

Vision

To be a premier department for education in Mechanical Engineering in Jharkhand State, moulding students into professional diplomats with ethical values as per the need of stake holders.

Mission

- ✚ **M1:** To provide teaching/learning facilities in Mechanical Engineering for easy adaptation to industry and higher learning
- ✚ **M2:** Provide a platform for self-learning to meet the challenges of changing technology and inculcate Ethical values, team spirit and leadership qualities to succeed in professional career.
- ✚ **M3:** Comprehend the societal needs and environmental concerns in the field of Mechanical engineering

Programme Educational Objectives (PEOs)

1. Analyze, design and solve problems related to Mechanical Engineering and adapt to changes in technology by self-learning.
2. Work effectively as individuals and in a team, exhibiting leadership qualities to meet the goals of a project or the organization.
3. Work with professionalism and concern for environment to meet the societal needs.
4. Engage in higher learning leading to degrees or certifications.

PROGRAM OUTCOMES (POs)

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

**Syllabus for Automobile Engg./ Mechanical Engg./
Metallurgical Engg./ Mechanical Engg. (Automobile)**

Project Management Skills

RATIONALE

Project Management is a confluence of Management principles and Engineering subject area. This course enables the students to develop conceptualization of Engineering Management principles and apply the same for their engineering projects, in their domains, example, Software Development project or Construction Project and so on. The course integrates three core areas of Planning, Execution and Auditing of Projects.

1. COURSE SKILL SET

Student will be able to:

1. Understand what constitutes a project, Plan for the execution of the project by breaking into manageable work units, and Prepare necessary project artifacts
2. Track and control the Project while preparing verifiable records for Project Inspections and Audits
3. Inspect and Audit projects for Milestones or other project completion criteria and other metrics, Defects and remediation, Project learnings
4. Gain knowledge and develop curiosity on latest technology trends in Project management

2. COURSE OUT COMES

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

CO1	Apply the concepts of Project Management to real projects which are expressed in the form of the Project reports or Engineering drawings
CO2	Estimate Project resources needed Time, Material and Effort, and Plan for Execution
CO3	Understand, analyze and assess the risks involved in a project and plan for managing them
CO4	Use Project Management Software and processes to track and control Projects
CO5	Conduct inspection of Projects and audit progress and bills
CO6	Understand the Digital Technology trends in Project management and concepts like Smart cities

3. DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets.

UNIT NO	Unit skill set (In cognitive domain)	Topics / Subtopics	Hours L-T-P
1. Introduction	Use Basic Science, Maths skills to understand Project management and project planning, execution and control.	Introduction and definition, Features of a Project, Types of Projects, Benefits and Obstacles in Project Management, Project Management Profession, Role of Project manager, Consultants, Project and Operation, Project Management Process, Project Scope	
2 Project Administration	Able to develop WBS, PEP and PM processes for Project with given inputs	Project Administration, Project Team, Project Design, Work Breakdown Structure (WBS), Project Execution Plan (PEP), Systems and Procedure Plan, Project Direction, Communication and Coordination, Project Success	
3. Project Lifecycle	Use project administration and project lifecycle knowledge to Assess and plan for project risk	Project Life Cycle, Phases - Project Planning, Project Execution, Project Closure, Project Risks, Project Cost Risk Analysis, Time and Cost overruns	
4. Project Planning, Project Scheduling and Project Monitoring and Implementation	Able to develop a detailed project plan given the inputs on manpower, funds availability and time availability	Project Planning Function, Structure, Project Scheduling, Project monitoring and Project evaluation	
5. Project Control, Review and Audit	Use Project Management lifecycle knowledge to Control project parameters, review and audit project performance	Project Control, Problems of Project Control, Gantt Charts, Milestone Charts, Critical Path Method (CPM), Network Technique in Project Scheduling, Crashing Project Duration through Network, Project Review, Initial Review, Performance Evaluation, Abandonment Analysis, Project Audit	

6.Digital Project Management	Understand latest trends of digital technologies impacting the domain of project management and application of the same in multiple scenario	Digital Technology trends in Project management, Cloud Technology, IoT, Smart cities, Data and analytics, case studies	
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4. MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	UNIT Linked	CL R/U/A	Sessions in Hrs	TOTAL - Marks
CO1	Understand the concepts of Project Management in relation to real projects which are expressed in the form of the Project reports or Engineering drawings					
CO2	Estimate Project resources needed Time, Material and Effort, and Plan for execution					
CO3	Evaluate the risks involved in a project and Plan for managing them					
CO4	Use Project Management methods with Software and/or processes to track and control Projects					
CO5	Conduct inspection of Projects and audit progress and bills					

C06	Understand the Digital Technology trends in Project management, and Engineering Industries					

	CO's	Programme Outcomes (PO s)						
		1	2	3	4	5	6	7
Project Management	C01							
	C02							
	C03							
	C04							
	C05							
	C06							
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped								

5. SUGGESTED LEARNING RESOURCES:

Sl No.	Author	Title of Books	Publication/Year
1	Dr. Lalitha Balakrishnan & Dr. Gowri Ramachandran	Project Management	Himalaya Publishing, 2019
2	Shailesh Kumar Shivakumar	Complete Guide to Digital Project Management	Apress, 2019
3	Prasanna Chandra	Project planning, analysis, selection, implementation and review	Tata McGraw Hill
4	Gopala Krishnan	Project Management	Mcmillan India Ltd.

STATISTICS AND ANALYTICS

RATIONALE

Statistics and analytics help the learner to use the proper methods to collect the data, employ the correct analyses, effectively present the results and conduct research, to be able to read and evaluate journal articles, to further develop critical thinking and analytic skills, to act as an informed consumer and to know when you need to hire outside statistical help. The python language is one of the most accessible programming languages available because it has simplified syntax and not complicated, which gives more emphasis on natural language.

COURSE OUT COMES

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

CO1	Understand the tools of data collection, classification and cleaning of data.
CO2	Able to summarize the given statistical data
CO3	Understand the measure of location and dispersion of data.
CO4	Learn the basics of Python programming.

DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill Sets for achieving CO to attain identified skill sets.

UNIT NO	Unit skill set (In cognitive domain)	Topics/Subtopics	Hours L-T-P
UNIT-1 STATISTICAL DATA COLLECTION AND TYPES	➤ Able to collect statistical data. ➤ Able to distinguish the data types. ➤ Understands the usage of data collection tools ➤ Able to specify problem statement for data collection ➤ Able to collect data pointing the root cause of the problem statement.	- a Definition of data and classification (qualitative quantitative discrete and continuous data). - b Data collection tools i) Questionnaires. ii) Survey. iii) Interviews. iv) Focus group discussion. 1.3 Data cleaning.	
UNIT-2 SUMMARIZATION OF DATA	➤ Sketches bar, pie and histograms on Microsoft Excel spread sheet. ➤ Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread sheet. ➤ Sketches bar, pie and histograms on Microsoft Excel spread sheet. ➤ Sketches frequency curve and frequency polygon for the data set on Microsoft Excel spread	- a Descriptive statistics i. Data tabulation(frequency table ii. Relative frequency table. - b Grouped data i. Bar graph ii. Pie chart iii. Line graph iv. Frequency polygon v. Frequency curve vi. Relative frequency polygon vii. Histograms viii. Box plot ix. Leaf-stem plot To be done in Microsoft excel.	

	sheet.		
UNIT-3 MEASURE OF LOCATION AND DISPERSION	➤ Able to determine the descriptive statistical variables using Microsoft Excel. ➤ Able to determine the absolute measures of dispersion of the given data set. ➤ Explain the symmetry and asymmetry of the distributed data.	- a Determination of central tendencies Range, Mean, Mode and Median for the data in Microsoft excel. - b Determination of absolute measures of dispersion for data like range quartile deviation, mean deviation, standard deviation and variance in Microsoft Excel. - c Skewness and kurtosis graphs in Microsoft excel and interpretations of results.	

UNIT-4 INTRODUCTION TO PYTHON PROGRAMMING	➤ Able Install and run the Python interpreter. Create and execute Python programs. ➤ Understand the concepts of file I/O. ➤ Able to read data from a text file using Python. ➤ Learn variable declarations in Python. ➤ Learn control structures. ➤ Learn Loop Constructs.	4.1 Introduction to PYTHON. 4.2 Syntax of PYTHON. 4.3 Comments of PYTHON. 4.4 Data types of PYTHON. 4.5 Variables of PYTHON. 4.6 If-else in PYTHON. 4.6 Loops in PYTHON. 4.7 Arrays and functions in PYTHON.	
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STATISTICS AND ANALYTICS LAB

SL NO	Practical outcomes/Practical exercises	Unit no	PO	CO	L:T:P
	Learn loop constructs.				
1	Prepare a questionnaire (closed end) containing 25 questions for a specified problem statement: for example experience of an individual in a restaurant.	1			
2	Prepare a Google form for a specified problem statement to collect the dataset. (for example questionnaire to conduct online quiz)	1			
3	Send out a survey on your problem statement to number of 50 (By Google forms) and collect the data.	1			
4	Remove duplicate or irrelevant observations. Remove unwanted observations from the dataset provided, including duplicate observations or irrelevant observations.	1			
5	In Microsoft Excel spread sheet draw the frequency distribution table for the given data (data set should contain minimum 50 data).	2			
6	In Microsoft Excel spread sheet draw the relative frequency distribution table for the given data (data set should contain minimum 50 data).	2			
7	Using Microsoft Excel spread sheet plot bar graph for the data collected from 100 people(for example, conduct a survey on the favorite fruit of a person in your locality(restricting to 5 to 6 fruits). Explain the bar graph with minimum 30 words.	2			
8	Using Microsoft Excel spread sheet plot pie chart for the data collected from 50 people(for example, conduct a survey on the smokers with respect to their ages in your locality. Explain the pie chart with minimum 30 words.	2			
9	Using Microsoft Excel spread sheet draw a line graph for the given dataset.	2			
10	Using Microsoft Excel spread sheet draw frequency polygon and frequency curve for the data collected from 50 people. (For example, marks obtained by the students in your class in 5 subjects in previous examination). Explain your observations from the graph in minimum 30 words.	2			

11	Using Microsoft Excel spread sheet construct a box plot for the given dataset. (For example dataset can be the number of passengers in a flat form at different time in a day).	2			
12	Using Microsoft Excel spread sheet construct a leaf plot for the given dataset. Explain the graph with minimum 30 words.	2			
13	Using Microsoft Excel spread sheet find the Mean, Mode and Median for the data (univariate data) given and also represent them in a Histogram.	3			
14	Generate a 50 random data sample (even and odd number dataset) using Microsoft Excel spread sheet and determine the range and Quartiles.	3			
15	Collect the current yield of a crop from 50 different persons (problem statement can be changed according	3			
	to priorities of the tutor) in your locality and determine mean deviation and Quartile deviation in Microsoft excel spread sheet and brief your inference with less than 30 words.				
16	Collect the data of any 2 livestock population from 50 different houses in your locality (problem statement can be changed according to priorities of the tutor) and determine standard deviation for both the two separately in Microsoft excel spread sheet and brief your inference with less than 30 words.	3			
17	Collect the data of two wheeler (with a rider and a pillion) crossing a busy junction in your locality in the peak hours (problem statement can be changed according to priorities of the tutor) and determine the variance of the data in Microsoft excel spread sheet and brief your inference with less than 30 words.	3			
18	Using Microsoft Excel spread sheet draw a Skewness graph and kurtosis graph for randomly generated dataset.	3			
20	Write a python program to add 2 integers and 2 strings and print the result.	4			
21	Write a python program to find the sum of first 10 natural numbers.	4			
22	Write a python program to find whether the number is odd or even.	4			
23	Write a python program to find the variance and standard deviation for the given data..	4			
24	Write a python program to display student marks from the record.	4			
25	Write a python program to create a labeled bar graph using matplotlib. pyplot.	4			

26	Write a python program to create a labeled pie chart using matplotlib. pyplot.				
Total Hours					

MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Tutorial & Practical Sessions in Hrs.	TOT AL
CO1	Understand the tools of data collection, classification and cleaning of data.				
CO2	Able to summarize the given statistical data				
CO3	Understand the measure of location and dispersion of data.				
CO4	Learn the basics of Python programming.				

Course	CO's	Programme Outcomes (PO's)						
Statistics & Analytics	CO1							
	CO2							
	CO3							
	CO4							
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

SUGGESTED LEARNING RESOURCES:

1. Statistical Analysis with Excel For Dummies (For Dummies Series) Paperback Import, 9 April 2013 by [Joseph Schmuller](#) (Author)
2. <https://www.brianheinold.net/python/A Practical Introduction to Python ProgrammingHeinold.pdf>
3. http://www.bikeprof.com/uploads/9/0/6/5/9065192/excel_stats_handout_npl.pdf
4. <https://adminfinance.umw.edu/tess/files/2013/06/Excel-Manual1.pdf>
5. <https://www.brianheinold.net/python/A Practical Introduction to Python ProgrammingHeinold.pdf>
6. Introduction to Python programming for beginners by Vivian Baily Kindle edition.
7. PYTHON PROGRAMMING: Python programming: the ultimate guide from a beginner to expert by Clive Campbell.
8. Open source for python: <https://hub.gke2.mybinder.org/user/jupyterlab-jupyterlab-demo-zfkdw4y/lab>

FUNDAMENTALS OF ELECTRICAL & ELECTRONICS ENGINEERING

1. RATIONALE

Fundamentals of Electrical and Electronics Engineering is essential for all streams of diploma engineering to work in any industry as it covers basic electrical safety, troubleshooting and repairing of simple electrical systems. Basic knowledge of electrical wiring circuits, protective devices, electrical machines and basic electronics devices is required to work in any engineering field.

2. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences

1. Perform and test domestic wiring
2. Can operate electrical machine
3. Test different electronics devices

3. INSTRUCTIONAL STRATEGY

1. Expose to different learning tools used in respective labs, Operational safety and Procedure to be followed in the laboratory.
2. Instructor should give examples from daily routine as well as, engineering/technology applications on various concepts and principles in each topic so that students are able to understand and grasp these concepts and principles. In all contents, SI units should be followed.
3. Activity- Theory - Demonstrate/practice approach may be followed throughout the course so that learning may be skill and employability based.

4. COURSE OUT COMES

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

C01	Comply with the safety procedures
C02	Apply the fundamentals of electricity.
C03	Install and test electrical wiring system.
C04	Identify and Operate electrical machines, Batteries and UPS.
C05	Identify and test the different electronic devices.

5. COURSE TOPICS:

Unit No	Unit Name	Hours
1	Electrical Safety	6
2	Electrical Fundamentals	15
3	Protective Devices and Wiring circuits	15
4	Electric Machines and Batteries and UPS	15
5	Introduction to Electronic Devices and Digital Electronics	27
	Total	78Hr

6. COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Sl No	Unit skill set (In cognitive domain) <i>On successful completion of the class, the students will be able to</i>	Topics/Sub topics	Practical	Hours L-T-P
UNIT-1 Electrical Safety				
1	Comply with the Electrical safety	1. Electrical Symbols 2. Electrical safety - Identify Various types of safety signs and what they mean - Demonstrate and practice use of PPE - Demonstrate how to free a person from electrocution - Administer appropriate first aid to victims, bandaging, heart attack, CPR, etc. - Fire safety, causes and precautionary activities. - Use of appropriate fire extinguishers on different types of fires. - Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency - Inform relevant authority about any abnormal situation http://nreeder.com/Flash/symbols.m http://bouteloup.pierre.free.fr/iufm/as/de/house/safety.html	1. Electrical symbols related to electrical engineering. 2. Electrical safety	

UNIT-2 Electrical Fundamentals				
2	1. Identify and select the different measuring devices. 2. Identify different electrical supply systems 3. Identify open circuit, close circuit and short circuit conditions.	1. Describe the sources of electrical energy. 2. Electrical current, voltage, emf, potential difference, resistance with their SI units. 3. Mention the meters used to measure different electrical quantities. 4. Explain supply systems like AC, DC. 5. Describe open circuit, close circuit and short circuit http://nreeder.com/Flash/units.htm	1. Identification of measuring devices. 2. Measure current, voltage and analyses the effects of shorts and opens in series/parallel circuits.	
3	Calculate basic electrical quantities	- Behaviour of V, I in Series and Parallel DC circuits. - Relationship between V, I and R. http://nreeder.com/Flash/ohmsLaw.htm	1. Measure the voltage and current against individual resistance in electrical circuit. 2. Compare the theoretical values with actual in the circuit.	
4	Connect resistances in different combination	1. Equation to find the connected in series 2. Equation to find connected Resistances series and in parallel 3. Resistances connected parallel combinations 4. Simple problems.	1. Determine the equivalent Resistance of series connected resistances. 2. Determine the equivalent Resistance of parallel connected resistances.	
5	Calculate and measurement of different parameters of an AC quantity.	Ac sinewave: Sinusoidal voltage, current, amplitude, time-period, cycle, frequency, phase, phase difference, and their units. http://nreeder.com/Flash/freqPeriod.htm http://nreeder.com/Flash/oscilloscope.htm	Demonstrate the measurement of frequency, time period and phase difference of AC quantity using CRO and function generator.	
6	1. Calculate and measure electric power and energy	1. Electrical work, energy, power and power factor - SI units - Mention the meters used to measure them	Measure the voltage, current, power and energy	

	2. Identify and differentiate Single phase and Three phase supply	2. Single phase and Three phase supply http://nreeder.com/Flash/powerLaw.htm	using relevant measuring instruments in a single-phase load. • Compare the theoretical values with actual in the circuit. • Measure the voltages in Single phase and Three phase supply.	
UNIT-3 Protective Devices and Wiring circuit s				
7	Identify and select Protective Devices for given current and voltage rating	1. Necessity of Protective Devices 2. Various Protective devices and their functions • fuse wire, • Glass cartridge fuse • HRC fuse • Kit-kat fuse • MCB • MCCB • RCCB • ELCB • Relay 3. Earthing • Types • Pipe earthing • Plate earthing	1. Identification and Selection of various protective devices 2. Inspection of their installation in the college building/public building.	
8	Identify and select the various electrician tools	1. Different types of electrician tools and their function. 2. Describe various wiring tools. 3. State procedure of care and maintenance of wiring tools.	Identification and selection of different tools.	
9	1. Identify and select Wiring systems for a given applications 2. Identify and select the cables used for different current and voltage ratings. 3. Draw the wiring diagram	1. Describe different types of wiring systems. • Surface conduit • concealed conduit • PVC casing capping 2. Wiring systems and their applications. 3. Describe the types of wires, cables used for different current and voltage ratings.	1. Identification and selection of different Wiring systems. 2. Wire up and test PVC Conduit wiring to control of 2 sockets and 2 lamps. 3. Wire up and test PVC Conduit wiring to control	

			one lamp from two different places.	
10	Estimate and plan electrical wiring	Explain Plan and estimate the cost of electrical wiring for one 3m × 3m room consisting of 2 lamps, 1 ceiling fan, 2 three pin sockets.	Prepare the estimation and plan	
UNIT-4 Electrical Machines and Batteries and UPS				
11	1. Identify the types of transformer. 2. verify the transformation ratio.	Transformer • working principle • Transformation ratio • Types and applications with their ratings	Connect the Single-phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	
12	1. Start and run the induction motor. 2. Troubleshoot DOL/Stardelta starter and induction motor	1. Induction motor • Types Induction motor and applications • Difference between single and three phase motors • Necessity of starters for AC motors • Describe different types of starters and applications 2. What are different causes and remedies for a failure of starter and induction motor.	1. Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/Stardelta starter. 2. Troubleshoot the DOL/S tar-delta starter and induction motor	
13	Select and test the battery for a given application	Battery • Types of batteries (Lead acid battery, lithium, sealed maintenance free (SMF) battery, Modular battery). • Selection criteria of batteries for different applications. • Ampere-Hour Capacity. • Efficiency	Testing Condition of a Lead-acid battery	

14	Select the size of the UPS for a given application	UPS - List the types and applications - Selection criteria of UPS - Sizing of UPS	Sizing of UPS	
UNIT-5 Introduction to Electronic Devices and Digital Electronics				
15	Identify and differentiate Conductors, insulators and semiconductors.	Compare Conductors, insulators and semiconductors with examples http://nreeder.com/Flash/resistor.htm	Identification of types and values of resistors-color codes. Determine the value of resistance by color code and compare it with multimeter readings.	
16	Identify and test PN junction Diode	PN junction diode - Symbol - Characteristics - Diode as switch. - Types of diodes and ratings - Applications	Identify the terminals of a Diode and test the diode for its condition.	
17	Build and test bridge rectifier circuit	Rectifier - Need for AC to DC conversion - Bridge rectifier with and without C filter, - Rectifier IC.	Construct and test bridge rectifiers using semiconductor diode and rectifier IC. Compare the waveforms using CRO.	
18	1. Identify and test Transistor 2. Build and test transistor as an electronic switch	Transistor (BJT) - Symbol - Structure - Working principle	1. Identification of transistor terminals and test. 2. Construct and test the transistor as an electronic switch	

19	1. Identify and test various Sensors and actuators.	1.Sensors • Concept • Types: Temperature, Pressure, Water, Light, Sound, Smoke, proximity Sensors, Flow, humidity, voltage, vibration, IR (Principle/working, ratings/ specifications, cost, and applications) 2.Actuators • Concept • Types and applications. • Relay as an actuator.	1. Connect and test an IR proximity sensor to a Digital circuit. 2. Connect and test a relay circuit using an Optocoupler. (Photo Diode & Transistor)	
20	1. Identify and test different digital IC	• Comparison of analog and digital signal • Digital systems, examples. • Binary numbers, Boolean identities and laws. • Digital system building blocks: Basic logic gates, symbols and truth tables. • IC-Definition and advantages.	• Test a Digital IC. • Identification and selection of suitable ICs for basic gates. • Verify NOT, AND, OR, NOR, EXOR and NAND gate operations (two inputs).	
21	Know the application of Microcontroller and PLC	• Microcontroller as a programmable device, and list of real-world applications. • PLC and Their applications.	• Identify different application microcontroller. • Identify commercially available PLC and their specifications	
TOTAL				Hours

FUNDAMENTAL OF ELE. & ELECTRONICS PRATICAL

Sl. No.	Practical Out Comes/Practical exercises	Unit No.	PO	CO	L: T:P Hrs.
1	1. Collect/draw standard prominent electrical symbols related to electrical engineering. 2. Identify Various types of safety signs and what they mean	1			
2	- Identify Various types of safety signs and what they mean - Demonstrate and practice use of PPE - Demonstrate how to free a person from electrocution - Administer appropriate first aid to victims, bandaging, heart attack, CPR, etc. - Fire safety, causes and precautionary activities. - Use of appropriate fire extinguishers on different types of fires. - Demonstrate rescue techniques applied during fire hazard, correct method to move injured people during emergency - Inform relevant authority about any abnormal situation	1			
3	1. Identification Measuring devices - Ammeter - Voltmeter - Wattmeter - Ohmmeter - Digital Multimeter - Megger - Tong tester 2. Measure current, voltage and analyses the effects of shorts and opens in series / parallel circuits.	2			
4	Measure the voltage and current against individual resistance in electrical circuit. Compare the theoretical values with actual in the circuit.	2			
5	1. Determine the equivalent Resistance of series connected resistances. 2. Determine the equivalent Resistance of parallel connected resistances.	2			
6	Demonstrate the measurement of frequency, time period and phase difference of AC quantity using CRO and function generator.	2			

7	Measure the voltage, current, power and energy using relevant measuring instruments in a Single-phase load. Compare the theoretical values with actual in the circuit.	2			
	Measure the voltages in Single phase and Three phase supply.				
8	1. Identification and selection of various protective devices. • HRC fuse • Kit kat fuse • MCB • MCCB • RCCB • ELCB • Relay Videos/Presentations/Discussion on different protective devices. 2. Inspection of their installation in the college building/public building.	3			
9	Identification and selection of different tools. Hands-on use of the tools for appropriate applications. Combination plier, Cutting Plier, Nose plier, screw driver set, line tester, Poker, Hand Drill, Power Drill, Concrete Drill, Megger, Earth tester, Continuity tester, crimping tool, wire cutter, Wire splicer, wire stripper standard wire gauge, soldering iron, wooden mallet, ball pin hammer, testing board	3			
10	1. Identification and selection of different tools. Hands-on use of the tools for appropriate applications. Surface conduit • concealed conduit • PVC casing capping 2. Wire up and test PVC Conduit wiring and practice control of 2 sockets and 2 lamps.	3			
11	Wire up and test PVC Conduit wiring to control one lamp from two different places.	3			
12	Plan and estimate the cost of electrical wiring for one 3mx3m room consisting of 2 CFL 1 ceiling fan, 2 three pin sockets.	3			
13	Connect the Single-phase transformer as Step-Up, Step-Down transformer and verify the transformation ratio.	4			
14	Construct a suitable circuit to start and reverse the direction of three phase induction motor using DOL/star-delta starter.	4			
15	Troubleshoot the DOL/Star-delta starter and induction motor	4			
16	Testing Condition of a Lead-acid battery	4			

17	Estimate the UPS rating for a computer lab with 50 computers/domestic.	4			
18	1.Identification of types and values of resistors-color codes. 2.Determine the value of resistance by color code and compare it with multimeter readings	5			
19	Identify the terminals of a Diode and test the diode for its condition.	5			
20	Construct and test bridge rectifiers using semiconductor diode and rectifier IC. Compare the waveforms using CRO.	5			
21	Identification of transistor terminals and test. Construct and test the transistor as an electronic switch.	5			
22	Connect and test an IR proximity sensor to a Digital circuit.	5			
23	Connect and test a relay circuit using an Optocoupler. (Photo Diode & Transistor)	5			
24	Test an IC. Verify the truth-table AND, OR, NOT logic gates.	5			
25	Verify the truth-table NAND, NOR, EX-OR, EX-NOR logic gates.	5			
26	1. Identify MCS-51 variants 2. Identify commercially available PLC and their specifications.	5			
Total					Hrs

7. MAPPING OF CO WITH PO

CO	Course Outcome	PO Mapped	Experiment	Cognitive Level R/U/A	Lecture & Practical Sessions in Hrs	TOTAL
C01	Comply with the safety procedures	P01, P04	1-2	A	6	
C02	Apply the fundamentals of electricity.	P01, P04	3-7	A	15	
C03	Install and test electrical wiring system and protective devices.	P01, P04	8-12	A	15	
C04	Identify and Operate electrical machines, Batteries and UPS.	P01, P04	13-17	A	15	
C05	Identify and test the different electronic devices.	P01, P04	18-26	A	27	

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Fundamentals of Electrical and Electronics Engineering	CO1	3	0	0	3	0	0	0
	CO2	3	0	0	3	0	0	0
	CO3	3	0	0	3	0	0	0
	CO4	3	0	0	3	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped								

8. SUGGESTED LEARNING RESOURCES:

Reference Books:

1. ABC of Electrical Engineering by B. L. Theraja and A. K. Theraja, S Chand Publishers, New Delhi, 2014 Edition.
2. Basic Electrical and Electronics Engineering by S. K. Bhattacharya, Pearson Education India, 2012 Edition.
3. Electronic Devices and Circuits by I. J. Nagrath, PHI Learning Pvt. Ltd., 2007 Edition.
4. Basic Electrical Engineering by V. Mittle and Arvind Mittle, McGrawHill Companies, 2005 Edition.
5. The 8051 Microcontroller & Embedded systems by S. K. Bhowmik, BB VVVVG assembly and C (2nd Edition) – M.A. Mazidi, J.C. Mazidi & R.D. McKinlay ISBN: 81-317-1026-2
6. Programmable Logic controllers, W BOLTON

e-Resources

1. https://www.youtube.com/watch?v=mc9790hitAg&list=PLWv9VM947MKi_7yI0_FCfzTBXpQU-Qd3K
2. <https://www.youtube.com/watch?v=CWulQ1ZSE3c>
3. en.wikipedia.org/wiki/Transformer
2. www.animations.physics.unsw.edu.au/~jw/AC.html
3. www.alpharubicon.com/altenergy/understandingAC.htm
4. www.electronics-tutorials
5. learn.sparkfun.com/tutorials/transistors
6. www.pitt.edu/~qi4/Academic/ME2082/Transistor%20Basics.pdf
7. www.technologystudent.com/elec1/transis1.htm
8. www.learningaboutelectronics.com
9. www.electrical4u.com
10. https://www.youtube.com/watch?v=zLW_7TPf310
11. <https://www.youtube.com/watch?v=8PTNjw-hQIM>

MATERIALS FOR ENGINEERING

1. RATIONALE

Materials for engineering play an important role as the vital tool for solving the problems of material selection and application in the production and manufacturing of equipment/machines, devices, tools, etc. Therefore, an engineering diploma student must be conversant with the properties, composition and behavior of materials from the point of view of reliability, sustainability and performance of the product. The study of basic concepts of materials will help the students understanding engineering subjects where the emphasis is laid on the application of these materials.

2. COURSE SKILL SET

The aim of the course is to help the student to attain the following industry identified competency through various teaching –learning experiences

1. Select Engineering materials based on properties, behavior and environmental effect for given engineering application.
2. Identify microstructure and alloying elements of given alternative materials for suitable application

3. COURSE OUT COMES

CO1	Able to understand the various properties of materials u in engineering
CO2	Able to Select relevant ferrous materials and cast iron, non-ferrous metals and advanced materials for Engineering applications
CO3	Adopt International practice of material designation and coding system
CO4	Able to find relevant heat treatment process for altering the properties of metals
CO5	Able to Suggest relevant Surface treatment process for protecting the surface of materials

4. SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours
I.	Basic of Engineering Materials.	
II.	Steel and alloys	
III.	Nonferrous Metals and alloys	
IV.	Nonmetallic and Advanced materials.	
V.	Heat treatment process.	
VI	Surface treatment for Materials	
	Total	

5. DETAILS OF COURSE CONTENT

The following topics/subtopics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

UNIT NO	Unit Learning outcomes (In cognitive domain)	Topics/Subtopics	Hours L-T-P
UNIT-1 BASICS OF ENGINEERING MATERIALS	1. Identify the crystal structure of the given material 2. Explain specimen preparation procedure 3. Distinguish various engineering properties of materials	1.1 Classification of Engineering Material 1.2 Structure of metal-unit cell, BCC, FCC and HCP structures 1.3 Types of microscopes 1.4 Specimen preparation procedure 1.5 Properties of metals-Physical-mechanical-Thermal properties	
UNIT-2 STEELS AND ALLOYS	1. Select relevant cast iron for the given job with justification 2. Select relevant steel for the given application 3. Able to designate different plain and alloy steel, cast iron as per BIS, ASME	2.1 Types of cast iron-White-grey-Nodular-malleable - Selection of appropriate cast iron for engineering application 2.2 Broad classification of steels I. Plain carbon steels-Definition-types-properties-composition and applications of low-medium-high carbon steels II. Alloy steels-definition-effect of alloying elements on properties of alloy steel III. Tool steel-cold worked-Hot work tool steel-High speed steel (HSS) IV. Stainless steel-Types and application V. Spring steel-composition and application 2.3 Steels for following-shaft -axles-bolts-nuts-Agriculture Equipment's-household utensils-Antifriction bearings. 2.4 Designation and coding (as per BIS, ASME) of plain & alloy steel and cast iron.	

UNIT-3 NON FERROUS METALS AND ALLOYS	1. Describe the properties and application of the given copper alloy 2. Describe the properties and application of the given Aluminum alloy 3. Describe the properties and application of the given Nickel alloy 4. Describe the properties and application of the given Bearing material 5. Select relevant non ferrous material for specified application with justification	3.1 Copper and its alloys-Brasses-Bronzes-Chemical composition-Properties and applications 3.2 Aluminum and its alloys-Y-Alloy-Hindalium-duralium with their -Chemical composition-Properties and applications. 3.3 Nickel and its alloys with their -Chemical Composition-Properties and applications 3.4 Bearing materials like White metal (Sn based), Aluminum Bronzes-Self-lubricating Bearings	
UNIT-4 NON METALIC AND ADVANCED MATERIALS	1. Distinguish between metallic and non metallic materials on the basis of given composition 2. Select relevant non metallic material for the given job with justification 3. Select relevant Composite material for the given job with justification 4. Select relevant Alternative material for the given job with justification	4.1 Polymeric materials-Polymer-types-characteristics 4.2 Classification of Polymers on basis of Thermal behavior -Thermo plastics and thermo setting plastics-Properties –uses 4.3 Ceramics-types of ceramics-properties and applications 4.4 Composite materials-properties and application of laminated and fiber reinforced materials 4.5 Advanced engineering materials-properties and application of, Biomaterials, nano materials and smart materials 4.6 Designation and coding of important non metallic materials as per BIS	
UNIT-5 HEAT TREATMENT PROCESSES	1. Interpret Iron-carbon equilibrium diagram of Mild steel 2. Identify the given phase diagram and reactions with justification 3. Conceptualize with sketches the specified heat treatment process 4. Select relevant Heat treatment process for the given material with justification	5.0 Concept of phase-pure metal-alloy –Solid solution 5.1 Iron-carbon equilibrium diagram indicating various phases-Critical temperature and its significance-Reactions on Iron carbon equilibrium diagram of Mild steel 5.2 Heat treatment-Definition- purpose of heat treatment--Mechanism of heat treatment Types of heat treatment process 5.3 Annealing-purposes of annealing-Annealing temperature range-applications. 5.4 Normalizing- purposes of Normalizing-temperature range-Broad applications 5.5 Tempering-Purposes of tempering-Types of tempering-Applications 5.6 Hardening -purposes of hardening -temperature range- Broad applications of hardening 5.7 Case hardening- Carburizing-Nitriding-Cyaniding	

UNIT-6 SURFACE TREATMENT FOR MATERIALS	1. Describe corrosion and its prevention 2. Select proper electrolysis process for surface coating	6.1 Corrosion-types and reasons for corrosion, protection from corrosion 6.2 Surface protection treatments-Methods of Surface treatments. 6.3 Electrolytes and Non-electrolytes – definition-Types of electrolytes 6.4 Construction and working of electro chemical cell 6.5 Electro-chemical series, galvanic series. 6.6 Surface coating through electrolysis-setup and working.	
	TOTAL		

Mapping of Course Outcomes with Programme Outcomes

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Theory Sessions In Hrs	Allotted marks for CIE on cognitive levels		TOTAL
					R	U	
C01	Able to understand the various properties of materials u in engineering						
C02	Able to Select relevant ferrous materials and cast iron, non-ferrous metals and advanced materials for Engineering applications						
C03	Adopt International practice of material designation and coding system						
C04	Able to find relevant heat treatment process for altering the properties of metals						
C05	Able to Suggest relevant Surface treatment process for protecting the surface of materials						
Total Hours of instruction							

R-Remember; U-Understanding.

Level of Mapping PO's with CO's

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Material for Engineering	CO1							
	CO2							
	CO3							
	CO4							
	CO5							
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped								

SUGGESTED LEARNING RESOURCES:

Sl.N o.	Author	Title of Books	Publication/Year
1	J. W. Martin	Materials for engineering	WOODHEAD PUBLISHING LIMITED Cambridge England
2	GBS Narang	Materials science	Khanna Publishers, New Delhi.
3	R.K.Rajput	Materials science	Laxmi Publication, Dariyaganj, New Delhi.
4	R.S.Khurmi & R.S.Sedha	Materials science	S.Chand
5	D.S.Nutt	Materials science and metallurgy	S.K.Katariya and sons, Delhi.
6	V.Raghavan	Materials science and Engineering	EEE Edition, Prentice Hill, New Delhi.
7	Sidney Avner	Physical Metallurgy	Tata McGraw-Hill Education (2011).

List of Major Equipment/Instrument

1. Metallurgical Microscope.
2. Standard specimens.
3. Furnaces to perform heat treatment process.
4. Sorted/required quenching mediums.
5. Hardness tester-to check Rockwell hardness-scales A,B and C.
6. Other hardness testers like scleroscope, etc.
7. Polishing machine to prepare specimens with necessary consumables.
8. Hand grinder – specifically to prepare specimens and for spark testing.
9. Other consumables.

C. List of Software/Learning Websites

1. <http://vimeo.com/32224002>
2. [http://www.substech.com/dokuwiki/doku.php?id=iron-carbon phase diagram](http://www.substech.com/dokuwiki/doku.php?id=iron-carbon_phase_diagram)
3. <http://www-g.eng.cam.ac.uk/mmg/teaching/typd/>
4. <http://www.ironcarbondiagram.com/>
5. <http://www.youtube.com/watch?v=fHt0bOfj3T0&feature=related>
6. <http://www.youtube.com/watch?v=cN5YH0iEvTo>
7. <http://www.youtube.com/watch?v=m9l1tVXyFp8>
8. <http://www.youtube.com/watch?v=98lh5Q0M0cg>
9. <http://www.youtube.com/watch?v=KlyGr-1snMY>
10. [http://en.wikipedia.org/wiki/Materials science](http://en.wikipedia.org/wiki/Materials_science)
11. <http://www.studyvilla.com/electrochem.aspx>

Advance Computer Aided Engineering Drawing

1. COURSE RATIONALE:

Engineering Drawing is an effective language of engineers. It is the foundation block which strengthens the engineering & technological structure. Moreover, it is the transmitting link between ideas and realization.

2. LIST OF COMPETENCIES:

The course content should be taught and implemented with the aim to develop different types of skills leading to the achievement of the following competencies:

1. Prepare engineering drawings both manually and using CAD with given geometrical dimensions using prevailing drawing standards and drafting instruments.
2. Visualize the shape of simple object from orthographic views and vice versa.

3. COURSE OUT COMES:

CO1	Adopt the standards, dimensioning and construct appropriate drawing scales, in technical drawing development.
CO2	Visualize objects in all planes and learn displaying techniques for graphical communication in design process.
CO3	Sketch orthographic projections into isometric projections and vice versa.
CO4	Use computer software and Apply computer aided drafting tools to create 2D /3 D engineering drawings

4. INSTRUCTIONAL STRATEGY:

1. Teacher should show model of real of the component/part whose drawing is to be made. Emphasis should be given on cleanliness, dimensioning and layout of sheet.
2. Focus should be on proper selection of drawing instruments and their proper use.
3. The institute should procure AutoCAD or other engineering graphics software for practice in engineering drawings.
4. Separate labs for practice on Engineering graphics Software should be established.

5. COURSE DETAILS:

The following topics/sub topics is to be taught and assessed in order to develop Unit Skill sets for achieving CO to attain identified skill sets

Unit	Major Learning Topics and Sub- Topics	Outcomes (in cognitive domain)	Hours L-T-P
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UNIT-1 Basic elements of Drawing	1.1 List the different drawing instruments and application 1.2 Convention of lines and its application (Thick, Thin, Axis etc.,) 1.3 Practice use of drawing instruments 1.4 Representative fraction 1.5 Scales - Full Scale, Reduced Scale and Enlarged Scale 1.6 Dimensioning a. Aligned system and Unidirectional system in the Sketches b. Chain dimensioning and Parallel dimensioning 1.7 Construct different polygons	1. Drawing equipments, instruments and materials. 2. Equipments-types, specifications, method to use them, applications. 3. Instruments-types, specifications, methods to use those and applications. 4. Pencils-grades, applications, Different types of lines. 5. Scaling technique used in drawing. 6. Dimensioning methods.- Aligned method. Unilateral with chain, parallel dimensioning. 7. Constructions of geometrical figures	
UNIT-2 Introduction to Projections	2.1 Introduction to Projections-Principle Planes of Projection and Principle Views 2.2 Introduction to First angle and Third angle method, their symbols 2.3 Projection of points in All 4 Quadrants	1. Reference planes, orthographic projections. 2. Concept of quadrant, 1st angle and 3rd angle projection and their symbols. 3. Projection of points.	
	2.4 Projection of Lines a) Parallel to both the planes b) Parallel to one and Perpendicular to another c) Parallel to one and Inclined to another	1. Projection of lines determination of true length and inclinations for following cases. (a) Line parallel to one or both the plane. (b) Line perpendicular to one of the plane. (c) Line inclined to one plane and parallel to another.	
	2.5 Projection of plane surfaces. a) Parallel to one plane and Perpendicular to other two b) Planes Perpendicular to one plane and inclined to the other (Resting on Edge, Corner, Inclined to HP And VP)	1. Projection of Planes. (a) Types of planes. (b) Projection of planes parallel to one of the reference planes. (c) Projection of plane inclined to one reference plane and perpendicular to another. Note: <i>Triangle, Square / rectangle, pentagon, hexagon and circle shape should be included in various plane problems.</i>	

	2.6 Projection of Solids for the above conditions	1. Projections of solids in various positions with respect to the reference planes. (Parallel, perpendicular and inclined to HP and / or VP.)	
UNIT-3 EXPOSURE TO CAD	3.1 Introduction to CAD- Hardware requirements. 3.2 Various CAD software available 3.3 Familiarization of CAD window - Commands like New file, Saving the file, Opening an existing drawing file, Creating templates 3.4 Setting up new drawing: Units, Limits, Grid, Snap. Standard sizes of sheet. 3.5 Selecting Various plotting parameters such as Paper size, paper units, Drawing orientation, plot scale, plot offset, plot area, print preview 3.6 Draw basic entities like Line, Circle, Arc, Polygon, Ellipse, Rectangle, Multiline, Dimensioning, Inserting text Applying constraints - horizontal, vertical, parallel, concentric, perpendicular, symmetric equal, collinear 3.7 Insert title block for the drawing and take the Print out 3.8 Create objects by applying constraints and convert the objects to full scale , reduced scale and enlarged scale 3.9 Apply copy, mirroring, array, fillet and trim on the object created	1. Computer graphics & its terminology. 2. CAD definition, concept & need. 3. Commands used in CAD 4. Functional areas of CAD. - Coordinate systems. 5. Familiarization of Cad commands 6. Draw simple Geometrical figures using CAD	

UNIT-4 Orthographic projections	4.1 Introduction to orthographic, Isometric projections 4.2 Conversion of pictorial view into Orthographic Views (USING SKETCH BOOK AND CAD)	1. Types of projections-orthographic, isometric projections: concept and applications. 2 Various term associated with orthographic projections. (a) Theory of projection. (b) Methods of projection. (c) Orthographic projection. (d) Planes of projection. 3. Conversion of simple pictorial views into Orthographic views. Illustrative problems on orthographic projection. Note : (1) Problem should be restricted up to - Front view/Elevation, Top view/Plan and Side views only. Use First Angle Method only.	
UNIT-5 Isometric projections	5.1 Introduction to Isometric Projections 5.2 Isometric Scales and Natural Scale 5.3 Isometric View and Isometric Projection 5.4 Conversion of Orthographic Views into Isometric (USING SKETCH BOOK AND CAD)	1. Isometric axis, lines and planes. 2. Isometric scales. 3. Isometric view and isometric drawing. 4. Difference between isometric projection and isometric drawing. 5. Illustrative problems limited to Simple elements	
UNIT-6 CAD Drafting	6.1 Draw different types of 2D/3D modeling entities using viewing commands, to view them (Problems solved in chapter no 3 and 4 i.e Orthographic, isometric projection). 6.2 2D/3D modeling for Thread profiles,nuts,bolts,studs,setscrews,was her,Locking arrangements. (USING CAD)	1 Difference between 2D & 3D models. 2.2D/3D modeling – concept, Simple objects	
		TOTAL	

LIST OF PRACTICAL EXERCISES:

Sl. No	Unit No	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
1	1	1. Teacher will demonstrate a: Use of a. Drawing instruments. b. Planning and layout as per IS. c: Scaling technique.	
		2. Draw following. Problem – 1 Drawing horizontal, vertical, 30 degree, 45 degree, 60 & 75 degrees lines using Tee and Set squares/ drafter.(Drawing sheet)	
		Problem – 2 Indicate different convention of lines on the drawing. .(Drawing sheet)	
		Problem – 3 Copy the sketch to the required scale and dimensioning adopting right system and positioning of dimensions using Tee and Set squares / drafter.(Drawing sheet)	
		Problem 4. Draw regular geometric constructions Pentagon, Hexagon, Square, circle, Triangle and other shapes. .(Drawing sheet)	
2	2	First angle Projection symbol Problem 5: Draw Projection of points in 1 st , 2 nd , 3 rd and 4 th Quadrants.(Drawing sheet)	
		Problem 6: Draw Projection of Lines a) Parallel to both the planes b) Parallel to one and Perpendicular to another c) Parallel to one and Inclined to another. .(Drawing sheet)	
		Problem 7: Draw Projection of plane surfaces. a) Parallel to one plane and Perpendicular to other two (Resting on Edge, Corner, Inclined to HP And VP)	
		Problem 8: Planes Perpendicular to one plane and inclined to the other (Resting on Edge, Corner, Inclined to HP And VP) (Drawing sheets)	
2	2	Problem 9: Draw Projection of Solids for the above conditions (Resting on Edge, Corner, Inclined to HP And VP) (Drawing sheet)	
		Use of CAD commands , plotting the drawing	
3	3	Problem 10: Drawing basic entities : Circle, Arc, Polygon, Ellipse, Rectangle, Multiline	

		Applying constraints draw basic entities Insert title Block (CAD Drawings and Printout)	
4	4	Problem 11: Draw Orthographic views for the given object. (Sketch book and CAD Drawing)	
5	5	Problem 12: Draw Isometric projections for the given Orthographic views (Sketch book and CAD Drawing)	
6	6	Problem 13: Produce Orthographic (2D) Drawings in CAD-Chap 3 Problem 14: Produce Isometric and 3D Drawings in CAD – Chap 4 (CAD Drawings and Printout)	
		Problem 15: create 3D models of Mechanical Elements such as Hexagonal headed bolt, Simple toy, ball bearing (CAD Drawings and Printout)	
		TOTAL	

Mapping of Course Outcomes with Programme Outcomes (Suggestive only):

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Engineering Graphics	CO1	3	0	0	3	0	0	0
	CO2	3	0	0	3	0	0	0
	CO3	3	0	0	3	0	0	0
	CO4	3	0	0	3	0	0	0
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0-Not Mapped Method is to relate the level of PO with the number of hours devoted to the CO's which maps the given PO. If $\geq 50\%$ of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 3 If 30 to 50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 2 If 5 to 30% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 1 If $< 5\%$ of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is considered not mapped i.e. Level 0								

SUGGESTED LEARNING RESOURCES:

1. **Bureau of Indian Standards. Engineering Drawing Practice for Schools and Colleges** IS: Sp-46. BIS. Government of India, Third Reprint, October 1998; ISBN: 81-7061-091-2.
2. **Bhatt, N. D. Engineering Drawing.** Charotar Publishing House, Anand, Gujarat 2010; ISBN: 978-93-80358-17-8.
3. **Jain & Gautam, Engineering Graphics & Design,** Khanna Publishing House, New Delhi (ISBN: 978- 93-86173-478)
4. **Jolhe, D. A. Engineering Drawing.** Tata McGraw Hill Edu. New Delhi, 2010; ISBN: 978- 0-07-064837-1
5. **Dhawan, R. K. Engineering Drawing. S. Chand and Company,** New Delhi; ISBN: 81-219- 1431-0. Diploma in Electronics & Communications Engineering 2020-21 C20 Department of Collegiate & Technical Education Bengaluru-560001 Page 45
6. **Shah, P. J. Engineering Drawing. S. Chand and Company,** New Delhi, 2008, ISBN: 81- 219-2964-4.
7. Kulkarni, D. M.; Rastogi, A. P.; Sarkar, A. K. Engineering Graphics with AutoCAD . PHI

Learning Private Limited-New Delhi (2010); ISBN: 978-8120337831.

8. **Jeyapoovan, T. Essentials of Engineering Drawing and Graphics using AutoCAD.** Vikas Publishing House Pvt. Ltd, Noida, 2011; ISBN: 978-8125953005.

9. **Autodesk. AutoCAD User Guide.** Autodesk Press, USA, 2015. 10. Sham, Tickoo. AutoCAD 2016 for Engineers and Designers .Dreamtech Press; Galgotia Publication, New Delhi, 2015; ISBN 978-9351199113.

SOFTWARE/LEARNING WEBSITES :

1. <https://www.youtube.com/watch?v=Tj4jGyDWCw>
2. https://www.youtube.com/watch?v=dmT6_n7Sgcg
3. <https://www.youtube.com/watch?v=MQScnLXL0M>
4. <https://www.youtube.com/watch?v=3WXPanCq9LI>
5. <https://www.youtube.com/watch?v=fvjk7PlxAuo>
6. <http://www.me.umn.edu/coursesme2011/handouts/engg%20graphics.pdf>
7. <https://www.machinedesignonline.com>

Environmental Sustainability

COURSE OBJECTIVES:

Technicians working in industries or elsewhere essentially require the knowledge of environmental science so as to enable them to work and produce most efficient, economical and eco-friendly finished products.

1. Solve various engineering problems applying ecosystem to produce eco – friendly products.
2. Use relevant air and noise control methods to solve domestic and industrial problems.
3. Use relevant water and soil control methods to solve domestic and industrial problems.
4. To recognize relevant energy sources required for domestic and industrial applications.
5. Solve local solid and e-waste problems.

COURSE OUTCOMES:

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

CO1	Importance of ecosystem and terminology.
CO2	The extent of air pollution, effects, control measures and acts.
CO3	The extent of noise pollution, effects, control measures and acts.
CO4	The water and soil pollution, effects, control measures and acts
CO5	Different renewable energy resources and efficient process of harvesting.
CO6	Solid Waste Management and Environmental acts.

Course Content

Unit No & Name	Detailed Course Content	CO	PO	Contact Hrs
1. Ecosystem	<i>Structure of ecosystem, Biotic & Abiotic components, Aquatic (Lentic and Lotic) and terrestrial ecosystem.</i>	CO1		
	<i>Global warming - Causes, effects.</i>	CO1		
	<i>Green House Effect, Ozone depletion - Causes, effects</i>	CO1		
2. Air and Pollution	<i>Air pollution, Natural sources of air pollution, Man Made sources of air pollution</i>	CO2		
	<i>Air pollutants and Types, Effects of Particulate Pollutants and control by Cyclone separator</i>	CO2		
	<i>Effects of Particulate Pollutants and control by Electrostatic Precipitator, Air (prevention and control of pollution) act 1981.</i>	CO2		
3. Noise pollution	<i>Noise pollution: sources of pollution, Measurement of Noise pollution level.</i>	CO3		

	Effects and Control of Noise pollution. Noise pollution (Regulation and Control) Rules, 2000	CO3		
4. Water and Soil Pollution:	Sources of water pollution. Types of water pollutants, Characteristics of water pollutants.	CO4		
	Control measures of water pollution.	CO4		
	Definition and list unit operations in water and Waste Water Treatment process, Water (prevention and control of pollution) act 1974.	CO4		
	Water conservation – Importance of Rain Water Harvesting	CO4		
	Soil pollution, Causes and Effects due to Fertilizers, Pesticides and Insecticides	CO4		
	Preventive measures of Soil Pollution due to Excessive use of Fertilizers, Pesticides and Insecticides.	CO4		
5. Renewable sources of Energy	Solar Energy: Basics of Solar energy. Solar collectors and advantages of Advanced solar collectors.	CO5		
	Solar water heater, Solar stills and their uses.	CO5		
	Biomass: Overview of biomass as energy source. Thermal characteristics of biomass as fuel.			
	Wind energy: Current status and future prospects of wind energy. Wind energy in India.	CO5		
	Need of new Energy sources, Different type's new energy sources. Environmental benefits of New Energy Sources-Hydrogen energy	CO5		
	Environmental benefits of New Energy Sources- Ocean energy resources	CO5		
	Environmental benefits of New Energy Sources-Tidal energy conversion.	CO5		
6. Solid Waste Management And Environmental Acts	Solid waste generation, Sources, Characteristics of solid waste Solid Waste Management rules 2016	CO6		
	E- Waste generation Sources and characteristics, E waste management rules 2016	CO6		
	Plastic Waste generation Sources and characteristics, Plastic Waste Sources and characteristics	CO6		
	Recycled plastic rules 2016,Importance of Environment (protection) act 1986,	CO6		
	Occupational health and safety measures.	CO6		
Total				

Mapping of Course Outcomes with Programme Outcomes

CO	Course Outcome	PO Mapped	Cognitive Level R/U/A	Theory Sessions In Hrs	Allotted marks for CIE on cognitive levels		TOTAL
					R	U	
C01	Importance Of ecosystem and terminology	1,5,7	R, U				
C02	The extent of air pollution, effects, control measures and acts.	1,5,7	R, U				
C03	The extent of noise pollution, effects, control measures and acts.	1,5,7	R, U				
C04	The water and soil pollution, effects, control measures and acts	1,5,7	R, U				
C05	Different renewable energy resources and efficient process of harvesting.	1,5,7	R, U				
C06	Solid Waste Management and Environmental acts.	1,5,7	R, U				
Total Hours of instruction							

R-Remember; U-Understanding.

Level of Mapping PO's with CO's

Course	CO's	Programme Outcomes (PO's)						
		1	2	3	4	5	6	7
Environmental Science	C01	3	0	0	0	2	0	1
	C02	3	0	0	0	2	0	1
	C03	3	0	0	0	2	0	1
	C04	3	0	0	0	2	0	1
	C05	3	0	0	0	2	0	1
	C06	3	0	0	0	2	0	1
Level 3- Highly Mapped, Level 2-Moderately Mapped, Level 1-Low Mapped, Level 0- Not Mapped Method is to relate the level of PO with the number of hours devoted to the CO s which maps the given PO. If $\geq 50\%$ of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 3 If 30 to 50% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 2 If 5 to 30% of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is mapped at Level 1 If $< 5\%$ of classroom sessions related to the CO are addressing a particular PO, it is considered that PO is considered not mapped i.e. Level 0								

Reference Books

1. S.C. Sharma & M.P. Poonia, Environmental Studies, Khanna Publishing House, New Delhi
2. C.N. R. Rao, Understanding Chemistry, Universities Press (India) Pvt. Ltd., 2011.
3. Arceivala, Soli Asolekar, Shyam, Wastewater Treatment for Pollution Control and Reuse, Mc-Graw Hill Education India Pvt. Ltd., New York, 2007, ISBN:978-07-062099.

4. Nazaroff, William, Cohen, Lisa, Environmental Engineering Science, Wiley, New York, 2000, ISBN 10: 0471144940.
5. O.P. Gupta, Elements of Environmental Pollution Control, Khanna Publishing House, New Delhi
6. Rao, C. S., Environmental Pollution Control and Engineering, New Age International Publication, 2007, ISBN: 81-224-1835-X.
7. Rao, M. N. Rao, H.V.N, Air Pollution, Tata Mc-Graw Hill Publication, New Delhi, 1988, ISBN: 0-07-451871-8.
8. Frank Kreith, Jan F Kreider, Principles of Solar Engineering, McGraw-Hill, New York ; 1978, ISBN: 9780070354760.
9. Aldo Vieira, Da Rosa, Fundamentals of renewable energy processes, Academic Press Oxford, UK; 2013. ISBN: 9780123978257.
10. Patvardhan, A.D, Industrial Solid Waste, Teri Press, New Delhi, 2013, ISBN: 978-81-7993-502-6
11. Metcalf & Eddy, Wastewater Engineering, Mc-Graw Hill, New York, 2013, ISBN: 077441206.
12. Keshav Kant, Air Pollution & Control, Khanna Publishing House, New Delhi (Edition 2018)