	Green hydrogen

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Sr.No	Link / Portal	Description
2	https://vedicheritage.gov.in/vedic-heritage-in-present-context/metallurgy	Ancient indian metallurgy (IKS)
3	https://vlab.amrita.edu/?sub=2&brch=193&sim=575&cnt=4	Determine turbidity by using a simulation
4	https://www.britannica.com/science/metallurgy	Metals and alloy
5	https://phet.colorado.edu/en/simulations/ph-scale	PH and POH
6	https://archive.nptel.ac.in/courses/103/105/103105110/	Solid fuel
7	www.physicsclassroom.com	Concepts of Physics
8	www.fearofphysics.com	Fundamental terms in Physics
9	https://iksindia.org	IKS

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 01/10/2024

Semester - 2, K Scheme

ELEMENTS OF ELECTRONICS**Course Code : 312309**

Programme Name/s : Electrical Engineering/ Electrical Power System
Programme Code : EE/ EP
Semester : Second
Course Title : ELEMENTS OF ELECTRONICS
Course Code : 312309

I. RATIONALE

Diploma in Electrical Engineering students need to maintain and operate electronics systems. This course deals with basic operating principles and handling of electronics devices to troubleshoot electronics circuits used in Electrical system.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Use electronic components and circuits in electrical equipment and systems

III. COURSE LEVEL LEARNING OUTCOMES (COs)

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

- CO1 - Identify various electronic components
- CO2 - Use semiconductor diodes in different applications.
- CO3 - Use semiconductor transistors in different applications.
- CO4 - Use different types of Oscillators as per requirement
- CO5 - Test operation of regulated power supply.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme			Credits	Paper Duration	Assessment Scheme								Total Marks						
				Actual Contact Hrs./Week					Theory		Based on LL & TL				Based on SL								
				CL	TL	LL			Theory			Practical		SLA									
									FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA									
				Max	Max	Max	Min	Max	Max	Min	Max	Min	Max	Min	Max	Min							
312309	ELEMENTS OF ELECTRONICS	EOE	DSC	4	-	4	2	10	5	3	30	70	100	40	25	10	25@ 10	25 10 175					

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	<p>TLO 1.1 Differentiate between given active and passive electronic components.</p> <p>TLO 1.2 Calculate value of given resistor and capacitor using colour code and printed information.</p> <p>TLO 1.3 Interpret with sketches given signal.</p> <p>TLO 1.4 Compare characteristics of given voltage and current source</p>	<p>Unit - I Electronic components and Signals</p> <p>1.1 Active and passive components</p> <p>1.2 Resistor, Capacitor, inductor, symbols, applications, colour codes, specifications</p> <p>1.3 Concept of Unipolar and Bipolar Devices.</p> <p>1.4 Classification of signals - sinusoidal, triangular and square</p> <p>1.5 Signal waveform, Time and Frequency domain, Representation, Amplitude, Frequency, phase, wavelength</p> <p>1.6 Voltage and current source Ideal and non ideal Sources Dependent voltage and current sources .</p>	<p>Chalk-Board Assignment Demonstrations Hands-on</p>

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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
2	TLO 2.1 TLO 2.1 Check the operation of the given diode TLO 2.2 TLO 2.2 Plot V-I characteristic of the given diode TLO 2.3 TLO 2.3 Describe working Principle of given type of Rectifier without and with Filter. TLO 2.4 TLO 2.4 Explain given type of wave shaping circuits	Unit - II Semiconductor Diodes 2.1 Construction, symbol, working principle, specification, applications ,types of biasing and V-I characteristic of Zener diode ,LED , Photo diode. Working principle and applications of OLED 2.2 Rectifiers- Full wave center tapped and Bridge Rectifier, circuit diagram, wave forms ,working principle . Rectifier IC KBU 808 Pin diagram and applications 2.3 Parameters of rectifier: Average DC value of current and voltage, ripple factor, PIV of diode, TUF and efficiency of rectifier. 2.4 Need of filters ,Types- C,LC,CLC,L ,circuit diagram wave forms and working principle. 2.5 Wave shaping circuits Linear and non linear wave shaping - RC integrator, RC Differentiator, Diode based Clipper circuits , Diode based Clamper. Circuits	Chalk-Board Assignment Presentations Hands-on
3	TLO 3.1 Describe the working of the given type of transistors TLO 3.2 Compare the performance of three type of transistor configurations. TLO 3.3 Solve simple numerical on Current gains. TLO 3.4 Use transistor for various applications (Amplifier and Switch). TLO 3.5 Explain working of given type of JFET and MOSFET.	Unit - III Semiconductor Transistors 3.1 Current operating Devices, Bipolar Junction Transistor- Types NPN , PNP, symbol, construction and working principle . 3.2 Need of biasing ,Types- Fixed bias and Voltage divider bias 3.3 Regions of operation and their significance - Cut off region , Active region and Saturation region 3.4 Transistor configurations: CB, CE, CC, working , comparison and applications 3.5 Transistor parameters- Alpha, Beta, Gama, Input, and output resistance, Relationship between alpha and beta, numerical on same. 3.6 Applications- Transistor as an amplifier- Small signal and power amplifier , Class A, Class B, Class C, Class AB Amplifier , Transistor as a switch , 3.7 Voltage operating devices, Construction Of JFET(N-Channel and P channel),symbol ,working principle, different parameters of JFET and applications. 3.8 MOSFET: Construction ,symbol ,working principle of Enhancement and Depletion MOSFET, and their applications.	Chalk-Board Assignment Demonstration Hands-on

ELEMENTS OF ELECTRONICS**Course Code : 312309**

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 Explain working principle of Oscillator with its need. TLO 4.2 Compare the performance of the given feedback. TLO 4.3 Explain Barkhausen's criterion. TLO 4.4 Describe working of the given type of oscillator with circuit diagram.	Unit - IV Oscillators 4.1 Oscillator: Need, Definition 4.2 Types of feedback: Positive feedback, Negative feedback. Barkhausen's criterion 4.3 Oscillator: Circuit Diagram , working and comparison of RC ,LC, and Crystal oscillator. 4.4 Types of RC oscillator- Wien bridge and RC Phase shift Oscillator Frequency calculation 4.5 Types of LC oscillator-Colpitts oscillators ,Hartley oscillators.Frequency calculation	Chalk-Board Assignment Demonstration Hands-on
5	TLO 5.1 Explain parameters of voltage regulators. TLO 5.2 Calculate output voltage of the given regulator. TLO 5.3 Check the working of the given type of regulator ICs. TLO 5.4 Explain working of SMPS.	Unit - V Regulators and power supply. 5.1 Voltage regulation Load and line regulation :Definition, formulae 5.2 Block diagram, Construction, and operation of DC Regulated power supply 5.3 Basic Zener diode as a voltage regulator. 5.4 Regulator IC's: IC's 78XX,79XX ,IC 723 as fixed, variable and Dual Regulated DC power supply 5.5 Switch mode power supply: Need, block diagram and working.	Chalk-Board Assignment Demonstration Hands-on

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 Identify active and passive components in given circuit LLO 1.2 Measure the value of given resistors on Digital Multimeter(DMM) LLO 1.3 Test Diode and LED on Digital Multimeter.	1	Identification of Active and Passive components and DMM handing.	4	CO1
LLO 2.1 Measure amplitude, time period and frequency of given signal on CRO	2	Measurement of amplitude, time period and frequency of given signal on CRO	2	CO1
LLO 3.1 Check PN junction Diode in forward bias. and Plot the V-I characteristics of PN junction diode and determine cut in voltage.	3	Check the performance of PN Junction diode.	2	CO2
LLO 4.1 Check the performance of Zener diode in forward and reverse biasing	4	* Check performance of Zener diode.	2	CO2
LLO 5.1 Build the circuit for Photo Diode and Observe the change in current with change in light intensity of the source	5	Test the performance of photo diode by varying the light intensity as well as the distance of the light source.	2	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 Construct and test half wave rectifier on breadboard .	6	* Construct and Test the half wave rectifier.	2	CO2
LLO 7.1 Prepare the circuit for Half Wave Rectifier with LC filter/ pi filter using PN junction Diode . LLO 7.2 Observe and draw input & output waveforms for sinusoidal wave .	7	*Prepare and Test the half wave rectifier with LC filter/ π filter	2	CO2
LLO 8.1 Build the circuit for Full Wave Centre Tapped Rectifier using PN junction Diode. LLO 8.2 Observe and draw input & output waveform for sinusoidal wave	8	*Build and Test the full wave rectifier using two diodes	2	CO2
LLO 9.1 Construct the circuit for Full Wave Bridge Rectifier using PN junction Diodes LLO 9.2 Observe and draw input and output waveform for sinusoidal wave	9	* Construct and Test the full wave Bridge rectifier on bread board using four diodes	2	CO2
LLO 10.1 Build the circuit for Full Wave Rectifier using PN junction Diode with LC/Pi filter LLO 10.2 Calculate ripple factor for given setup.	10	*Use LC/ π filter with full wave rectifier to measure ripple factor.	2	CO2
LLO 11.1 Prepare the circuit for full wave rectifier using IC KBU 808 with filter LLO 11.2 Observe and draw input & output waveform for sinusoidal wave.	11	* Prepare and Test the full wave rectifier on bread board using IC KBU 808 with filter.	2	CO2
LLO 12.1 Build/Test positive Clipper circuit. LLO 12.2 Build/Test negative Clipper circuit.	12	*Build clipper circuit and observe the waveforms.	2	CO2
LLO 13.1 Construct and Test Positive Clamper Circuit LLO 13.2 Construct and Test negative Clamper Circuit	13	* Construct clamper circuit and observe waveforms.	2	CO2
LLO 14.1 Identify the terminals of the PNP and NPN transistor for TO-5, TO-220, TO-66 LLO 14.2 Selection of transistor for different parameters as max. voltage, current and switching speed	14	Identify and select transistors for given application using datasheets	2	CO3
LLO 15.1 Build the circuit for BJT in common base configuration LLO 15.2 Plot input and output characteristics of common base configuration	15	Build and Test the performance of BJT in CB mode	2	CO3

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Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 16.1 Construct the circuit for BJT in common emitter configuration. LLO 16.2 Plot input and output characteristics of common emitter configuration.	16	* Construct and test the circuit for BJT in common emitter configuration.	2	CO3
LLO 17.1 Test the performance parameters of BJT as Switch LLO 17.2 Identify Cutoff and saturation regions.	17	*Test the performance parameters of BJT as Switch	2	CO3
LLO 18.1 Build the circuit for FET in common source configuration. LLO 18.2 Plot characteristics for drain to source voltage VDS verses drain current ID for different Values of VGS	18	* Check the performance of FET drain Characteristics.	2	CO3
LLO 19.1 Build the circuit for FET in common source configuration LLO 19.2 Plot characteristics for Gate to source voltage VGS verses drain current ID and calculate transconductance.	19	Test the performance of FET transfer characteristics and calculate transconductance.	2	CO3
LLO 20.1 Build the circuit and measure the frequency of given LC Oscillator circuit LLO 20.2 Build the circuit and measure the frequency of given RC Oscillator circuit	20	Measure the frequency of given Oscillator circuit	2	CO4
LLO 21.1 Test the voltages &waveforms at various Test points of regulated dc power supply. LLO 21.2 Identify the various faults in the Regulated DC power supply	21	*Find out faults at different stages of regulated DC power supply	2	CO5
LLO 22.1 Rectify the various faults in the Regulated DC power supply.	22	*Trouble shoot given DC regulated power supply	2	CO5
LLO 23.1 Build Zener voltage regulator for given voltage. LLO 23.2 Calculate load and line regulation.	23	*Build and Test the performance of Zener voltage regulator for given voltage.	2	CO5
LLO 24.1 Construct the circuit for Positive voltage regulator using 78XX IC. LLO 24.2 Calculate load and line regulation.	24	* Construct and Test the performance of Positive voltage regulator using 78XX , three terminal IC for given voltage.	2	CO5
LLO 25.1 Prepare the circuit for Dual voltage regulator using 78XX and 79XX IC LLO 25.2 Calculate load and Line regulation.	25	* Prepare and Test the performance of Dual voltage regulator using 78XX and 79XX ,three terminal IC for given voltage	2	CO5
LLO 26.1 Build LOW/High voltage regulator circuit using IC LM723. Calculate load and line regulation	26	*Test the performance of IC 723 as Regulator.	2	CO5

ELEMENTS OF ELECTRONICS**Course Code : 312309**

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 -				
<ul style="list-style-type: none"> • '*' 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**

- Transistor as switch- Build /Test transistor switch circuit on General purpose PCB for various input signals
- Diode: Build a circuit on general purpose PCB to clip a positive half cycle at 1.5 v of a waveform with input signal 5Vpp, and prepare the report
- Diode: Build a circuit on general purpose PCB to clamp a waveform at 3.0 V using diode and passive components.
- Photodiode: Build a circuit on breadboard to turn the relay on and off by using photo diode and prepare a report.
- Rectifier: Build a half wave rectifier for 6V, 500mA output current on general purpose PCB.
- Rectifier: Build a full wave bridge rectifier with capacitor filter for 6V, 500mA output current on general purpose PCB
- Using Data sheets compare various electronic parameters of different types of JFET and MOSFET.
- Transistor as switch- Build /Test transistor switch circuit on General purpose PCB for various input signals
- Transistor- Build a circuit to switch on and off the LED using BJT as a switching component
- Voltage Regulator: Build a circuit of DC regulated power supply on general purpose PCB for 9V and 500mA output
- Oscillator: Build circuit to generate audio frequency.
- Prepare display boards/models/charts to visualize the appearance of electronic active and passive components.

Assignment

- Study Different types of Rectifier ICs available.
- Study working of OLED Display.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
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ELEMENTS OF ELECTRONICS**Course Code : 312309**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Function Generator 0-2 MHz with Sine, square and triangular output with variable frequency and amplitude.	2,5,6,7,8,9,10
2	Variable DC power supply 0-30V, 2A, SC protection, display for voltage and current.	3,4,11,12,16,17,18,19
3	Lux meter 3000 Lumen. Battery operated hand held type	4
4	Cathode Ray Oscilloscope Dual Trace 20Mhz. 1 5Mega ohm Input impedance	5,6,7,8,9,10
5	Trainer Kits/Breadboard for Rectifiers, Regulators, Transistors, JFET	5,6,7,8,9,10,11,13,14,16,17,18,19
6	Digital Multimeter: 3 1/2 digit display, 9999 counts digital multimeter measures: Vae Vee (1000V max), Ade- Aae (10 amp max), Resistance (0-100 MS2). Capacitance and Temperature measurement	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	Electronic components and Signals	CO1	10	4	4	4	12
2	II	Semiconductor Diodes	CO2	14	4	6	6	16
3	III	Semiconductor Transistors	CO3	14	4	6	6	16
4	IV	Oscillators	CO4	12	4	4	6	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)**

- Each practical will be assessed considering 60% weightage to process and 40% product based on the nature of practicals.
- Two formative assessment tests 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

ELEMENTS OF ELECTRONICS**Course Code : 312309**

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	-	1	1	2	-	2			
CO3	2	1	1	1	2	1	2			
CO4	2	1	1	1	2	1	2			
CO5	2	1	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	V.K. Mehta ,Rohit Mehta	Principles of Electronics	S.Chand and Company Ram Nagar, New Delhi-110 055,11th edition 2014, ISBN 9788121924504
2	B.L.Theraja	Basic Electronics	S. Chand Publishing, 2007,ISBN:9788121925556
3	R.S.Sedha	A textbook of Applied Electronics	S Chand, New Delhi 2008, ISBN:978-8121927833
4	Mottershead,Allen	Electronic Devices and Circuit: An introduction	Goodyear Publishing Co. New Delhi ISBN: 9780876202654
5	Horowitz, Paul Hill, Winfield	The Art of Electronics	Cambridge University Press, New Delhi 2015 ISBN: 9780521689175
6	Bell, David	Fundamentals of Electronic Devices and Circuits	Oxford University Press, International edition, USA,2015,ISBN:9780195425239
7	Vijay Baru, Rajendra Kaduskar, Sunil T. Gaikwad	Basic Electronic Engineering	Dreamtech press,New Delhi,2015,ISBN:9789350040126

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.youtube.com/watch?v=Fwj_d3uO5g8	Diodes
2	http://www.eleccircuit.com	Electronic circuit
3	https://www.electroschematics.com/tools/	Electronic tools
4	www.futurlec.com	Electronic tools/components
5	www.alldatasheet.com	Datasheets
6	www.nptel.iitm.ac.in	Electronic circuits
7	www.electronics-tutorials	Electronic circuits
8	https://www.learningaboutelectronics.com/	Voltage Regulator

ELEMENTS OF ELECTRONICS**Course Code : 312309**

Sr.No	Link / Portal	Description
9	https://www.animations.physics.unsw.edu.au/	Electronic tools/components/Circuit

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

MSBTE Approval Dt. 01/10/2024**Semester - 2, K Scheme**

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310****Programme Name/s : Electrical Engineering/ Electrical Power System****Programme Code : EE/ EP****Semester : Second****Course Title : FUNDAMENTAL OF ELECTRICAL ENGINEERING****Course Code : 312310****I. RATIONALE**

Technologists in electrical engineering are expected to handle electrical machines, instruments, devices and equipment. The basic aim of this course is that, the student must understand the basic concepts, principles and laws of electric and magnetic circuits and practical thereof. The basic aim of this course is that the student must develop the basic concepts, fundamental laws of electric circuits, magnetic circuits,electromagnetic induction, Capacitors, Batteries and practical thereof. This course will enable the students to apply the fundamental concepts of electrical engineering to understanding of other higher level subjects in further study.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Apply basic principles of electrical engineering to solve the simple electrical engineering problems.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

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

- CO1 - Determine various parameters used in electric circuit.
- CO2 - Use basic laws of electrical engineering in D.C. Circuits.
- CO3 - Use capacitor and battery in electrical circuits.
- CO4 - Use principles of magnetism in Magnetic Circuits.
- CO5 - Apply Laws of electromagnetism in electrical circuit and systems.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme				Credits	Paper Duration	Assessment Scheme								Total Marks								
				Actual Contact Hrs./Week			SLH			Theory			Based on LL & TL				Based on SL									
				CL	TL	LL				Theory		Practical		FA-PR		SA-PR										
										FA-TH	SA-TH	Total	FA-PR	SA-PR	SLA											
				Max	Max	Max	Max	Min	Max	Max	Min	Max	Min	Max	Min	Max	Min									
312310	FUNDAMENTAL OF ELECTRICAL ENGINEERING	FEE	DSC	4	-	4	2	10	5	3	30	70	100	40	25	10	25#	10	25	10	175					

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310****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 Interpret the given electric parameters. TLO 1.2 Explain the given terms of electric circuit. TLO 1.3 Explain the given effect of the electric current TLO 1.4 Calculate work, power and energy for the given circuit.	Unit - I Basic Electrical Parameters 1.1 Direct Current (DC), Alternating Current (AC), Voltage Source and Current Source: Ideal and Practical. 1.2 Electric Current, Electric Potential, Potential Difference(PD), Electro-Motive Force(EMF) 1.3 Electrical Work, Power and Energy. 1.4 Resistance, Resistivity, Conductivity, Effect of Temperature on Resistance 1.5 Types of Resistor and their application 1.6 Heating Effect, Magnetic Effect, Chemical Effect of Electric current	Chalk-Board Presentations Demonstration Model Demonstration Video Demonstrations
2	TLO 2.1 Apply Ohm's law to calculate internal resistance of the given circuit. TLO 2.2 Calculate equivalent resistance for the given circuit. TLO 2.3 Categorize the given type of network TLO 2.4 Apply the Kirchhoff's current law and Kirchhoff's voltage law to calculate the electrical quantities in the given circuit.	Unit - II D.C. Circuits 2.1 Ohm's Law, Internal resistance of source, internal voltage drop, Terminal Voltage. 2.2 Resistance in Series, Resistance in Parallel. (theory and numerical) 2.3 Active, Passive, Linear, Non-linear Circuit, Unilateral Circuit and Bi-lateral Circuit, Passive and Active Network, Node, Branch, Loop, Mesh. 2.4 Comparison of Kirchhoff's Current Law, Kirchhoff's Voltage Law (Simple numericals).	Chalk-Board Demonstration Video Demonstrations Presentations

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310**

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 construction of the given type of capacitor. TLO 3.2 Explain the working of the capacitor in the given circuit. TLO 3.3 Calculate equivalent capacitance in the given D.C. circuit. TLO 3.4 Define Battery and state its types and connections TLO 3.5 Plot charging and discharging curves for the given capacitor and battery.	Unit - III Capacitors and Battery 3.1 Capacitor, it's construction, Parallel Plate Capacitor 3.2 Various connections of capacitor. 3.3 Energy Stored in Capacitor. 3.4 Charging and Discharging of Capacitor. 3.5 Breakdown voltage and Di-electric strength. 3.6 Applications of Capacitor 3.7 Types of battery, Construction, series and parallel connection of Battery 3.8 Charging and Discharging of Capacitor and battery	Chalk-Board Video Demonstrations Presentations Model Demonstration Hands-on
4	TLO 4.1 Interpret the terms related to a magnetic circuit. TLO 4.2 Calculate various parameters of the given magnetic circuit. TLO 4.3 Compare the series and parallel magnetic circuit based on the given criteria. TLO 4.4 Plot B-H curve and hysteresis loop of the given magnetic materials.	Unit - IV Magnetic Circuits 4.1 Magnetic lines of force, Flux, Flux density, Magnetic flux intensity. 4.2 Magneto-Motive-Forces (MMF), Ampere Turns (AT), Reluctance, Permeance, Reluctivity. 4.3 Electric and Magnetic circuit: Series Magnetic and Parallel Magnetic Circuit. 4.4 Magnetization Curve (B-H Curve) 4.5 Magnetic Hysteresis, Hysteresis Loop, Applications.	Chalk-Board Video Demonstrations Demonstration Model Demonstration Presentations
5	TLO 5.1 Describe the use of Faraday's laws of electromagnetic induction in the given application. TLO 5.2 Distinguish between the given type of e.m.fs. TLO 5.3 Apply Faraday's laws to calculate induced e.m.f. in the given circuit. TLO 5.4 Calculate self-inductance and energy stored in the magnetic field of the given circuit.	Unit - V Electromagnetic Induction 5.1 Development of Induced e.m.f. and Current, Faraday's Laws of Electromagnetic Induction. 5.2 Static and dynamic emf, Lenz's Law, Fleming's Right hand rule 5.3 Self Inductance, Coefficient of Self-inductance (L), Mutual inductance, Coefficient of Mutual inductance (M), self induced e.m.f. and mutually induced e.m.f, Coefficient of Coupling. 5.4 Inductance in series 5.5 Types of inductor, their application and Energy Stored in Magnetic Field	Chalk-Board Model Demonstration Video Demonstrations 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 *Draw layout of Electrical Engineering laboratory.	1	Preparation of Layout of Electrical Engineering Laboratory.	2	CO1
LLO 2.1 *Operate the fire extinguishers and prepare charts of the safety rules to be followed in the electrical lab	2	Operation of fire extinguisher and preparation of safety rules charts	2	CO1

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 3.1 *Use relevant electric tools for various applications	3	Check lab supply system and make use of relevant electric tools for various applications.	2	CO1
LLO 4.1 *Verify Ohm's Law	4	Verification of Ohm's Law	2	CO1 CO2
LLO 5.1 *Able to connect and read multi range analog meters (Ammeter, Voltmeter)	5	Read analog meters for measurement of various electrical quantities in AC/DC circuits.	2	CO1
LLO 6.1 *Operate Multimeter and Clip-On meter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit.	6	Use of Multimeter and Clip-On meter for the measurement of AC/DC Current, Voltage and Resistance in the given circuit	2	CO1 CO2
LLO 7.1 *Check frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO	7	Measurement of frequency, Time period, Peak Value and Average Value of the given A.C. wave on CRO.	2	CO1 CO2
LLO 8.1 *Verify Kirchoff's Voltage Law	8	Verification of Kirchoff's Voltage Law	2	CO1
LLO 9.1 *Verification of Kirchoff's Current Law.	9	Verification of Kirchoff's Current Voltage Law	2	CO1 CO2
LLO 10.1 **Use rheostat as current regulator and potential divider.	10	Use of rheostat as current regulator and potential divider	2	CO1 CO2
LLO 11.1 *Determine PD,EMF and internal resistance of DC source .	11	Determination of PD,EMF and internal resistance of DC source .	2	CO1 CO2
LLO 12.1 *Verify the properties of circuit of series connected resistance.	12	Verification of parameters of two/three resistances connected in series connection.	2	CO1 CO2
LLO 13.1 *Verify the properties of circuit of parallel connected resistance.	13	Verification of parameters of two/three resistances connected in parallel connection.	2	CO1 CO2
LLO 14.1 Determine the time constant (RC) by plotting the charging curves of a capacitor(C) through resistor (R)	14	Plot the charging characteristics of capacitor and find the time constant (RC).	2	CO1 CO3
LLO 15.1 Determine the time constant (RC) by plotting the discharging curves of a capacitor(C) through resistor (R)	15	Plot the discharging characteristics of capacitor and find the time constant (RC).	2	CO1 CO3
LLO 16.1 * Find the equivalent capacitance in the series connected circuits	16	Verification of the equivalent capacitance in series connected circuits	2	CO1 CO3
LLO 17.1 *Find equivalent capacitance of the parallel connected circuits	17	Verification of equivalent capacitance of the parallel connected circuits	2	CO1 CO3
LLO 18.1 Determine the Rise characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	18	Plot the Rise characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	2	CO1 CO4
LLO 19.1 Determine the Decay characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	19	Plot the decay characteristics of Electric current in a circuit consisting of resistance and inductance in the circuit.	2	CO1 CO4
LLO 20.1 *Find B-H curve for the given magnetic material	20	Plot B-H curve for the given magnetic material.	2	CO4

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 21.1 *Obtain magnetization curve for magnetic material	21	Plot magnetization curve for magnetic core	2	CO4
LLO 22.1 *Plot Hysteresis Loop for the given transformer coil	22	Study of Hysteresis loop for the given transformer coil	2	CO4
LLO 23.1 *Verify Faraday's Law of Electromagnetic Induction (Statically Induced EMF)	23	Verification of Faraday's Law of Electromagnetic Induction (Statically Induced EMF)	2	CO4 CO5
LLO 24.1 *Verify Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF)	24	Verification of Faraday's Law of Electromagnetic Induction (Dynamically Induced EMF)	2	CO4 CO5
LLO 25.1 Verify Fleming's Right Hand Rule	25	Verification of Fleming's Right Hand Rule	2	CO4 CO5
LLO 26.1 Verify Fleming's Left Hand Rule	26	Verification of Fleming's Left Hand Rule	2	CO4 CO5
LLO 27.1 *Determine Charging and discharging Curves of Battery.	27	Plot the Charging and discharging Curves of Battery	2	CO1 CO3

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**

- a. Types of Electrical equipment: Prepare chart showing real-life examples indicating various types of electrical equipment.
- b. Resistance: Collect samples of resistors and prepare models of simple series circuit and parallel circuit.
- c. Capacitance: Collect samples of capacitors and prepare models of simple series circuit and parallel circuit.
- d. Inductance: Collect samples of inductors and prepare models of simple series circuit and parallel circuit.
- e. Batteries : Collect samples and specifications of various batteries of different make and prepare chart of the same.
- f. EV-Batteries : Collect samples and specifications of various EV-batteries of different make and prepare chart of the same.
- g. Connect battery in series connection and measure voltage across each battery and total voltage .
- h. Connect battery in parallel connection and measure voltage across each battery and total voltage

Assignment

- a. Numerical based on Voltage and Current Source.
- b. Numerical based on Resistance, Resistivity, Effect of temperature on Resistance.
- c. Numerical based on Equivalent Resistance of Series and Parallel connection of Resistances in given D.C. Circuits.
- d. Numerical based on Equivalent Capacitance in given D.C. Circuits.
- e. Numerical based on calculation of various parameters of given magnetic circuit.
- f. Numerical based on calculation of self Inductance.
- g. Numerical based on Energy Stored in Magnetic Field.

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310****Suggested Student Activity**

- a. Illustrate situations wherein electrical energy is required.
- b. Prepare models in the form of mini-projects.
- c. Prepare power point presentation related to basics of electrical engineering.
- d. Prepare a chart of electric circuit elements and relevant industrial application.
- e. Prepare question bank referring old MSBTE question papers.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Electrical Drawing of the Laboratory	1
2	1.EMF source: Ampere:0-1A, Voltage:0-20V ,1 No. 2.Voltmeter Suitable voltage1 No. 3.Ammeter: Suitable current1 No. 4.Rheostat : Suitable load in ohm,1 No. 5. Resistive Load,1No	10
3	1.EMF source: Ampere=0-1A ,Voltage=0-20V ,1 No. 2 Voltmeter: Suitable Voltage range,2 No. 3 Ammeter: Suitable current range,1 No 4 Series resistance: Suitable resistance in ohm,2 No.	12
4	1.EMF source: Ampere:0-1A ,Voltage:0-20V ,1 No. 2 Voltmeter: Suitable Voltage range,2 No. 3 Ammeter: Suitable current range,1 No. 4 Parallel resistance: Suitable resistance in ohm,2 No.	13
5	1.EMF source: Ampere=0-1uA, Voltage=0-20V,1 No. 2.Voltmeter: Suitable voltage,1 No. 3. Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No.	14
6	1.EMF source: Ampere=0-1uA, Voltage=0-20V,1 No. 2.Voltmeter: Suitable voltage,1 No. 3. Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No.	15

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
7	1.EMF source: Ampere=0-1A, Voltage=0-20V :1 No. 2.Voltmeter : Suitable Voltage,1 No. 3.Ammeter :Suitable Current,1 No. 4.Capacitor:Suitable Capacitor in Farad ,3 No.	16
8	1.EMF source: Ampere=0-1A, Voltage=0-20V :1 No. 2.Voltmeter : Suitable Voltage,1 No. 3.Ammeter :Suitable Current,1 No. 4.Capacitor:Suitable Capacitor in Farad ,3 No.	17
9	1.Battery or D.C. Supply: Suitable Range 2. Single Pole Two Way Switch 3. Multi-meter 4. Stopwatch 5.A Choke Coil or a resistor in series with inductor	18
10	1.Battery or D.C. Supply: Suitable Range 2. Single Pole Two Way Switch 3. Multi-meter 4. Stopwatch 5.A Choke Coil or a resistor in series with inductor	19
11	Fire Extinguisher Kit	2
12	1.EMF source: Ampere: 0-1A, Voltage:0-300V ,1 No. 2. Voltmeter: Suitable voltage:1 No. 3.Ammeter: Suitable current: 1 No. 4.Inductive coil: Suitable inductor,1 No.	20
13	1.EMF source: Ampere: 0-1A, Voltage:0-300V ,1 No. 2. Voltmeter: Suitable voltage:1 No. 3.Ammeter: Suitable current: 1 No. 4.Inductive coil: Suitable inductor,1 No.	21
14	1:EMF source: Ampere: 0-1A, Voltage:0-300V ,1 No. 2:Voltmeter:Suitable Voltage,1 No. 3:Ammeter: Suitable current,1 No. 4.Transformer :(0.5/1kVA)Suitable transformer,1 No.	22
15	1.EMF source : Ampere:0-1A, Voltage:0-300V ,1 No. 2.Voltmeter : Suitable voltage,1 No. 3.Ammeter: Suitable current,1 No. 4.Inductive coil :Suitable Inductor 1 No.	23
16	1.EMF source: Ampere=0-1A, Voltage:0-300V ,1 No. 2.Voltmeter:Suitable Voltage,1 No. 3.Ammeter :Suitable current,1 No. 4.Inductive coil: Suitable inductor,1 No.	24
17	1.DC Generator: Suitable rating,1No	25
18	1.DC motor: Suitable motor:1No	26
19	1.EMF source: Ampere=0-1uA, Voltage=0-20V,1 No. 2.Voltmeter: Suitable voltage,1 No. 3. Ammeter: Suitable current,1 No. 4.Capacitors: Suitable capacitor,1 No. 5.Resistance: Suitable resistance ,1 No. 6.Stop watch: Suitable stop watch 1 No. 7. Suitable EV-Battery Data	27

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310**

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
20	Stripper, Hammer, Plier, Nose Plier, Multi-meter, tester, Tachometer, Megger, Standard Wire Gauge crimping tool, wire gauge etc	3
21	Rheostat (0-90 Ohm, 5A), Nichrome wire wound rheostat on epoxy resin or class F insulating tube with two fixed and one sliding contact, DC Source, Milliammeter	4
22	Lugs, Wire crimping tool, Soldering Gun, Banana clips	5
23	Multi-meter, Clip -On Meter, Ammeter, Voltmeter, Rheostat, etc	6
24	1. CRO with probe, 10Hz-30MHz, 1No 2. Rheostat of suitable rating 3. Autotransformer of suitable rating	7
25	1. D.C. Dual Power Supply, 1No 2. D.C. Voltmeter of Suitable Range, 3No 3. Rheostat of Suitable Range, 3No	8
26	1. Rheostat of suitable range, 3 No 2. D.C. Dual Power Supply, suitable range, 1 No 3. D.C. milli-Ammeter, suitable range, 3 No	9

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	Basic Electrical Parameters	CO1	10	2	6	4	12
2	II	D.C. Circuits	CO2	12	4	6	4	14
3	III	Capacitors and Battery	CO3	12	4	6	4	14
4	IV	Magnetic Circuits	CO4	12	4	4	6	14
5	V	Electromagnetic Induction	CO5	14	4	4	8	16
Grand Total				60	18	26	26	70

X. ASSESSMENT METHODOLOGIES/TOOLS**Formative assessment (Assessment for Learning)**

- Two unit tests of 30 marks will be conducted and average of two unit tests considered.
- For formative assessment of laboratory learning 25 marks.
- Each practical will be assessed considering appropriate % weightage to process and product and other instructions of assessment.

Summative Assessment (Assessment of Learning)

- End semester summative assessment of 25 marks for laboratory learning.
- End semester assessment of 70 marks through offline mode of examination.

XI. SUGGESTED COS - POS MATRIX FORM

FUNDAMENTAL OF ELECTRICAL ENGINEERING**Course Code : 312310**

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	-	-	2			
CO2	3	1	1	1	1	-	2			
CO3	3	1	1	2	2	-	2			
CO4	3	1	1	2	2	-	2			
CO5	3	1	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	Theraja, B. L. Theraja, A. K.	A Text Book of Electrical Technology Vol-I	S.Chand and Co. New Delhi 2014 ISBN: 9788121924405
2	Mittle, V. N.	Basic Electrical Engg.	Tata McGraw-Hill, New Delhi ISBN : 978-0-07-0088572-5
3	Hughes, Edward	Electrical Technology	Pearson Education, New Delhi ISBN-13: 978-0582405196
4	S. B. Lal Seksena and Kaustuv Dasgupta	Fundamentals of Electrical Engineering Part-1	Cambridge University Press, New Delhi ISBN : 9781107464353
5	Jegathesan V., Vinod Kumar K., Saravanakumar R.	Basic Electrical and Electronics Engineering	Wiley India, New Delhi 2014 ISBN : 97881236529513
6	Husain Ashfaq	Fundamentals of Electrical Engineering	Dhanpat Rai & Co. (p) Ltd-delhi, ISBN: 978-817700436

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.electrical4u.com/electrical-engineering-articles/basic-electrical/	Basic Electrical Parameters
2	https://en.wikipedia.org/wiki/Capacitor	Capacitor
3	https://www.corsi.univr.it/documenti/OccorrenzaIns/matdid/ma_tdid441904.pdf	D.C. Circuits
4	https://www.slideshare.net/ChetanPatil396/basic-electrical-parameters-basic-electrical-engineering	Basic Electrical Parameters
5	https://www.britannica.com/science	Magnetic Circuits
6	https://en.wikipedia.org/wiki/Magnetic_circuit	Magnetic Circuits
7	https://en.wikipedia.org/wiki/Electromagnetic_induction	Electromagnetic Induction
8	https://youtu.be/XT-UmPviH64?si=MLIZBB5BgOA2SWBk	Electromagnetic Induction
9	https://youtu.be/M-QfX2fvpp4?si=xpZDAiX3-7xrnnr	Basics Magnetic Circuits

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Sr.No	Link / Portal	Description
10	https://archive.nptel.ac.in/courses/117/106/117106108/	Basic Electrical Circuits
11	https://en.wikipedia.org/wiki/Electric_battery	Battery

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

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