



SHRI VILEPARLE KELAVANI MANDAL'S
SHRI BHAGUBHAI MAFATLAL
POLYTECHNIC & COE



**DEPARTMENT OF ELECTRICAL
ENGINEERING**

SCHEME -2023



SEMESTER-IV

Shri Vile Parle Kelavani Mandal's
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

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

Program Name	: Diploma In Electrical Engineering		
Programme Code	: EE	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: IV	Scheme	: 2023

Sr No	Course Title & Code ⁰	Course Type	IKS (Hrs)	Learning Scheme					Credits	Assessment Scheme								Total Marks
				Actual Contact Hrs./Week			Self-Learning (SL) (Term Work + Assignment) (Hrs)	Notional Learning Hrs (Week)		Paper Duration (Hrs.)	Theory (Marks)			Based on LI & TI			Based on Self Learning	
				CL	TL	LL					FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
							CL	TL									LL	
1	Social & Life Skills (SLN230013)	VEC	-	-	-	-	2	2	1	-	-	-	-	-	-	-	25	025
2	# Switchgear & Protection (SGP230312)	DSC	-	4	-	2	2	8	4	3	30	70	100	25	-	25	25	175
3	# Power Electronics (PEN230313)	DSC	-	4	-	2	2	8	4	3	30	70	100	25	25	-	25	175
4	Electrical Contracting & Estimation (ECE230314)	DSC	-	4	-	2	-	6	3	3	30	70	100	25	-	25	-	150
5	DC & Synchronous Machines (DSM230315)	DSC	-	4	-	2	-	6	3	3	30	70	100	25	25	-	-	150
6	# Elective -1 (Any One)																	
6.1	Utilisation of Electrical Energy (UEE230316)	DSE	-	4	-	2	2	8	4	3	30	70	100	25	-	25	25	175
6.2	Renewable Energy Generation (REG230317)	DSE	-	4	-	2	2	8	4	3	30	70	100	25	-	25	25	175
7	Generic Elective *** (Any One)	GE	-	2	-	-	-	2	1	-	-	-	-	50	-	-	-	050
Total			-	22	-	10	8	40	20	No. of Papers = 5	150	350	500	175	50	75	100	900

Abbreviations: IKS - Indian Knowledge System, CL- Classroom Learning, TL- Tutorial Learning, LL-Laboratory Learning, FA - Formative Assessment, SA -Summative Assessment, SLA - Self Learning Assessment, TH-Theory, PR-Practical, OR-Oral

Legends: *** As per Annexure-AA
* Award Winning Courses

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+TL+LL+SL)Hrs. x 15 Weeks
 5. 1 credit is equivalent to 30 Notional Hrs.
 6. * Self learning hours shall not be reflected in the Time Table.
 7. SA-PR,SA-OR: Assessed by Internal and External Examiners Jointly FA-PR, SLA: Assessed by Internal Examiner Only
- Course Category :** Discipline Specific Course & Core (DSC) : 4, Discipline Specific Elective (DSE) : 2, Value Education Course (VEC) : 1, Intern /Apprenti/Project, Community (INP) : 0, Ability Enhancement Course (AEC) : 0, Skill Enhancement Course (SEC) : 0, Generic Elective (GE) : 1


Head of Department


Controller of Examination


Secretary CDC


Principal

ANNEXURE AA

Shri Vile Parle Kelavani Mandal's
SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

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

Program Name	:Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering.		
Programme Code	: CE,ME,EE,PL,CH,EXTC	With Effect From Academic Year	: 2023-24
Duration Of Programme	: 6 Semester	Duration	: 16 WEEKS
Semester	: IV	Scheme	: 2023

Generic Electives

Sr. No.	Course Name	Course Code
1	Airport & Mass Rapid Transportation	ART230014
2	Disaster Management	DMA230015
3	Modern Trends In Civil Engineering	MTC 230016
4	Additive Manufacturing	ADM230017
5	Energy Conservation & Audit	ECA230018
6	Introduction To Green Technology	IGT230019
7	Intellectual Property Rights	IPR230020
8	German Language	GEL230021
9	Digital Marketing	DIM230022
10	Renewable Energy	REN230023
11	Indian Music	INM230024


Head of Department


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Secretary CDC




Principal

1. COURSE DETAILS

Programme: CE/ME/EE/PE/CH/EXTC	Semester: III
Course: Social & Life Skills	Course Category: VEC
Course Code: SLS230013	Duration: 16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Paper Duration (Hrs.)	Assessment Scheme								Total Marks
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs.)			Theory (Marks)			Based on LL & TL			Based on Self Learning		
CL	TL	LL				FA-TH	SA-TH	Total	Practical (Marks)					
									FA-PR	SA-PR	SA-OR	SLA (Marks)		
-	-	-	2	1	-	-	-	-	-	---	--	25	25	

3. COURSE OBJECTIVE: Life skills include social skills and interpersonal skills that help individual make informed decisions, solve problems, think critically and creatively, build healthy relationships, empathize with others, by managing one's life. Life skills are essentially those abilities that help to promote overall wellbeing with holistic approach to face the problems of real life. Students learn socio-life skills from parents, teachers and significant other individuals to translate knowledge, attitude and values into actual abilities.

Note: The course offers three different alternatives(modules) for achieving above objective. Students must complete any one module from the following .

- MODULE-I : **Unnat Maharashtra Abhiyan (UMA)**
- MODULE-II : **National Service Scheme (NSS)**
- MODULE-III : **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 may be offered different MODULE based on their choices.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- Decision making
- Problem solving
- Time management
- Presentation and Grooming skills
- Social Skills & Empathy
- Emotional intelligence
- Financial Literacy



5. **COURSE OUTCOMES (COs):** At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Develop interpersonal skills and leadership skills for empowerment of self and others
CO2	Provide the opportunity to get social experience while working individually or in group for society.
CO3	Develop financial literacy skills for self & community development.
CO4	Communicate professionally for liaisoning between individual & group .

6. **CO-PO, CO- PSO MAPPING TABLE**

Civil Engineering

Course and Code	Course Outcomes	Programme Outcomes								
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Social & Life Skills (SLS230013)	CO 1	-	-	-	-	-	3	1	-	-
	CO 2	-	-	-		3	1	1	-	-
	CO 3	-	-	-		2	1	1	-	-
	CO 4	-	-	-		1	3	1	-	-
	CO Avg.	-	-	-		2	2	1	-	-

Mechanical Engineering

Course and Code	Course Outcomes	Programme Outcomes								
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Social & Life Skills (SLS230013)	CO 1	-	-	-	-	-	3	1	-	-
	CO 2	-	-	-		3	1	1	-	-
	CO 3	-	-	-		2	1	1	-	-
	CO 4	-	-	-		1	3	1	-	-
	CO Avg.	-	-	-		2	2	1	-	-



Electrical Engineering

Course and Code	Course Outcomes	Programme Outcomes								
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Social & Life Skills (SLS230013)	CO 1	-	-	-	-	-	3	1	-	-
	CO 2	-	-	-	-	3	1	1	-	-
	CO 3	-	-	-	-	2	1	1	-	-
	CO 4	-	-	-	-	1	3	1	-	-
	CO Avg.	-	-	-	-	2	2	1	-	-

Plastics Engineering

Course and Code	Course Outcomes	Programme Outcomes									
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO 1	PSO 2	PSO 3
Social & Life Skills (SLS230013)	CO 1	-	-	-	-	-	3	1	-	-	-
	CO 2	-	-	-	-	3	1	1	-	-	-
	CO 3	-	-	-	-	2	1	1	-	-	-
	CO 4	-	-	-	-	1	3	1	-	-	-
	CO Avg.	-	-	-	-	2	2	1	-	-	-

Chemical Engineering

Course and Code	Course Outcomes	Programme Outcomes								
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Social & Life Skills (SLS230013)	CO 1	-	-	-	-	-	3	1	-	-
	CO 2	-	-	-	-	3	1	1	-	-
	CO 3	-	-	-	-	2	1	1	-	-
	CO 4	-	-	-	-	1	3	1	-	-
	CO Avg.	-	-	-	-	2	2	1	-	-



Electronics & Telecommunications Engineering

Course and Code	Course Outcomes	Programme Outcomes								
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Social & Life Skills (SLS230013)	CO 1	-	-	-	-	-	3	1	-	-
	CO 2	-	-	-		3	1	1	-	-
	CO 3	-	-	-		2	1	1	-	-
	CO 4	-	-	-		1	3	1	-	-
	CO Avg.	-	-	-		2	2	1	-	-

7. COURSE CONTENTS

UNIT NO	TOPIC/sub topic	CO
I	<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 Various instruments used for data collection - survey templates, simple measuring equipment.</p> <p>1.7 Format for measurement of identified attributes/ survey form and piloting of the same</p> <p>1.8 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>1.9 Analysis and Report writing 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>	CO1 CO2 CO4



<p style="text-align: center;">II</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>CO1</p> <p>CO2</p>
<p style="text-align: center;">III</p>	<p>MODULE-III : Financial Literacy</p> <p>3.1 Introduction - Life Goals and financial goals</p> <p>3.2 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>3.3 Retirement planning</p> <p>3.4 Cashless transactions</p> <p>3.5 Income, expenditure and budgeting – Concepts and Importance</p> <p>3.6 Inflation- Concept, effect on financial planning of an individual</p> <p>3.7 Loans – Types, Management of loans, Tax benefits</p> <p>3.8 Insurance – Types, Advantages, selection</p> <p>3.9 Dos and Dons in Financial planning and Transactions</p>	<p>CO3</p>

8. List of activities for Self Learning:

Following list is an illustrative list of the type of activities that can be undertaken. Under this course it would be open to undertake one of these or many other activities which may seem suitable to local needs.

- 1) Plantation of trees, their preservation and upkeep
- 2) Construction & maintenance of village streets, drains.
- (3) Cleaning of village ponds and wells.



- (4) Popularization and construction of Gobar Gas Plants, use of non- conventional Energy.
- (5) Disposal of garbage & composting.
- (6) Prevention of soil erosion and work for soil conservation.
- (7) Watershed management and wasteland development.
- (8) Preservation and upkeep of monuments, and creation of consciousness about the preservation of cultural heritage among the community.
- (9) Health education, AIDS Awareness and preliminary health care.
- (10) Working with cancer patients / orphans/ old age home/ welfare organizations of women with NGO.
- (11) Empowering women by creating awareness among them and imparting training in sewing, embroidery, knitting and other skills wherever possible to make them financially independent.
- (12) Organizing Blood donation/Eye check Up/Body donation camp.
- (13) Popularization of small savings and assistance in procuring bank loans of government schemes, mutual funds and share market, financial planning.
- (14) Organization of youth clubs, rural land indigenous sports in collaboration with Nehru Yuva Kendras;
- (15) Assisting the authorities in distribution of rations, medicine, clothes, immunization, supply of medicine, relief and rescue operation; collection of clothes and other materials, and sending the same to the affected areas

9. IMPLEMENTATION STRATEGY (PLANNING)

1. Industry visit
2. Guest/Expert lectures
3. Demonstrations
4. Slides
5. Self-Learning Online Resources
6. Case Study
7. Role Play
8. Collaborative learning



10. SUGGESTED LEARNING RESOURCES

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

11 LEARNING WEBSITE & PORTALS

- 1 <https://gr.maharashtra.gov.in/Site/Upload/Government>
- 2 <https://gr.maharashtra.gov.in/Site/>
- 3 <https://censusindia.gov.in/census.website/>
- 4 <https://gsda.maharashtra.gov.in/english/>
- 5 <https://mrsac.gov.in/MRSAC/map/map>
- 6 <https://ejalshakti.gov.in/jjmreport/JJMIndia.aspx>
- 7 <https://cpcb.nic.in/>
- 8 <http://www.mahapwd.com/#>
- 9 <http://tutorial.communitygis.net/>
- 10 <https://nss.gov.in/>

12. ASSESSMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Self-Learning
2. Seminar/Presentation
3. Report and presentation of fieldwork activities
4. Assignment

13. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mr. Balaji M. Pande, Senior Lecturer in English
2	Internal	Mrs. Keerti P. Bhawe Lecturer (Selection Grade),Chemistry
3	Internal	Mr. Prasad S. Dhuri, Lecturer, Electronics and Telecommunications Engg.



1.COURSE DETAILS

Programme: Electrical Engineering	Semester: IV
Course: #Switchgear & Protection	Course Category: DSC
Course Code: SGP230312	Duration:16 Weeks

2.LEARNING AND ASSESSMENT SCHEME

Learning Scheme			Credits	Assessment Scheme									Total Marks
Actual Contact Hrs./Week				Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning		
CL	TL	LL			FA-TH	SA-TH	Total	Practical (Marks)					
								FA-PR	SA-PR	SA-OR	SLA (Marks)		
4	-	2	2	4	3	30	70	100	25	-	25	25	175

3. COURSE OBJECTIVE

Electrical supervisor must be aware of continuous need of electric supply, as nobody in this era can tolerate interruption even for small duration of time, this is made possible by called a device “Switchgear “which ensure continuity of supply and prevent damage of costly equipment in factories. Thus arises need of remote sensing of fault & hence various relay systems & protection scheme are suggested in subject, which takes care of protection of generator, transformer, transmission lines & receiving station.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- **Maintain switchgear and protection schemes used in power system**

5.COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Describe various types of switchgear equipment used in power system.
CO2	Use different methods of protection for various power system components.
CO3	Understand overvoltage protection of power system.
CO4	Choose appropriate grounding system for various equipment



6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Switchgear & Protection (SGP230312)	CO1	1	-	3	2	2	2	-	3	2
	CO2	2	2	3	2	1	2	2	3	2
	CO3	2	2	3	2	-	2	1	3	2
	CO4	1	2	3	-	2	2	1	2	2
	CO Avg.	1.50	2.00	3.00	2.00	1.66	2.00	1.33	2.75	2.00

7. COURSE CONTENTS

UNIT NO.	Topic/Sub-Topic
I	<p>Switches</p> <p>1.1 Isolator- types of isolators- rating of isolators.</p> <p>1.2 Bus bar arrangement-requirements, different types of Bus bar arrangements</p> <p>1.3 switchgear in generating stations. Main switchgear and auxiliary switchgear.</p> <p>1.4 Requirements of fuse,</p> <p>1.5 Different types of fuses-Rewireable, H.R.C, Expulsion type, Draw-out fuses.</p> <p>1.6 Characteristics and different ratings of fuses.</p>
II	<p>Relays and contactor</p> <p>2.1 Introduction, Quality requirements of relay, important terms related to relay</p> <p>2.2 Protection zones, primary and backup protection</p> <p>2.3Types-Electromagnetic Relay, Induction Relay, overcurrent Relay, power Relay, directional overcurrent Relay, Distance Relay, Static Relay (block diagram),</p> <p>2.4 Introduction to Numerical relay.</p> <p>2.5 Construction ,operation, application of contactor</p>
III	<p>Circuit Breakers</p> <p>3.1 Requirement of circuit breaker. Difference in fuse and circuit breaker.</p> <p>3.2 Theory of arc extinction in direct current and in alternating current circuits.</p> <p>3.3 Recovery of voltage, Restriking voltage, rate of rise of restriking voltage.</p> <p>3.4 Types-Construction, principle of operation, operating mechanisms of Bulk Oil Circuit Breaker (BOCB)</p>



	<p>Minimum oil content (small oil volume SOV) circuit breakers vacuum circuit breakers (VCB)</p> <p>SF6 circuit breaker (Single Pressure and Double Pressure type)</p> <p>3.5 Making, breaking capacities, contact materials.</p> <p>3.6 L.T Circuit breakers (Construction and principle of operation)</p> <ol style="list-style-type: none"> 1. Air Circuit Breaker (ACB), 2. Miniature circuit breakers (MCB), 3. Moulded case circuit breakers (MCCB), 4. Earth Leakage circuit breakers (ELCB or RLCB), 5. Comparison of Fuse and MCCB
<p style="text-align: center;">IV</p>	<p>Protection systems</p> <p>4.1 Necessity, functions of protective system.</p> <p>4.2 Normal and abnormal conditions.</p> <p>4.3 Types of faults and their causes.</p> <p>4.4 Need of current limiting reactors and their arrangements.</p> <p>4.5 protection schemes for</p> <p>1 Generators:</p> <ol style="list-style-type: none"> a) Merz price protection, b) Earth fault protection <p>2 Transformers:</p> <ol style="list-style-type: none"> 1) a) Over current and earth fault protection 2) b) Percentage differential protection. <p>3 Motors:</p> <ol style="list-style-type: none"> a) over current protection, 2) b) Earth fault Protection <p>4 Bus bars, feeders and transmission lines:</p> <ol style="list-style-type: none"> 1) a) Differential protection 2) b) Directional over current protection 3) c) Definite distance relay protection d) Inverse time over current protection <p>4.6 Basic block diagram of SCADA</p>
<p style="text-align: center;">V</p>	<p>Overvoltage Protection</p> <p>5.1 Causes of over voltages.</p> <p>5.2 Lightning phenomena and over voltage due to lightning.</p> <p>5.3 Protection of transmission line and substation from direct stroke.</p>



	<p>5.4 Construction and principle of operation of different types of lightning arrestors such as Rod gap, horn gap, Expulsion-type lightning arrester, Metal-Oxide Lightning arrester</p> <p>5.5 Surge absorbers (Definition, construction and working of different types)</p>
VI	<p>Neutral Grounding</p> <p>6.1 Introduction</p> <p>6.2 Necessity of neutral grounding and Arcing Ground Phenomena</p> <p>6.3 Different methods of neutral grounding, advantages and disadvantages of neutral grounding.</p> <p>6.4 Comparison between earthing & neutral grounding</p>

8. LIST OF PRACTICALS AND DRAWING SHEETS:

Term Work consists of minimum 4 Practicals and 4 Drawing sheets from the following.

Sr No.	Title of Practical	Approx. HRS required	COs
1.	Identify the components of different types of isolators with their specifications. (through visits , video).	2	CO1
2	Dismantle MCB / MCCB and identify their various parts.	2	CO1
3	Demonstrate SF6 & Vacuum CB model (through Video)	2	CO1
4	Calculate Plug Setting Multiplier & Time Setting Multiplier of induction type electromagnetic relay.	2	CO1
5	Simulate overcurrent protection scheme for 3-phase transmission line using the available kit.	2	CO2
6	Demonstration of IDMT Relay	2	CO1
	Title of Drawing Sheet		
1.	Draw different types of Isolators, Bus-Bar Arrangements and Fuses	4	CO1
2.	Sketch the constructional details, scheme details of different types of relays.	4	CO1
3.	Sketch the constructional details, scheme details of different types of Circuit Breaker	4	CO1
4.	Sketch the constructional details, scheme details of Different protection schemes for Transformer, Induction Motor, Alternator and protection devices. (2Sheets)	2	CO2
5.	Draw different types of Devices used for overvoltage protections.	2	CO3
6.	Draw different methods of neutral grounding.	2	CO4
TOTAL		30	



9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

1. Seminar/Presentation
2. Model/Chart making
3. Assignment
4. Case Study
5. Quiz

Assignments-

1. Explain construction and working of Different types of fuses.
2. Describe different types of LV and HV circuit breakers.
3. Explain construction and working of Different types of Relays
4. Explain construction and working of Different types of lightning Arrestors.
5. Describe operation of various types of Substation and compare it.

Model/Chart making –

Prepare chart on Different types of fuses

1. Prepare chart on LV and HV circuit breakers.
2. Prepare chart on Different types of Relays
3. Prepare chart on Different types of lightning Arrestors.
4. Prepare chart on various types of Substation.

10. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of Practicals/drawings.
3. Industry visit
4. Guest/Expert lectures
5. Slides
6. Demonstrations
7. Self-Learning Online Resources

11. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of the Book	Author	Publication
1	S. S. Rao	Switchgear & protection	Khanna Publications
2.	V. L. Uppal Electrical	Electrical Power	Khanna Publication
2	V. K. Mehta Power System	Power System	Chand & Co
3	Soni, Gupta & Bhatnagar	Electrical Power	Dhanpatrai & sons
4	J.B.Gupta	Electrical Power	Khanna Publication



12. LEARNING WEBSITE & PORTALS (minimum 5)

1. www.nptel.ac.in
2. www.electricaltechnology.org
3. www.electricalvolt.com
4. www.Electrical4u.com
5. www.Electrical powerinfo.com

13. ASSESMENT METHODOLOGY/LEARNING TOOLS

Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Self-Learning
4. Term Work

Summative Assessment (Assessment of Learning)

1. End Term Exam
2. Oral Exam

14. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Aligned COs	Teaching Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
1.	Switches	CO1	10	2	6	4	12
2.	Relays and contactor	CO1	12	2	7	5	14
3.	Circuit Breakers	CO1	12	2	4	8	14
4.	Protection systems	CO2	14	2	6	8	16
5.	Overvoltage Protection	CO3	6	-	4	4	08
6.	Neutral Grounding	CO4	6	-	2	4	06
TOTAL			60	8	29	33	70

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

15. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mrs Ajayshree N. Kinhekar
2	Internal	Mr. Namdeo D.Adate
3	External	Mrs. Bhagyashree Firake Organisation: K.J.Somaiya, Polytechnic



1.COURSE DETAILS:

Programme: Electrical Engineering	Semester: IV
Course: # Power Electronics	Course Category: DSC
Course Code: PEX230313	Duration:16 Weeks

2. TEACHING AND EXAMINATION SCHEME:

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	Practical (Marks)				
									FA-PR	SA-PR	SA-OR	SLA (Marks)	
4	-	2	2	4	3	30	70	100	25	25	-	25	

3. COURSE OBJECTIVE

To become a perfect technician in electrical engineering, knowledge and applications of electronic Power Devices, AC-DC Motor controls, Inverters, Choppers and SMPS is essential.

4. SKILL COMPETENCY

- Maintain the proper functioning of power electronic devices used in domestics and industries applications.

5.COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Interpret the use of power electronics devices as per its characteristics.
CO2	Explain Thyristor turn-on and turn-off control circuits.
CO3	Analyze the working of Converters (i.e. controlled rectifiers)
CO4	Maintain different types of inverter circuits
CO5	Describe the operation of choppers.
CO6	Illustrate the applications of power Electronics



6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Power Electronics (PEX230313)	CO1	3	-	2	2	1	2	2	3	2
	CO2	2	2	1	3	1	-	2	2	3
	CO3	2	2	3	2	-	2	1	3	2
	CO4	1	2	3	-	1	2	1	2	2
	CO5	3	2	1	-	1	-	-	2	3
	CO6	3	2	2	1	2	-	1	2	3
	CO Avg.	2.33	2.00	2.00	2.00	1.20	2.00	1.40	2.33	2.50

7. COURSE CONTENTS

UNIT NO.	Topic/Sub-Topic
I	<p>1.0 Power Electronics Devices</p> <p>1.1 Introduction of Power Electronics, Power electronics concepts.</p> <p>1.2 SCR: Construction, working and V-I characteristics.</p> <p>1.3 Two transistor analogy of SCR</p> <p>1.4 Thyristors family power devices: GTO, LASCR, TRIAC, symbol, construction, operating principle and V-I characteristics.</p> <p>1.5 Thyristors family triggering devices: UJT, PUT, DIAC, SCS, SBS symbol, construction, operating principle and V-I characteristics.</p> <p>1.6 IGBT: construction, working principle, V-I characteristics and applications.</p> <p>1.7 MOSFET: construction, working principle, V-I characteristics and application.</p> <p>1.8 Know the symbol, characteristics, property and applications of modern power electronics devices such as IGCT (Integrated gate commutated thyristor) , MCT (MOS controlled thyristor, SITH (Static induction thyristor)</p>
II	<p>2.0 Turn-on and turn-off methods of Thyristors</p> <p>2.1 SCR Turn-ON methods: -High forward voltage , thermal triggering, Illumination triggering, dv/dt triggering and Gate triggering.</p> <p>2.2 Gate trigger circuits: - Resistance and Resistance –Capacitance trigger circuits</p> <p>2.3 SCR triggering using UJT and PUT, Relaxation Oscillator and unsynchronized UJT triggering circuit.</p> <p>2.4 Pulse transformer and opto-coupler based triggering.</p> <p>2.5 SCR Turn-Off methods: - Class A –Series resonant commutation circuit, Class B- Shunt resonant commutation circuit, Class C- Complimentary symmetry commutation circuit, Class D- Auxiliary commutation, Class E- External</p> <p>2.6 pulse commutation, Class F- Line or Natural commutation.</p>



III	<p>3.0 Controlled Rectifiers</p> <p>3.1 Phase control, firing angle, conduction angle</p> <p>3.2 Single phase half wave controlled rectifier with resistive load, RL load, RL load with freewheeling diode and general load.</p> <p>3.3 Single phase full wave controlled rectifier using a center tapped transformer with resistive load, RL load, RL load with freewheeling diode and general load.</p> <p>3.4 Single phase fully controlled bridge converter with resistive load, RL load, RL load with freewheeling diode and general load.</p> <p>3.5 Single phase full wave half controlled bridge converter (1- Ph semi converter)</p> <p>3.6 Three phase half wave and full wave controlled rectifier for R and RL loads.</p> <p>3.7 Comparison of single phase and three phase converters.</p>
IV	<p>4.0 Inverter Circuits</p> <p>4.1 Operating principles of inverter</p> <p>4.1.1 Single phase voltage source Inverters</p> <p>4.1.2 Single phase bridge Inverters</p> <p>4.2 Principles of operation of different inverter circuits</p> <p>4.3 Inverter waveforms</p> <p>4.4 Inverter using Thyristors</p> <p>4.5 Series and Parallel Inverters</p> <p>4.6 A.C Voltage Control</p> <p>Three-phase bridge inverter description with circuits and waveforms of 120° & 180° mode with star and delta connected load.</p>
V	<p>5.0 Chopper Circuits</p> <p>5.1 Principles of Chopper</p> <p>5.2 Control strategies</p> <p>5.2.1 Constant frequency system</p> <p>5.2.2 Variable frequency system</p> <p>5.3 Step up choppers</p> <p>5.4 Types of chopper circuits</p> <p>5.4.1 Type A,B, C, D and E Chopper circuits</p>
VI	<p>6.0 Applications of Power Electronics</p> <p>6.1 Industrial application</p> <p>6.1.1 Introduction of Electric Drive. Need of drives</p> <p>6.1.2 DC drives. Components of a DC drive. DC drives types and it's working principle. Analog and Digital drives.</p> <p>6.1.3 AC drives. Classification of AC drives. Construction and principle operation of variable frequency drive (VFD).</p> <p>6.2 Domestic applications, Static circuit breaker (DC and AC), SCR battery charger controller, static VAR compensation, SMPS, UPS.</p> <p>6.3 Power system application</p> <p>6.3.1 HVDC transmission system.</p> <p>6.4 Interconnection of renewable energy sources and energy storage systems to the utility</p>



8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing minimum no of 10 Experiments/assignments/drawings

Sr No.	Title of Practical	Approx. HRS required	CO
1.	Plot the V –I characteristics forward biased SCR for different gate currents.	2	CO1
2.	Plot the V –I characteristics of DIAC	2	CO1
3.	Plot the V –I characteristics of TRIAC	2	CO1
4.	Plot the V –I characteristics of IGBT	2	CO1
5.	Test the function of R triggering circuit for SCR	2	CO2
6.	Test the function of RC triggering circuit for SCR	2	CO2
7.	Test the functioning of Class C commutation for turning off SCR	2	CO2
8.	Check the performance of impulse commutated chopper	2	CO2
9.	Study industrial applications of phase controlled circuits	2	CO3
10.	Construct series inverter circuit and plot & analyze the output waveforms.	2	CO4
11.	Construct parallel inverter circuit and plot & analyze the output waveforms.	2	CO4
12.	Study of different types of choppers	4	CO5
13.	Test the function of light dimmer using SCR and UJT	2	CO6
14.	Test the function of light dimmer using DIAC & TRIAC	2	CO6
15.	Assignment on functioning of SMPS	-	CO6
16.	Assignment on functioning of UPS	-	CO6
	Total	30	

9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

1. Assessment to be based on one of the following tools and rubrics for evaluation of SLA to be well defined by course teacher.
2. Micro-Project
3. Seminar/ Presentation
4. Quiz
5. Assignment

Micro Projects:

1. Prepare working kit depicting the applications of SCR
2. Prepare working kit depicting the applications of GTO
3. Prepare working kit depicting the applications of SUS
4. Prepare working kit depicting the applications of SCS/SUS
5. Prepare working kit depicting the applications of MCT/FCT
6. Prepare working kit of light dimmer using Diac and Triac



Assignment:

1. Study assignment on phase controlled rectifiers
2. Study assignment on choppers
3. Study assignment on inverters
4. Study assignments on SMPS and Battery charger circuits using SCR (working & Diagram)

10. IMPLEMENTATION STRATEGY(PLANNING):

In depth study and understanding of the subject will be implemented by adopting following strategy.

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Industry visit
4. Guest/Expert lectures
5. Slides
6. Self-Learning Online Resources

11. SUGGESTED LEARNING RESOURCES:

Sr.No.	Title of the Book	Author	Publication
1	Power Electronics	M D Singh K B Khanchandani	Tata-Mcgraw Hill, New Delhi
2	Thyristors Control and Applications	M. Ramamurthy	EWP Publications
3	Electronics in Industry	Chute and Chute	Tata-Mcgraw Hill, New Delhi
4	Industrial Electronics	Cage	Tata-Mcgraw Hill, New Delhi
5	Industrial Electronics Lab Manual	Zbar	Tata-Mcgraw Hill, New Delhi
6	Industrial Electronics	Sameer Datta	PHI Publication, New Delhi
7	Power Electronics	P.S.Bimbhra	Khanna Publishers, New Delhi
8	Power Electronics, The Electrical Engineering Handbook	Rajashekara, K., Bhat, A.K.S., Bose, B.K.	

12 WEB WEBSITE & PORTALS (minimum 5)

1. <https://www.electricaltechnology.org/2015/10/electrical-drives-ac-drives-vfd-dc-drives.html>
2. <https://www.electricaltechnology.org/2015/10/electrical-drives-ac-drives-vfd-dc-drives.html>
3. www.nptel.ac.in/courses/108101038
4. www.ee.iitb.ac.in/~apel
5. www.tutorialpoint.com/power_electronics/
6. SEQUEL: software for power electronics
7. www.youtube.com



13. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

- 1 Test
- 2 Rubrics for COs Assignment
- 3 Self-Learning
- 4 Term Work

Summative Assessment (Assessment of Learning)

- 1 End Term Exam

14. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Unit No.	Unit Title	Aligned COs	Teaching Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I	Power Electronics Devices	CO1	12	2	4	8	14
II	Turn-on and turn-off methods of Thyristors.	CO2	08	2	4	4	10
III	Controlled Rectifiers	CO3	10	2	6	4	12
IV	Inverter Circuits	CO4	10	2	2	6	10
V	Chopper Circuits	CO5	08	2	2	6	10
VI	Applications of Power Electronics	CO6	12	4	6	4	14
TOTAL			60	14	24	32	70

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

15. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mr. N D Adate
2	Internal	Mr P S Dhuri
3	External	Mr. Vinod Yadav
		Organisation: Premlila Vithaldas Polytechnic, SNDDT, Mumbai



1. COURSE DETAILS

Programme: Electrical Engineering	Semester: IV
Course: Electrical Contracting & Estimation	Course Category: DSC
Course Code: ECE230314	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme									
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks	
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR			SLA (Marks)
												4		

3. COURSE OBJECTIVE

Electrical Diploma holders have to work as Technicians & Supervisors for Electrical Installations of various companies, commercial and Industrial electrification schemes and prepare estimates for these schemes. They also work as Independent electrical contractors and execute illumination and electrification schemes. This course will help them to prepare detailed estimates.

4. SKILL COMPETENCY

- Design electrical installation with costing for tendering

5. COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Follow National Electrical Code in electrical installations
CO2	Prepare tender and quotation of various installations
CO3	Estimate the work of Residential Installation
CO4	Estimate the work of Commercial Installation
CO5	Estimate the work of Industrial Installation
CO6	Estimate the work of public lighting Installation



6. CO - PO, CO - PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical Contracting & Estimation (ECE230314)	CO1	3	1	1	2	-	-	-	2	2
	CO2	1	-	3	-	2	-	-	3	3
	CO3	1	2	3	-	-	-	-	3	3
	CO4	1	2	3	-	-	-	-	3	3
	CO5	1	2	3	-	-	-	-	3	3
	CO6	1	2	3	-	-	-	-	3	3
	CO Avg	1.33	1.80	2.67	2	2	-	-	2.83	2.83

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-Topic
I	<p>1.0 Electrical Installation and Drawing</p> <p>1.1 Scope and features of National electric code in India</p> <p>1.2 General requirement of Electrical installation</p> <p>1.3 Types of electrical installation</p> <p>1.4 Reading and Interpretation of Electrical Engineering Drawings</p> <p>1.5 Various diagrams, plans and layout</p>
II	<p>2.0 Estimation and Costing</p> <p>2.1 Meaning and purpose of rough estimate, detailed estimate, supplementary estimate, annual maintenance estimate and revised estimate</p> <p>2.2 Factors to be considered while preparation of detailed estimate and economical execution of work</p> <p>2.3 Contracts- Concepts of contracts, types of contracts, contractor, Criteria for selecting Contractor, role of contractor</p> <p>2.4 Tenders and Quotations- Type of tender, tender notice, preparation of tender document, and procedure of opening of tendering documents</p> <p>2.5 Comparative statements</p> <p>2.6 Principles of execution of work, need of planning for the execution of work</p>
III	<p>3.0 Residential Building Installation</p> <p>3.1 General rules guidelines for wiring of Residential Installation and positioning of equipment</p> <p>3.2 Principles of circuit design in lighting and power circuits</p> <p>3.3 Procedures for designing the circuits and deciding the number of circuits</p> <p>3.4 Method of drawing single line diagram</p> <p>3.5 Selection of type of wiring and rating of wires & cables</p> <p>3.6 Load calculations and selection of size of conductor</p>



	<p>3.7 Selection of rating of main switch, distributions board, protective switchgear ELCB, MCB and wiring accessories.</p> <p>3.8 Earthing of Residential Installation. Plate and Pipe earthing.</p> <p>3.9 Sequence to be followed for preparing Estimate.</p> <p>3.10 Preparation of detailed estimates and costing of Residential Installation</p>
IV	<p>4.0 Commercial Installation</p> <p>4.1 Concept of commercial Installation</p> <p>4.2 Differentiate between electrification of Residential and commercial Installation</p> <p>4.3 Fundamental considerations for planning of an electrical Installation system for commercial building</p> <p>4.4 Design considerations of electrical Installation system for commercial building</p> <p>4.5 Load calculations & selection of size of service connection and nature of supply</p> <p>4.6 Deciding the size of cables, bus bar and bus bar chambers</p> <p>4.7 Mounting arrangements and positioning of Switchboards, distribution boards, main switch etc.</p> <p>4.8 Earthing of the electrical Installation</p> <p>4.9 Selection of type of wire, wiring system & layout</p> <p>4.10 Sequence to be followed to prepare estimate</p> <p>4.11 Preparation of detailed estimate and costing of commercial Installation</p>
V	<p>5.0 Industrial Installation</p> <p>5.1 Concept of Industrial load</p> <p>5.2 Concept of Motor wiring circuit and single line diagram</p> <p>5.3 Important guidelines about power wiring and Motor wiring</p> <p>5.4 Design consideration of Electrical Installation in small Industry/Factory/workshop</p> <p>5.5 Motor current calculations</p> <p>5.6 Selection and rating of wire, cable size & conduct</p> <p>5.7 Deciding fuse rating, starter, distribution boards, main switch etc.</p> <p>5.8 Deciding the cable route, determination of length of wire, cable, conduit, earth wire, and earthing</p> <p>5.9 Sequence to be followed to prepare estimate.</p> <p>5.10 Preparations of detailed estimate and costing of small factory unit/ workshop.</p>
VI	<p>6.0 Public Lighting Installation</p> <p>6.1 Classification of outdoor installations streetlight/ public lighting installation</p> <p>6.2 Street light pole structures. Selection of equipments, sources used in street light installations.</p> <p>6.3 Cables, recommended types and sizes of cable. Control of street light installation.</p> <p>6.4 Design, estimation and costing of streetlight</p>



8. **LIST OF DRAWING SHEETS:** Term Work consists of minimum number of Five Drawing Sheets and assignments from the following. Drawing sheets are to be prepared either by manual or Electrical CAD.

Sr. No.	Title of Drawing Sheet	Approx.Hrs required	CO
1.	Different Types of Electrical Symbols and wiring diagrams	4	CO1
2.	Prepare a quotation for purchasing different electrical material required.	2	CO2
3.	Electrical Installation scheme for single flat, independent bungalow and small house. Draw wiring diagram and prepare detailed estimate and its costing	4	CO3
4.	Electrical Installation scheme for commercial buildings. Draw wiring diagram and prepare detailed estimate and its costing	4	CO4
5.	Electrical Installation scheme for small factory unit. Draw single line layout and prepare detailed estimate and its costing 1) Small factory unit 2) Workshop 3) Agriculture pump and flour mills	4	CO5
6	Estimate with a proposal of the electrical Installation of streetlight scheme for small premises after designing	2	CO6
Sr. No.	Title of Drawing Sheet(Drawing sheets to be prepared with the help of Electrical CAD	Approx.Hrs required	CO
1	To draw the wiring diagram for controlling one Lamp, one Tube light, one fan and one socket	2	CO3
2	To draw the circuit diagram of practical set up for Speed Control of DC shunt Motor by flux control method	2	CO5
3	To draw the circuit diagram of practical set up for load test on DC shunt generator	2	CO5
4	Preparation of wiring diagram for residential/Commercial/Industrial installations	4	CO3/CO4/CO5
	Total	30	
	Assignments-		
	1. Draw different types of wiring Systems	-	CO1
	2. Explain in detail Contracts and Tenders	-	CO6

9. **SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING): NA**

10. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan
2. Minimum no of drawings.
3. Industry visit
4. Guest/Expert lectures



5. Power point presentation
6. Group discussions
7. Self Learning Online Resource

11. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of the Book	Author	Publication
1	Electrical Design Estimating and costing	K.B. Raina	New Age International
2	Electrical Estimating and costing	Surjit Ravi Deep Singh	Dhanpat Rai & Sons
3	Electrical Estimating and costing	Allagappan, N.S.Ekambarram	Tata Mc-Graw Hill
4	Electrical Design Estimating and costing	S.L.Uppal	Khanna Publication
5	AutoCAD 2013 for Engineers and Designers.	Sham Tickoo	Dream tech press, New Delhi, Latest edition
6	Mastering AutoCAD 2013 and AutoCAD LT 2013	George Omura	Sybex, New Delhi, Latest edition
7	AutoCAD 2011 & AutoCAD LT 2011	Ellen Finkelstein	Wiley India publication

12. WEB REFERANCES

1. www.electricalinstallation.com
2. www.totalestimating.com
3. www.electriciantalk.com
4. www.electriciansforums.net
5. www.electrical4u.com
6. <http://www.circuitstoday.com/circuit-design-and-simulation-softwares>
7. <http://coolcadelectronics.com/coolspice/>
8. <http://students.autodesk.com>

13. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Term Work

Summative Assessment (Assessment of Learning)

1. End Term Exam
2. Oral Exam



**14.SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE
(Specification Table)**

Unit No.	Unit Title	Aligned COs	Teaching Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I	Electrical Installation and Drawing	CO1	06	04	02	02	08
II	Estimation and Costing	CO2	10	02	04	06	12
III	Residential Building Installation	CO3	14	04	04	08	16
IV	Commercial Installation	CO4	11	02	04	06	12
V	Industrial Installation	CO5	11	02	04	06	12
VI	Public Lighting Installation	CO6	08	02	04	04	10
TOTAL			60	16	22	32	70

R- Remembering, U- Understanding, A- Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

15. COURSE EXPERT COMMITTEE MEMBERS

SR.NO.		NAME
1	Internal	Mr. Dinesh G Rajmandai
2	Internal	Mr. N.D.Adate
3	External	Shri.A.K Dhulshette
		Organization: Government Polytechnic, Mumbai



1. COURSE DETAILS

Programme: Electrical Engineering	Semester: IV
Course: DC & Synchronous Machines	Course Category: DSC
Course Code: DSM230315	Duration: 16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Paper Duration (Hrs.)	Assessment Scheme							Total Marks
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)			Theory (Marks)			Based on LL & TL			Based on Self Learning	
CL	TL	LL				FA-TH	SA-TH	Total	Practical (Marks)				
									FA-PR	SA-PR	SA-OR		
4	-	2	-	3	3	30	70	100	25	25	-	-	150

3. COURSE OBJECTIVE

This Course deals with the study of DC Machines, Alternator, Synchronous Motor and practical's thereof. In order to understand Electrical testing & maintenance, Traction and Drives, Power Electronics knowledge of DC & Synchronous Machines is very important.

4. SKILL COMPETENCY

- Use relevant DC Machines and Synchronous machines for different electrical engineering applications.

5. COURSE OUTCOMES (COs) At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Know the various types, constructional details and characteristics of D.C Generator
CO2	Know the various types, constructional details and characteristics of D.C Motor
CO3	Calculate losses and efficiency of D.C Generator and Motor
CO4	Use the relevant three phase alternator for different load conditions.
CO5	Conduct parallel operation of three phase Alternator.
CO6	Use suitable Synchronous motors in different applications.



6. CO - PO, CO - PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
DC & Synchronous Machines (DSM230315)	CO1	3	1	-	2	-	-	-	2	2
	CO2	3	1	-	2	-	-	-	2	2
	CO3	3	2	1	1	-	-	-	3	3
	CO4	2	2	3	1	-	-	1	3	3
	CO5	2	2	1	3	-	-	-	3	3
	CO6	2	2	3	1	-	-	1	3	3
	CO Avg	2.5	1.67	2.0	1.67	-	-	1.0	2.67	2.67

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic
I	<p>1.0 D.C generator</p> <p>1.1 Introduction of D.C Machines</p> <p>1.2 Principle of operation & construction of Generator.</p> <p>1.3 Armature winding (Only Basics)</p> <p>1.4 E.M.F equation of D.C Generator. (Simple Numericals)</p> <p>1.5 Types of DC generators, their circuit diagram and necessary equations</p> <p>1.5.1 DC Shunt Generator</p> <p>1.5.2 DC Series Generator</p> <p>1.5.3 DC Compound Generator</p> <p>1.6 DC generators characteristics</p> <p>1.6.1 Open circuit characteristics</p> <p>1.6.2 External characteristics</p> <p>1.6.3 Internal characteristics</p> <p>1.7 Building up process of dc shunt generator. Concept of Critical field resistance and critical speed.</p>
II	<p>2.0 D.C Motor</p> <p>2.1 Principle of operation and Construction of D.C motor.</p> <p>2.2 Back emf & torque equation of dc Motor, simple numericals</p> <p>2.3 Types of dc motors, their circuit diagram and necessary equations</p> <p>2.3.1 DC Shunt Motor</p> <p>2.3.2 DC Series Motor</p> <p>2.3.3 DC Compound Motor</p> <p>2.4 Characteristics and Applications of dc motors</p> <p>2.5 Method of speed control of dc shunt and series motors.</p> <p>2.6 Starting of dc motors:</p> <p>2.6.1 Three Point starter</p> <p>2.6.2 Four-point starter.</p> <p>2.7 Brushless DC Motor (Construction, working principle, advantages and applications)</p>



III	3.0 Losses & efficiency in dc machines 3.1 Power losses in dc machines 3.2 Power flow diagram 3.3 Efficiency of dc motor and DC generator 3.4 Derivation of condition for maximum efficiency of dc motor and DC generator. 3.5 Simple Numericals based on above topics.
IV	4.0 Three phase alternators. 4.1 Construction of synchronous machine and its working principle. 4.2 Concept of synchronous speed. 4.3 Salient pole & non-salient pole type field structure. 4.4 Classification of stator armature winding. Single and Double layer. 4.5 Emf equation of Alternator by considering Short pitch factor and Distribution factor. 4.6 Phasor diagrams of alternator on various load. 4.7 Synchronous Impedance and its determination by open circuit and short circuit test. 4.8 Voltage regulation of an alternator by direct loading and synchronous impedance method. 4.9 Simple numericals based on the above topics
V	5.0 Parallel operation of Three Phase Alternators 5.1 Necessity of Parallel operation of three phase alternators 5.2 Conditions or requirements of Parallel operation of three phase alternators 5.3 Methods of parallel operation of three phase alternators 5.3.1 Three dark lamp method 5.3.2 Two bright and one dark lamp method 5.3.3 Synchroscope method
VI	6.0 Synchronous motors 6.1 Principle and operation of Synchronous motor 6.2 Starting methods of synchronous motor 6.3 Starting torque, running torque, pull in torque, pull out torque 6.4 Effect of load on synchronous motor with constant excitation 6.5 Behavior of synchronous motors with constant load and variable excitation 6.6 Hunting and phase swinging 6.7 V- curves and Inverted V- curves 6.8 Applications of Synchronous motor

8. LIST OF PRACTICALS/ASSIGNMENTS/TUTORIALS/DRAWINGS

Term work consist of Journal containing minimum number of 10 Experiments/assignments/drawings

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	CO
1	To Plot the characteristics of a dc shunt generator on Load	4	CO1
2	To Plot the characteristics of a dc series generator on Load	4	CO1
3	To Plot Magnetization curve of a dc generator and determination of critical field resistance.	2	CO1
4	To Plot Speed V/S load characteristics of a dc shunt motor.	2	CO2



5	Speed Control of DC shunt Motor by Armature Rheostatic control method	2	CO2
6	Study of Brushless D.C Motor	2	CO2
7	Speed Control of DC shunt Motor by flux control method	2	CO2
8	Assignment – Condition of maximum efficiency of DC Motor and DC Generator	-	CO3
9	To Plot open circuit Characteristics of an Alternator	2	CO4
10	To Plot Short Circuit Characteristics of an Alternator	2	CO4
11	Determination of regulation & efficiency of an alternator from open circuit & short circuit characteristics	4	CO4
12	Parallel operation of three phase Alternators	2	CO5
13	To Plot V and inverted V curve of a synchronous motor	2	CO6
TOTAL		30	

9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING): NA

10. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan.
2. Minimum number of practicals/Assignments.
3. Industry visit.
4. Guest/Expert lectures.
5. Demonstrations.
6. Power point presentation
7. Self-Learning Online Resources

11. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Electrical Technology Volume – II	B.L.Theraja	S.Chand and Co. New Delhi.
2	Electrical Machines	S.K.Bhattacharya	Tata McGraw Hill Pub Co.Ltd. New Delhi.
3	Electrical Machinery	P.S.Bhimra	Khanna Publishers
4	Elements Of Electrical Machines	Pradip Kumar Sadhu	CBS Publications
5	Electrical Machines –II	J B Gupta	<u>S.K. Kataria & Sons</u> ISBN 10: 9350141604 ISBN 13: 9789350141601
6	Fundamentals of Electric Machines	B R Gupta	New Age International (P) Ltd. ISBN: 9788122416145



12. WEB REFERENCES

- 1) <http://www.nptel.ac.in/courses/108105017>
- 2) www.electricaltechnology.org
- 3) www.electrical4u.com
- 4) <http://www.electriceasy.com>
- 5) <http://www.youtube.com/watch?v=D4RFFnzRdkk>

13. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Self-Learning
4. Term Work

Summative Assessment (Assessment of Learning)

1. End Term Exam
2. Oral Exam

14. SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE (Specification Table)

Unit No.	Unit Title	Aligned COs	Learning Hours	Distribution of Theory Marks			
				R Level	U Level	A Level	Total Marks
I	D.C generator	CO1	10	4	4	4	12
II	D.C Motor	CO2	14	6	6	4	16
III	Losses & efficiency in dc machines	CO3	08	3	4	3	10
IV	Three phase Alternators	CO4	11	4	4	4	12
V	Parallel operation of Three phase Alternators	CO5	06	3	3	2	08
VI	Synchronous motors	CO6	11	4	4	4	12
TOTAL			60	24	25	21	70

R- Remembering, U - Understanding, A- Applying (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

15. COURSE EXPERT COMMITTEE MEMBERS

SR.NO.		NAME
1	Internal	Mr.Dinesh G Rajmandai
2	Internal	Mr.N.D.Adate
3	External	Shri.A.K.Dhulshette
		Organisation: Government polytechnic, Bandra.



1. COURSE DETAILS

Programme: Electrical Engineering	Semester: IV
Course: #Utilization of Electrical Energy	Course Category: DSE
Course Code: UEE230316	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								Total Marks
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
4	-	2	2	4	3	30	70	100	25	-	25	25	175

3. COURSE OBJECTIVE

Electrical Engineering diploma holders are appointed in industries in the supervisory cadre. Their main job functions are to supervise the operation and control of various electrical furnaces, electrical welding equipment, refrigeration, air-conditioning systems. The factory illumination scheme is also to be maintaining by them. Also, nowadays they are responsible to conserve energy and reduce the bills and environmental impact of various processes. Therefore, the knowledge of operation and control of these machines and equipment is vital for every diploma holder.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- **Suggest the appropriate method/scheme for illumination, heating, welding and techniques for conserving energy while utilizing electrical energy for various applications.**

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Select appropriate type, rating, number of light source and lighting scheme for indoor lighting as per given specifications/requirement.
CO2	Select suitable method of electric heating and welding for various applications.
CO3	Determine the appropriate methods to improve energy efficiency in compressors, pumps, refrigeration and HVAC systems.
CO4	Justify the need of energy conservation and hence energy audit.
CO5	Determine appropriate energy conservation techniques and devices in motors, transformers, illumination and transmission-distribution.
CO6	Estimate tariff, its applicable tariff and methods to reduce the same.



6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
#Utilization of Electrical Energy (UEE230316)	CO1	3	2	3	1	1	-	1	2	3
	CO2	3	2	1	1	1	-	1	2	3
	CO3	3	3	1	1	1	-	1	2	3
	CO4	3	2	1	1	3	1	1	2	3
	CO5	3	2	1	-	3	-	1	2	3
	CO6	3	3	2	1	1	-	1	2	3
	CO Avg.	3.00	2.33	1.50	1.00	1.66	1.00	1.00	2.00	3.00

7. COURSE CONTENTS

UNIT NO.	Topic /Sub-Topics
I	<p>Illumination:</p> <p>1.1 Definitions of terms used in illuminations: Light, Luminous flux, luminous intensity, Lumen, Candle power, illumination, lux or meter candle, mean horizontal candle power (MHCP), means spherical candle power (MSCP), means hemispherical candle power (MHSCP), Reduction factor, lamp efficiency, specific consumption, glare, space to height ratio, utilization factor, maintenance factor, depreciation factor, waste light factor, absorption factor, reflection factor, plane angle, solid angle.</p> <p>1.2 Laws of illumination</p> <p>1.2.1 Law of inverse squares.</p> <p>1.2.2 Lambert's cosine law</p> <p>1.3 Sources of light: Construction, working and application of LED lamps</p> <p>1.4 Types of indoor lighting schemes</p> <p>1.5 Design of indoor lighting schemes</p> <p>1.5.1 Objectives of lighting scheme</p> <p>1.5.2 Factors to be considered while designing the lighting scheme</p> <p>1.6 Lighting calculations (simple numerical)</p> <p>1.7 Street lighting, public lighting</p>
II	<p>Electrical heating & welding:</p> <p>2.1 Concept of Electric Heating, Classification of electric heating, Advantages and disadvantages, Modes of heat transfer</p> <p>2.2 Resistance heating: Direct and indirect resistance heating, their working principle and construction, Properties of heating element material, Causes of failure of heating element, methods of temperature control, application of resistance heating, Advantages and disadvantages (No numerical)</p> <p>2.3 Arc heating: Direct arc heating, indirect arc heating, applications of arc heating, Advantages and disadvantages</p> <p>2.4 Induction heating. Core type induction furnaces- Ajax Wyatt furnace, coreless induction</p>



	<p>furnace, Application of induction heating, Advantages and disadvantages</p> <p>2.5 Dielectric heating- Principle, application of dielectric heating, Advantages and disadvantages</p> <p>2.6 Electric welding, Advantages, Classifications</p> <p>2.7 Resistance welding</p> <p>2.7.1 Principle of resistance welding, Advantages and disadvantages</p> <p>2.7.2 Types of resistance welding and their applications</p> <p>2.7.3 Quality of good weld, welding defects</p> <p>2.8 Arc welding Machines: Principle and operation, Metal arc welding, Carbon arc welding, Advantages of coated electrodes, Supply (AC/DC), applications, Arc Welding Machines, AC Welding Machines – Welding Transformer.</p>
III	<p>Refrigeration and Heating, Ventilation and Air Conditioning (HVAC):</p> <p>3.1 Refrigeration cycle, difference between refrigeration and air conditioning</p> <p>3.2 Basic block diagram of HVAC</p> <p>3.3 Function of compressors</p> <p>3.4 Types of compressors</p> <p>3.5 Compressed air system components</p> <p>3.6 Function of pumps</p> <p>3.7 Working of Centrifugal</p> <p>3.8 Energy efficiency in HVAC and refrigeration</p>
IV	<p>Energy Conservation:</p> <p>4.1 Preset energy scenario.</p> <p>4.2 Energy Conservation: Definition, Importance of energy conservation</p> <p>4.3 Electricity Act – 2003, Energy conservation act 2001</p> <p>4.4 Bureau of Energy Efficiency and its functions</p> <p>4.5 Energy audit (only introduction)</p>
V	<p>Energy conservation techniques in electric systems:</p> <p>5.1 Electrical Motors: Types, Energy Efficient Motors, Factors affecting efficiency of motors</p> <p>5.2 Energy Efficient Transformer</p> <p>5.3 Energy Efficient Lighting and Control</p> <p>5.4 Losses in Transmission and Distribution System and its Minimization</p> <p>5.5 Reactive Power Compensation</p> <p>5.6 Demand Side Management System</p>
VI	<p>Economic aspects of utilizing electrical energy</p> <p>6.1 Costing of electrical energy: fixed charge, Semi fixed charge & running Charge.</p> <p>6.2 Various types of tariff: Simple tariff, Flat rate tariff, Block rate tariff, two-part tariff, Maximum demand tariff and Power factor tariff, Time of day tariff, Availability Based tariff</p> <p>6.3 Types of consumers and their Tariffs: Domestic, Commercial, Agricultural and Industrial consumers. (Simple numerical on Tariffs)</p> <p>6.4 Power factor improvement: causes of low power factor, disadvantage of Low power factor, Methods of power factor improvement</p> <p>6.5 Most economical power factor (Derivation and simple numerical)</p>



8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

The term work consists of journal consisting of minimum 5 assignments (from 1 to 6) and mini project/study project/industry visit with approximate number of hours required with corresponding CO's

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs. required	COs
1	To measure of illumination by lux meter for different locations and of different lamps, to prepare a report on Illumination laws and case studies on the same	2	CO1
2	To prepare a report on Electric Heating, welding	2	CO2
3	To prepare a report on Refrigeration and HVAC	2	CO3
4	To prepare a detailed energy audit report of a house/site	4	CO4
5	To determine various parameters in electricity bill of domestic and industrial consumers and suitable methods/means for conservation of electricity	2	CO5/CO6
6	To estimate energy conserved by improving power factor for given cases	4	CO6
7	Mini project/Study project/Project based on Industry visit	14	CO1/CO2/CO3/CO4/CO5/CO6
Total Hours		30	

9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

Assessment to be based on one of the following tools and rubrics for evaluation of SLA to be well defined by course teacher.

1. Micro-Project
2. Seminar/ Presentation
3. Model/Chart making
4. Surveys
5. Case Study
6. Quiz
7. Assignment

SUGGESTED STUDENT ACTIVITIES

1. Assignments

Assignments will be given on following chapter and students will solve it in a notebook. The notebook will be assessed at the end of the semester.

- i. Illumination
- ii. Electrical heating & welding
- iii. Compressors, pumps, Refrigeration and HVAC
- iv. Energy Conservation
- v. Energy conservation techniques in electric systems
- vi. Economic aspects of utilizing electrical energy



2. Quiz

An online quiz will be prepared on Microsoft forms and students need to solve it in prescribed duration in the classroom.

- i. Illumination
- ii. Electrical heating & welding
- iii. Compressors, pumps, Refrigeration and HVAC
- iv. Energy Conservation
- v. Energy conservation techniques in electric systems
- vi. Economic aspects of utilizing electrical energy

10. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Industry visit
4. Guest/Expert lectures
5. Slides
6. Self-Learning Online Resources
7. Any other method adopted

11. SUGGESTED LEARNING RESOURCES

Sr. no.	Title of Book	Author	Publication
1	Art & science of utilization of electric energy	H. Partab	Dhanpat rai & sons
2	Utilization of electric power & electric traction	J. B. Gupta	S.K Kataria & sons
3	Utilization of electric power & electric traction	G.C. Garg	Khanna Publishers
4	General aspects of Energy Management and Energy Audit	Bureau of Energy efficiency	Bureau of Energy efficiency
5	Energy efficiency in Electrical Utilities	Bureau of Energy efficiency	Bureau of Energy efficiency
6	Generation, Distribution and Utilization if Electrical	C. L. Wadhwa	Wiley Eastern Ltd. New Delhi

12. LEARNING WEBSITE & PORTALS:

1. <https://beeindia.gov.in/en>
2. <https://nptel.ac.in/>
3. <https://www.adeetie.beeindia.gov.in/>
4. www.khanacademy.com

13. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Self-Learning
4. Term Work
5. Seminar/Presentation



Summative Assessment (Assessment of Learning)

1. End Term Exam
2. Micro-project

14. SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE (Specification Table)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Illumination	13	3	4	8	15
2	Electrical heating & welding	10	3	3	6	12
3	Compressors, pumps, Refrigeration and HVAC	6	3	3	-	6
4	Energy Conservation	6	3	4	-	7
5	Energy conservation techniques in electric systems	12	3	4	8	15
6	Economic aspects of utilizing electrical energy	13	3	4	8	15
TOTAL		60	18	22	30	70

R Remembering, U Understanding, A Applying, (Bloom's revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

15. COURSE EXPERT COMMITTEE MEMBERS

SR. NO.		NAME
1	Internal	Ms. Urvi H. Sawant
2	Internal	Mr. Dinesh G. Rajmandai
3	External	Mrs. Ashwini Patil
		Organization: Government Polytechnic, Mumbai



1. COURSE DETAILS

Programme: Electrical Engineering	Semester: IV
Course: #Renewable Energy Generation	Course Category: DSE
Course Code: REG230317	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
4	-	2	2	4	3	30	70	100	25	-	25	25	

3. COURSE OBJECTIVE

Renewable energy sources are of immense important now-a-days. They differ from fossil fuels principally in their diversity, abundance and potential for use anywhere on the planet, but above all in that they produce neither greenhouse gas which cause climate change, nor polluting emissions. Electrical diploma pass outs should know the principle of generation of electricity using renewable energy sources, their environmental impact and recent trends in power.

4.SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- Suggest the appropriate method of power generation for given application.

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Justify the use of renewables considering adverse environmental effects due to non-renewable energy sources.
CO2	Recommend the methods of utilizing solar energy for power generation.
CO3	Select site and type of the plant suitable for harvesting Geothermal, Biomass and Ocean energy.
CO4	Select site and type of the plant suitable for harvesting Wind and energy.
CO5	Recommend the use of Fuel cell and Hydrogen energy for specific application.



6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
# Renewable Energy Generation (REG230317)	CO1	3	1	-	-	3	-	1	3	1
	CO2	3	1	1	3	2	-	1	3	3
	CO3	3	-	-	-	3	-	1	3	2
	CO4	3	1	1	3	2	-	1	3	3
	CO5	3	1	1	-	3	-	1	3	2
	CO Avg.	3.00	1	1	3.00	2.60	-	1.00	3.00	2.20

7. COURSE CONTENTS

UNIT NO.	Topic/Subtopic
I	<p>Environmental issues of non-renewable energy sources</p> <p>1.1. Review of conventional and non-conventional energy sources</p> <p>1.2. Environmental Impact of non-renewable sources</p> <p>1.3. Green House effect, Acid rain, Pollution, Smog, Nuclear Radiation</p> <p>1.4. Kyoto Protocol</p> <p>1.5. Carbon credits</p>
II	<p>Solar Energy</p> <p>2.1 Potential of Solar energy</p> <p>2.2 Merits and demerits</p> <p>2.3 Solar Thermal Energy Conversion</p> <p>2.4 Collectors- Flat plate, Focusing</p> <p>2.5 Photovoltaic effect</p> <p>2.6 Solar cell: Construction, working, material, I-V and P-V characteristic, tilt angle Module, Panel and Array Components of off-grid, standalone solar system On-grid solar energy system</p> <p>2.7 Merits and demerits</p>
III	<p>Wind Energy</p> <p>3.1 Principle of Electricity Generation with the help of Wind Energy</p> <p>3.2 Selection of sites for Wind Mills and Environmental Impact</p> <p>3.3 Types of Wind mills: Horizontal Axis and Vertical Axis Wind Turbine</p> <p>3.4 Block diagram and working of Wind energy plant</p> <p>3.5 Recent development: Yaw control, Pitch control, Variable speed drive</p> <p>3.6 Generators is wind turbine</p> <p>3.7 Status of Wind Energy in India</p>



IV	<p>Other renewable energy sources</p> <p>4.1 Geothermal Energy: Geothermal Energy Resources, Electricity Generation using Geothermal Energy, Merits and demerits</p> <p>4.2 Ocean Energy:</p> <ul style="list-style-type: none"> • Ocean Thermal Electric conversion- Working, Merits and Demerits, • Operation of Tidal Power Plant, Advantages, Limitations, Site requirements, Environmental Impact, Potential sites in India <p>4.3 Bio-mass & Bio-gas energy: Bio-fuels, Biomass resources, Biomass conversion techniques, Merits and demerits, Energy Plantation</p>
V	<p>Recent Trends in Electricity Generation (only concept and advantages)</p> <p>5.1 Fuel Cell: Construction and working, Applications, Merits and Demerits</p> <p>5.2 Hydrogen Energy: Properties of Hydrogen, Production methods, Safety issues, Energy conversion of Hydrogen, Application</p>

8. LIST OF PRACTICALS/ASSIGNMENTS/ TUTORIALS/DRAWINGS

Term Work consists of Journal containing at least 10 experiments of the following:

Sr. No.	Title of experiments	Approx. no. of hours required	CO
1	To prepare report on environmental impact by non-renewable energy sources	2	CO1
2	To demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level	2	CO2
3	To demonstrate the I-V and P-V characteristics of series and parallel combination of PV modules	2	CO2
4	To observe the effect of variation in tilt angle and shading on module output power	4	CO2
5	To calculate of power flow in stand-alone PV system with load	4	CO2
6	To evaluate cut-in speed of wind turbine experimentally	2	CO2
7	To plot wind power versus wind speed curve	4	CO3
8	To evaluate coefficient of performance of wind turbine	4	CO3
9	To prepare report on existing geothermal/ ocean/ biomass power plants in the world.	2	CO4
10	To prepare report on fuel cell and hydrogen energy in power generation	2	CO5
11	To prepare report on any one recent trends in electricity generation	2	CO5
Total		30	



9. SUGGESTED MICRO PROJECT/ASSIGNMENT/ACTIVITIES FOR SPECIFIC LEARNING / SKILL DEVELOPMENT (SELF LEARNING)

Assessment to be based on one of the following tools and rubrics for evaluation of SLA to be well defined by course teacher.

1. Micro-Project
2. Seminar/ Presentation
3. Model/Chart making
4. Surveys
5. Case Study
6. Quiz
7. Assignment

SUGGESTED STUDENT ACTIVITIES

Assignments

Assignments will be given on following chapter and students will solve it in a notebook. The notebook will be assessed at the end of the semester.

- a. Environmental issues of non-renewable energy sources
- b. Solar Energy
- c. Wind Energy
- d. Other renewable energy sources
- e. Recent Trends in Electricity Generation

Case study

Students will study any of the running plant based on any of the following energy in detail and prepare a report on the same.

- a. Solar Energy
- b. Wind Energy
- c. Geothermal energy
- d. Ocean energy
- e. Biomass energy
- f. Fuel cell
- g. Hydrogen energy

10. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Industry visit
4. Guest/Expert lectures
5. Slides
6. Self-Learning Online Resources
7. Any other method adopted



11. SUGGESTED LEARNING RESOURCES

Sr. no.	Title of Book	Author	Publication
1	A course in Electrical Power	J. B. Gupta	S. K. Kataria & Sons
2	Power Plant Engineering	P. K. Nag	McGraw Hill Education (India)
3	Electrical Power	Dr. S. L. Uppal	Khanna Publishers.
4	Non-conventional Energy sources	Prof. G. D. Rai	Khanna, New Delhi
5	Non-conventional Energy sources	G. S. Sawhney	PHI Learning Pvt Ltd
6	Generation, Distribution and Utilization of Electrical	C. L. Wadhwa	Wiley Eastern Ltd. New Delhi

12. LEARNING WEBSITE & PORTALS:

1. <http://www.mnre.gov.in/11>
2. <https://www.ireda.in/home>
3. <https://www.makeinindia.com/sector/renewable-energy>
4. <https://www.energy.gov/eere/renewable-energy>
5. <https://www.edfenergy.com/>

13. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Test
2. Rubrics for COs Assignment
3. Self-Learning
4. Term Work
5. Seminar/Presentation

Summative Assessment (Assessment of Learning)

1. End Term Exam
2. Micro-project

14. SUGGESTED WEIGHTAGE FOR LEARNING EFFORTS & ASSESMENT PURPOSE (Specification Table)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Environmental issues of non-renewable energy sources	03	4	-	-	04
2	Solar Energy	18	3	10	8	21
3	Wind Energy	15	3	6	8	17
4	Other renewable energy sources	13	3	4	8	15
5	Recent Trends in Electricity Generation	11	3	4	6	13
TOTAL		60	16	24	30	70



R Remembering, U Understanding, A Applying, (Bloom’s revised taxonomy levels)

NOTE: This specification table provides general guidelines to assist students for their learning and to teachers to teach and assess students with respect to attainment of COs. The actual distribution of marks at different taxonomy levels (R, U, A) in the question paper may vary from above table.

15 COURSE EXPERT COMMITTEE MEMBERS

SR. NO.		NAME
1	Internal	Ms. Urvi H. Sawant
2	Internal	Mr. Dinesh G. Rajmandai
3	External	Mrs. Ashwini Patil
		Organization: Government Polytechnic, Mumbai



Generic Electives

Sr. No.	Course Name	Course Code
1	Airport & Mass Rapid Transportation	ART230014
2	Disaster Management	DMA230015
3	Modern Trends In Civil Engineering	MTC 230016
4	Additive Manufacturing	ADM230017
5	Energy Conservation & Audit	ECA230018
6	Introduction To Green Technology	IGT230019
7	Intellectual Property Rights	IPR230020
8	German Language	GEL230021
9	Digital Marketing	DIM230022
10	Renewable Energy	REN230023
11	Indian Music	INM230024



1. COURSE DETAILS

Programme: Diploma in Civil, Mechanical, Electrical, Plastics, Chemical, Electronics & telecommunications Engineering		Semester : IV
Course: Airport & Mass Rapid Transportation		Course Category: GE
Course Code: ART230014		Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	Practical (Marks)				
									FA-PR	SA-PR	SA-OR	SLA (Marks)	
2	-	-	-	1	-	-	-	-	50	-	-	-	50

Total IKS Hrs for the course: - 00

3. COURSE OBJECTIVE

The objective of this course is to provide students with fundamental knowledge and practical skills required to design, plan, and manage airport facilities and mass rapid transit systems. The course emphasizes the integration of engineering principles, safety standards, and sustainable practices to develop efficient and reliable transportation infrastructure.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- Undertake need assessment exercise for identifying transportation system for mobility of people within and from locality, town, city and region,
- Apply knowledge to participate in team's entrusted design and construction of airports and various mass rapid transportation systems.
- Able to understand various terms and project management related activities of various MRTS projects.
- Able to undertake repair and maintenance of civil works related to airports railways, metro, mono, suburban and bullet trains, coastal roads etc.



5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Correlate the requirement of airport and MRTS
CO2	Analyze the essential requirements of airport planning
CO3	Carry out project management activities related to Mono and Metro rails and understand salient features of MRTS Projects

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Airport & Mass Rapid Transportation (ART230014)	CO1	1	1	3	-	2	2	2	3	2
	CO2	1	-	3	-	2	1	-	3	1
	CO3	1	3	3	3	2	2	1	2	3
	CO Avg.	1	2	3	3	2	1.66	1.50	2.66	2.0

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic	Hrs	CO
I	Introduction Introduction to airport engineering, development of air transport in India, Hub air ports. Recent scenario of other transport system. Need of MRTS in towns, metro and mega cities. Airport planning and design standards, selection of site, stages of development of airport, orientation of runways, length of runways, design standards, estimate of future traffic requirement.	8	CO1
II	Airport Essentials Airport terminal area and layout, terminal requirements, typical airport requirements, types of pavements, flexible, rigid and LCN system of pavement. Airport drainages, surface, underground, special features of airport drainage, traffic aids, marking terminal read control, run ways, lighting of runways, accidents and causes, navigational aids, landing categories.	12	CO2
III	Mass Rapid Transportation Systems (MRTS)	10	CO3



UNIT NO.	TOPIC/Sub-topic	Hrs	CO
	<p>Metro and mono rails, BRTS, Coastal Road, Need, Concept and construction, High speed M.R.T.S: Bullet trains and superfast Express trains.</p> <p>Management and Maintenance of MRTS projects</p> <p>Feasibility, safety, new modes like sky walks, station traffic control systems, Linkages, Trans Harbor link, link roads, FOBs, common ticketing, point to point services, Government initiatives for private sector to participate in MRTS, Maintenance of civil works related to MRTS like metro, mono, BRTS, Coastal Road etc. Customer facilities: Parking, AC trains and busses, E-bikes</p>		

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Guest/Expert lectures
3. Demonstrations
4. Site Visits
5. Self-Learning Online Resources

9. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1.	Arora Airport Planning and Design	S K Khanna M G	Nem Chand & Bros,
2.	Airport Engineering	Rangwala	Charotar Publication
3.	Optimization of Mass Rapid Transit systems	Danny Tandela	Danny Tandela
4.	Urban Mass transit: The Life story of a technology	Johns Hopkins University Press	Johns Hopkins University Press
5.	Advanced transportation systems, analysis, modelling and evaluation of performance.	Janic and Milan	Springer books



10. LEARNING WEBSITE & PORTALS

1. Delhi Metro Rail Corporation: DMRC: <http://www.delhimetrorail.com/>
2. Mumbai Metro Rail Corporation: MMRCL: <https://www.mmrc.com/>
3. Gujarat Metro Rail Corporation: GMRCL: <https://www.gujaratmetrorail.com/>
4. Lucknow Metro Rail Corporation: www.lmrc.com
5. Madhya Pradesh Rail Corporation limited: <http://www.mppmetrorail.com/index.php>
6. Hyderabad Metro Rail Ltd: www.ltmetro.com
7. Kolkata Metro Rail Corporation Ltd: www.kmrc.in
8. Chennai Metro Rail Ltd: chennaietrorail.org
9. Kochi Metro Rail Ltd: kochimetro.org

11. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

4. Assignments
5. Visit Reports
6. Rubrics for COs Assignment

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Neelam N. Petkar
2	Internal	Dr. Sandeep Ranshur
3	External	Mr. Dheeraj Pandirkar
		Organization: Chief Engineer, MHADA



1. COURSE DETAILS

Programme: Diploma in Civil, Mechanical, Electrical, Plastics, Chemical, Electronics & telecommunications Engineering	Semester : IV
Course: Disaster Management	Course Category: GE
Course Code: DMA230015	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	Practical (Marks)				
									FA-PR	SA-PR	SA-OR		
2	-	-	-	1	-	-	-	-	50	-	-	-	50

Total IKS Hrs for the course: - 00

3. COURSE OBJECTIVE

The objective of the Disaster Management course is to equip students with the knowledge, skills, and strategies necessary to identify, assess, and mitigate risks associated with natural and man-made disasters. The course emphasizes the role of civil engineers in disaster preparedness, response, recovery, and prevention, ensuring the development of resilient infrastructure and sustainable practices.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- To assess various hazard, vulnerability, capacity and risk associated with the district.
- To prepare various measures and guidelines for prevention and mitigation.
- To differentiate the preparedness measures for all stakeholders

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Discuss different types of disaster and remedial measures.
CO2	Know early warnings and safety measures of disasters and Risk assessment
CO3	Use Prevention, Mitigation, Preparedness, Response and Recovery, Rehabilitation & Reconstruction methods appropriately



6. CO-PO, CO- PSO MAPPING TABLE

Civil Engineering

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Disaster Management (DMA230015)	CO1	-	-	-	3	2	3	3	1	1
	CO2	-	-	-	3	1	3	3	1	1
	CO3	-	-	-	3	2	3	3	1	1
	CO Avg.	-	-	-	3	1.66	3	3	1	1

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic	Hrs	CO
I	1.0 Introduction on Disaster Different Types of Disaster Definition, Classification, Natural and Anthropogenic, Accidents, Disaster Profile of India. Geo-climatic and social conditions, Past records, Vulnerable areas of the country, national response approach. Types of disaster, A) Natural Disaster: such as Flood, Cyclone, Earthquakes, and Landslides etc. B) Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail & Road), Structural failures (Building and Bridge), War & Terrorism etc. Causes, effects and practical examples for all disasters.	6	CO1
II	2.0 Prediction & Preparation Prediction and forecasting, disaster preparedness, data base Assessment of disaster relief and Rehabilitation measures, Mobilization of men and material, Legal frame work, Trigger mechanism – Water, Climate and Geologically related Chemical, Industrial, Nuclear, GIS enabled Disk 6net, Activities, Agencies, Resources and Funds, Implementation and Monitoring Flood Hazard Map, Quick response flow chart, Emergency operation center, Emergency support functions, Disaster specific modules.	6	CO2
III	3.0 Risk Assessment	6	CO2



UNIT NO.	TOPIC/Sub-topic	Hrs	CO
	Risk assessment, Contingency Planning, Major Natural disasters, Earth Quake, Cyclone, Flood, Epidemics, Check list-Agencies, Personnel, Equipment, Materials, Services and Time management, Risk and Vulnerability Analysis: Risk concept and analysis, Risk Reduction, Vulnerability: Its concept and analysis, Strategic Development for Vulnerability Reduction.		
IV	4.0 Disaster Preparedness: Concept and Nature, Disaster Preparedness Plan, Prediction, Early Warnings and Safety Measures of Disaster, Role of Information, Education, Communication, and Training, Role of Government, International and NGO Bodies, Role of IT in Disaster Preparedness, Role of Engineers on Disaster Management.	6	CO3
V	5.0 Rehabilitation, Reconstruction and Recovery: Reconstruction and Rehabilitation as a Means of Development, Damage Assessment, Post Disaster effects and Remedial Measures, Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction, Sanitation and Hygiene, Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning, Role of Educational Institute.	6	CO3

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Guest/Expert lectures
3. Demonstrations
4. Site Visits
5. Self-Learning Online Resources



9. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
6.	W. Nick Carter	Disaster Management Handbook	Asian Development Bank
7.	Sapir Ghua-D, Parry CV, Degomme O (Belgium) & Joshi, PC, Arnold Saulina JP (India)	Risk factors for mortality and injury: Post tsunami epidemiological findings from Tamil Nadu	Cred
8.	Anil Sinha	Disaster Management – Lessons drawn and strategies for future.	NIDM – National Institute of Disaster Management
9.	M.C. Gupta, L. C. Gupta, B.K. Tamini & Vinod K. Sharma	Disaster Management	NIDM - National Institute of Disaster Management
10	Arun Jha & A. A. Khan	Manual on Disaster Management in India	NIDM - National Institute of Disaster Management
11	National Institute of Disaster Management	Natural Disasters in India – some recent case studies	NIDM - National Institute of Disaster Management

10. LEARNING WEBSITE & PORTALS

1. <https://nptel.ac.in/courses/124/107/124107010/>
2. <https://nptel.ac.in/courses/105/104/105104183/>
3. <http://dm.mcgm.gov.in/home>
4. <http://www.dmc.gov.lk>
5. <https://www.mohfw.gov.in>

11. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

7. Assignments
8. Visit Reports
9. Rubrics for COs Assignment

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Neelam N. Petkar
2	Internal	Dr. Sandeep Ranshur
3	External	Mr. Dheeraj Pandirkar Organization: Chief Engineer, MHADA



1. COURSE DETAILS

Programme: Diploma in Civil, Mechanical, Electrical, Plastics, Chemical, Electronics & telecommunications Engineering	Semester : IV
Course: Modern Trends In Civil Engineering	Course Category: GE
Course Code: MTC230016	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL') (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	Practical (Marks)				
									FA-PR	SA-PR	SA-OR		
2	-	-	-	1	-	-	-	50	-	-	-	50	

Total IKS Hrs for the course: - 00

3. COURSE OBJECTIVE

To equip students with a comprehensive understanding of emerging trends, innovative practices, and advanced technologies in civil engineering. This course aims to develop skills for sustainable design, smart infrastructure, and resilient construction methods, fostering an ability to analyze, adapt, and implement modern engineering solutions in real-world scenarios.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- **Demonstrate an understanding of modern technologies such as Building Information Modelling (BIM), Internet of Things (IoT) applications in smart cities, and advanced construction materials.**
- **Apply principles of sustainability to design and construction, emphasizing renewable resources, energy efficiency, and minimal environmental impact.**
- **Stay updated with advancements like modular construction, 3D printing, and AI-driven engineering processes, integrating them into project designs.**
- **Work effectively within multidisciplinary teams to design and execute civil engineering projects using cutting-edge practices.**



5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Analyze and articulate the latest trends and innovations in civil engineering, including advanced materials, smart construction methods, and cutting-edge technologies.
CO2	Develop sustainable solutions for civil engineering projects by integrating eco-friendly materials, energy-efficient designs, and green building standards.
CO3	Work effectively in interdisciplinary teams to address real-world challenges, integrating knowledge from various engineering domains.

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Modern Trends In Civil Engineering (MTC230016)	CO1	3	2	2	1	2	2	2	3	1
	CO2	2	2	1	1	2	2	1	3	1
	CO3	1	3	2	1	2	2	2	3	1
	CO4	1	2	1	1	3	3	1	3	1
	CO Avg.	1.75	2.25	1.5	1	2.25	2.25	1.5	3	1

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic	Hrs	CO
I	Introduction to Modern Trends in Civil Engineering Overview of civil engineering advancements. <ul style="list-style-type: none"> Role of technology in transforming construction and infrastructure. Importance of sustainability and smart infrastructure 	2	CO1
II	Sustainable Civil Engineering Practices <ul style="list-style-type: none"> Concepts of green building and eco-friendly construction. 	4	CO2



UNIT NO.	TOPIC/Sub-topic	Hrs	CO
	<ul style="list-style-type: none"> • Sustainable materials: Recycled aggregates, fly ash, and geopolymer concrete. • Energy-efficient construction techniques. • Case studies on sustainable projects. 		
III	Advanced Construction Materials <ul style="list-style-type: none"> • High-performance concrete and self-healing concrete. • Fiber-reinforced polymers (FRPs). • Nano-materials in construction. • Smart materials and their applications in civil engineering. 	6	CO2
IV	Modern Construction Techniques <ul style="list-style-type: none"> • Prefabrication and modular construction. • 3D printing in civil engineering. • Robotics in construction. • Advanced excavation and tunnelling methods. 	6	CO2
V	Building Information Modelling (BIM) <ul style="list-style-type: none"> • Introduction to BIM and its components. • Role of BIM in planning, design, and construction. • Hands-on demonstration of BIM software (basic exposure). 	2	CO2
VI	Practical Component (wherever applicable) <ul style="list-style-type: none"> • Field visits to smart city projects or sustainable construction sites. • Demonstrations of modern surveying tools like drones and GIS. • Hands-on workshops on BIM and basic construction technologies. Application IoT in Civil Engineering. 	10	CO3

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Guest/Expert lectures
3. Demonstrations
4. Site Visits



9. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
12.	Handbook of Modern Construction Practices	Jay P. Singh and Bibhuti Bhusan Das	Springer
13.	Sustainable Construction: Green Building Design and Delivery	Charles J. Kibert	John Wiley & Sons
14.	Artificial Intelligence and Machine Learning for Civil Engineers	Afaq Ahmad, Vagelis Plevris, Nikos D. Lagaros	IGI Global
15.	3D Printing in Concrete: Applications and Challenges	Arnaud Perrot	John Wiley & Sons
16.	Disaster Resilient Infrastructure	Mukesh Khare and Gopalakrishnan Nair	Asian Development Bank

10. LEARNING WEBSITE & PORTALS

1. www.nptel.ac.in
2. <https://www.wiley.com>
3. www.swayam.gov.in
4. www.researchgate.net
5. <https://www.smartdatacollective.com>

11. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Assignments
2. Visit Reports
3. Rubrics for COs Assignment

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Ms. Neelam N. Petkar
2	Internal	Dr. Sandeep Ranshur
3	External	Mr. Dheeraj Pandirkar
		Organization: Chief Engineer, MHADA



1. COURSE DETAILS

Programme: Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering	Semester: IV
Course: Additive Manufacturing	Course Category: GE
Course Code: ADM230017	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
2	-	-	-	-								-	

Total IKS Hrs for the course: -

3. COURSE OBJECTIVE

To educate students with fundamental and advanced knowledge in the field of Additive manufacturing technology by exploring the applications of Additive Manufacturing (AM) processes in various fields to select the suitable material and process for fabricating a given product.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

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

- Understand the basics of different tooling and its methods for AM
- Design and develop basic model of AM Process

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Understand the working principle of AM processes
CO2	Develop the optimal modeling of AM components for product.
CO3	Select the suitable AM process for manufacturing a given product.
CO4	Understand the different post processing methods of AM part.



6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Additive Manufacturing (ADM230017)	CO1	3	-	1	-	1	-	2	3	-
	CO2	2	-	3	1	2	-	2	3	-
	CO3	2	2	2	1	2	-	2	2	-
	CO4	2	2	1	-	1	-	2	2	-
	CO Avg.	2.25	2	1.75	1	1.5	-	2	2.5	-

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic	CO	Hours
I	Introduction to Additive Manufacturing 1.1 Overview of Additive Manufacturing (AM); AM history 1.2 Classification of AM 1.3 Advantages, limitations and applications of AM process 1.4 Introduction to AM software's. 1.5 Types of materials for AM.	CO1	04
II	CAD Data Processing for AM 2.1 CAD model development; Overview on Data requirements 2.2 Data formats (STL, SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP) 2.3 Data interfacing, Part orientation and support generation; Design of support structure for AM; Overview on slicing methods; Tool path generation for AM.	CO2	10
III	Liquid, Solid & Powder Based AM Technologies 3.1 Working Principles, materials, merits, drawbacks and applications of 3.1.1 Stereo lithography 3.1.1 FDM 3.1.3 LOM 3.1.4 Multijet Modelling 3.1.5 SLS 3.1.6 Direct Metal Laser Sintering	CO3	12



	<p>3.1.7 3-Dimensional Printing</p> <p>3.2 Direct Energy Deposition AM Process: Working principles, products, benefits and drawbacks, applications of</p> <p>3.2.1 Laser Engineered Net Shaping (LENS)</p> <p>3.2.2 Direct Metal Deposition (DMD)</p> <p>3.3.3 Electron Beam based metal deposition</p> <p>3.3 Overview on new & Hybrid AM technologies.</p>		
IV	<p>Post Processing of AM Part</p> <p>4.1 Overview on support material removal,</p> <p>4.2 Surface quality and aesthetic improvement. Applications of AM.</p> <p>4.3 Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.</p>	CO4	04

8. IMPLEMENTATION STRATEGY (PLANNING)

7. Teaching Plan
8. Assignments.
9. Demonstrations
10. Slides
11. Self-Learning Online Resources

9. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling	D.T. Pham, S.S. Dimov	Springer 2001
2	Rapid Prototyping: Principles and Applications in Manufacturing	Rafiq Noorani	John Wiley & Sons, 2006
3	3D Printing and Additive Manufacturing: Principles & Applications	Chua Chee Kai, Leong Kah Fai,	World Scientific

10. WEB REFERENCES

1. <https://library.fiveable.me/additive-manufacturing-and-3d-printing/unit-1/history-additive-manufacturing/study-guide/2aKxu5iTHiCEskfBhttps://www.youtube.com/watch?v=TJ4jGyD-WCw>
2. https://application.wiley-vch.de/books/sample/3527347917_c01.pdf
3. https://home.iitk.ac.in/~nsinha/Additive_Manufacturing%20I.pdf
4. <https://www.lboro.ac.uk/research/amrg/about/materials/>



5. <https://www.studocu.com/in/document/rashtreeya-vidyalaya-college-of-engineering/materials-manufacturing-processes-for-designers/unit-5-data-formats-rp-r-v-college-of-engineering/53948980>
6. <https://www.metal-am.com/introduction-to-metal-additive-manufacturing-and-3d-printing/metal-3d-printing-additive-manufacturing-processes/>
7. <https://www.postprocess.com/2022/09/what-is-post-processing-in-additive-manufacturing/>
8. <https://www.mdpi.com/1996-1944/16/13/4610>
9. https://www.youtube.com/watch?v=NLoB52nPua0&list=PL3lIrnJwjW5nKT71mMX7Luyaliyb_BLy
10. <https://www.youtube.com/watch?v=I-0E-eiJdWk>
11. https://www.youtube.com/watch?v=33vzF_pce0A

11. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

Rubrics for COs Assignment

Term Work

Students should prepare a journal containing assignments based on each topic.

Seminar/Presentation

Students should prepare and give a presentation on latest trends or case studies on additive manufacturing.

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Dr. Pravin R. Parate
2	Internal	Shri Girish B. Deshpande
3	External	Shri Alope Chaudhary
		Organization: Director, S M TECHNOCRATS PVT. LTD.



1. COURSE DETAILS:

Programme: Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering.	Semester: IV
Course: Energy Conservation & Audit	Course Category : GE
Course Code: ECA230018	Duration: 16 Weeks

2. LEARNING & ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
2	-	-	-	01	-	-	-	-	50	-	-	-	50

3. COURSE OBJECTIVE

This course is categorized under generic technology subjects, Rapid Developments in the standard of living of countrymen results into increased energy consumption. But due to limited availability of conventional sources and difficulties in their tapping and uneconomical and insufficient R and D aspect of non-conventional sources, energy conservation is the most important tool to some extent, to face the problem of the increased demand. Hence electrical engineers must have knowledge of various methods of energy conservation and concept of energy audit and its implementation.

4. SKILL COMPETENCY:

- **Undertake energy audit of small, medium and large organisation and recommend suggestions for power saving**

5. COURSE OUTCOMES (COs): At the end of the semester students will be able to :-

CO. No.	COURSE OUTCOMES
CO1	Interpret energy conservation policies in India.
CO2	Implement energy conservation techniques in electrical machines.
CO3	Apply energy conservation techniques in electrical installations.
CO4	Develop energy audit and Prepare report of energy audit



6. CO- PO, CO – PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Energy Conservation & Audit (ECA230018)	CO1	2	-	-	2	2	3	1	1	1
	CO2	2	2	1	-	3	-	1	2	2
	CO3	2	2	1	-	3	-	1	2	2
	CO4	2	-	-	2	2	3	1	3	3
	CO Avg.	2.00	2.00	1.00	2.00	2.50	3.00	1.00	2.00	2.00

7. COURSE CONTENTS

UNIT NO.	Topic/Sub-Topics	CO	Hours
I	1.0 Energy Conservation Basics 1.1 Energy Scenario: Primary and Secondary Energy, 1.2 Energy demand and supply, 1.3 National scenario. Energy conservation and Energy audit; 1.4 concepts and difference Indian Electricity Act 2001; 1.5 Relevant clauses of energy conservation 1.6 BEE and its Roles 1.7 MEDA and its Roles 1.8 Star Labelling: Need and its benefits.	CO1	05
II	2.0 Energy Conservation in Electrical Machines 2.1 Need for energy conservation in induction motor and transformer. 2.2 Energy conservation techniques in induction motor by: - Improving Power quality. - Motor Survey Matching motor with loading. - Minimizing the idle and redundant running of motor. - Operating in star mode. Rewinding of motor. - Replacement by energy efficient motor - Periodic maintenance - Energy efficient motor; significant features, advantages, applications and limitations. 2.3 Energy conservation techniques in Transformer. - Loading Sharing Parallel Operation Isolating techniques. - Replacement by energy efficient transformers. - Periodic maintenance. 2.4 Energy Conservation Equipment: - Soft starters, - Automatic star delta convertor, - Variable Frequency Drives, - Automatic p. f. controller (APFC), - Intelligent p. f. controller (IPFC)	CO2	10
III	3.0 Energy conservation in Electrical Installation systems	CO3	10



	<p>3.1 Aggregated Technical and commercial losses (ATC); Power system at state, regional, national and global level.</p> <p>3.2 Technical losses; causes and measures to reduce by.</p> <p>a) Controlling I² R losses. b) Optimizing distribution voltage</p> <p>c) Balancing phase currents d) Compensating reactive power flow</p> <p>Commercial losses:</p> <p>3.3 pilferage, causes and remedies</p> <p>3.4 Energy Conservation in Lighting System</p> <p>a) Replacing Lamp sources. b) Using energy efficient luminaries.</p> <p>c) Using light controlled gears. d) Installation of separate transformer / servo stabilizer for lighting.</p> <p>e) Periodic survey and adequate maintenance programs.</p> <p>3.4 Energy Conservation techniques in fans, Electronic regulators.</p>		
IV	<p>4.0 Energy Audit of Electrical System</p> <p>4.1 Energy audit (definition as per Energy Conservation Act)</p> <p>4.2 Energy audit instruments and their use.</p> <p>4.3 Questionnaire for energy audit projects.</p> <p>4.4 Energy flow diagram (Sankey diagram) Simple payback period,</p> <p>4.5 Energy Audit procedure (walk through audit and detailed audit).</p> <p>4.6 Energy Audit report format.</p>	CO4	05
	Total Hours		30

8. IMPLEMENTATION STRATEGY (PLANNING):

1. Teaching Plan
2. Industrial Visits
3. Guest/Expert Lectures
4. Demonstrations
5. Self-Learning Online Resources

9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Guide books no.1 to 4 for National Certification examination for Energy Managers & Energy auditors	Bureau of Energy Efficiency (BEE)	Bureau of Energy Efficiency (Forth Edition 2015)
2	Energy Resources & Management	Renu Dhupper	Cbs Publication ISBN - 978812392575
3	Energy management & Conservation	K V Sharma P Venkateshaiah	I.K. International Publishing House Pvt. Ltd. ISBN:978-93-81141-29-8
4	Energy Management	Umesh Rathore	SK Kataria & Sons ISBN 978-93-5014-101-4
5	Electrical Energy Conservation & Auditing	Er. Udit Mamodiya	Ashirwad Publication ISBN -139788194250692
6	Power Factor Correction Management & Energy Audit	Siemens	New Age Vol.38 2005



10. LEARNING WEBSITES & PORTALS

1. <https://beeindia.gov.in/>
- 2 www.nptel.ac.in
3. <https://www.worldenergy.org/>
- 4 <https://www.electricalindia.in/energy-management-and-conservation/>
5. <https://www.technicalbookspdf.com/power-electronics-handbook-fourth-edition/>

11. ASSESSMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

Term Work (Assignments)

1. Identify star labelled electrical apparatus and compare the data for various star ratings
2. Determine the ‘% loading’ of the given loaded Induction motor.
3. Determine the reduction in power consumption in star mode operation of Induction motor compared to delta mode.
4. Use APFC unit for improvement of p. f. of electrical load.
5. Compare power consumption of different types of TL with choke, electronic ballast and LED lamps by direct measurements.
6. Determine the reduction in power consumption by replacement of lamps in a class room / laboratory.
7. Determine the reduction in power consumption by replacement of Fans and regulators in a class room / laboratory
8. Estimate energy saving by improving power factor and load factor for given cases.
9. Collect electricity bill of a residential consumer and suggest suitable means for conservation and reduction of the energy bill.
10. Prepare a sample energy audit questionnaire for the given industrial facility.
11. Prepare an energy audit report (phase –I, II and III)

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.	NAME	
1	Internal	Mr. N D Adate
2	Internal	Ms. U H Sawant
3	External	Dr. P. N. Padghan
		Organization : Government Polytechnic Mumbai



1. COURSE DETAILS

Programme: Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering		Semester: IV	
Course: Introduction To Green Technology		Course Category: GE	
Course Code: IGT230019		Duration:16 Weeks	

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Paper Duration (Hrs.)	Assessment Scheme							Total Marks
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)			Theory (Marks)			Based on LL & TL			Based on Self Learning	
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
2	-	-	-	1	-	-	-	-	50	-	-	-	50

3. COURSE OBJECTIVE

Introduction to Green Technology is an introductory science course that prepares students for further learning in the emerging engineering fields of green technologies, environmental technology, and renewable energy forms.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

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

- **To seek opportunities for alternative sourcing, conservation, efficiency and repurposing through an understanding of product life cycles from origins to recycling or inevitable disposal.**
- **To combine technical and scientific skills with an understanding of the environment, renewable energy management, waste utilization, resource management and land based industries who can contribute to the national and global development.**



5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Introduce the concept of Green Technology.
CO2	Impart the Knowledge of Carbon emission.
CO3	Introduce the concept of Life cycle Assessment.
CO4	Learn the importance of green fuels and its impact on environment.

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Introduction to Green Technology (IGT230019)	CO1	1	1	-	-	3	-	2	2	-
	CO2	1	2	2	-	-	-	-	2	-
	CO3	-	2	-	-	2	-	1	2	-
	CO4	1		2	-	3	-	-	2	-
	CO Avg.	1	1.67	2	-	2.5	-	1.5	2	-



7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic	CO	Hours
I	Introduction to Green Technology 1.1 Definition and its importance 1.2 Principles of Green Technology 1.3 Advantages and disadvantages of green technologies 1.4 Factors affecting green technologies 1.5 Role of industry, Government and institution 1.6 Introduction to industrial Ecology and role of industrial ecology in green technology	CO1	04
II	Cleaner Production 2.1 Definition and its Importance 2.2 Principles and its benefits 2.3 Role of industry, Government and institution in Cleaner production 2.4 Clean development mechanism 2.5 Reuse, Recovery, Recycle 2.6 Raw material substitution- Wealth from waste.	CO2	08
III	CP Awareness and life cycle Assessment (LCA) 3.1 Pollution prevention and cleaner production awareness plan 3.2 Waste audit 3.3 Environmental statements 3.4 Carbon credit and carbon trading 3.5 Introduction to LCA and elements of LCA	CO3	06
IV	Energy sources 4.1 Availability and need of conventional energy resources, 4.2 Major environmental problems related to conventional energy resources, 4.3 Future possibilities of energy need and availability	CO4	06
V	Green Fuels	CO4	06



	5.1 Definition of green fuels 5.2 Benefits and challenges 5.3 Comparison of green fuel with conventional fossil fuels with reference to environmental, economic and social impact 5.4 Public policies and market driven initiatives.		
	Total Hours		30

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Industry visit
3. Guest/Expert lectures
4. Demonstrations
5. Self-Learning Online Resources (Swayam NPTEL)

9.SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Pollution prevention: Fundamentals and practices	Paul Bishop	McGraw Hill International
2	Cleaner Production Audit (1995)	Prasad Modak, C Visvanathan and Mandar Parasnis	Environmental system review, Asian institute of technology, Bangkok
3	Handbook of organic waste conversion	Bewik M W M	Bewik M W M

10. LEARNING WEBSITE & PORTALS

1. www.researchgate.net/publication/350443477_Green_Technology_and_its_Implications_Worldwide
2. www.jetir.org/papers/JETIREW06032.pdf
3. www.wipo.int/edocs/pubdocs/en/wipo-pub-1080-en-green-technology-book.pdf
4. ripublication.com/ijaes17/ijaesv12n5_18.pdf
5. <https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage>



11. ASSESSMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

Term Work (Assignments)

Sr. No.	Title of Assignment
1	Definition of Green technology, its importance and advantages and disadvantages
2	Role of industrial ecology in Green technology
3	Principles of Cleaner production and its benefits
4	Clean development mechanism, wealth from waste
5	Carbon credit and carbon trading
6	Introduction to LCA and its elements
7	Comparison of conventional and non-conventional energy sources
8	Device and technology used in solar energy conversion
9	Green fuels, their benefits and challenges
10	Concept of biomass energy utilization, types of biomass
11	Suitability of wind, tidal and geothermal energy in Indian context

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mrs. Jyoti S Sangle
2	Internal	Mr. M. M. Belwalkar
3	External	Prof. Pradeep. G. Talwelkar
		Organization: D.J.Sanghavi College of Engineering



1. COURSE DETAILS

Programme: Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering .	Semester: IV
Course: Intellectual Property Rights	Course Category: GE
Course Code: IPR230020	Duration:16 Weeks

2. LEARNING AND ASSESSMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
2	-	-	-	1	-	-	-	-	50	-	-	-	50

3. COURSE OBJECTIVE

As per NEP guidelines a diploma holder is expected to have multidisciplinary knowledge. This course is designed to introduce the basics of Intellectual Property Rights from legal perspective for an engineering student. In addition to this, it is important to make the students aware of their rights for the protection of their invention done in their project work and to get registration in our country and foreign countries of their invention, designs and thesis or theory written by the students during their project work and for this they must have knowledge of patents, copy right, trademarks.

4. SKILL COMPETENCY/INDUSTRY/EMPLOYER EXPECTED OUTCOME

- Apply concepts of Intellectual property rights in relevant fields.

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	Recognize the importance of intellectual properties.
CO2	Understand the significance of Copyright Act 1957.
CO3	Understand the various aspects of Patents.
CO4	Elaborate the procedure of obtaining Patents.
CO5	Interpret the basic concepts of Trademarks



6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Intellectual Property Rights (IPR230020)	CO1	1	-	3		3	2	2	1	1
	CO2	2	1	2	1	2	2	1	-	-
	CO3	-	-	2		2	2	1	1	-
	CO4	1	-	1	1	1	-	1	-	1
	CO5	1	-	2	-	-	2	-	-	-
	CO Avg.	1.25	1	2	1	2	2	1.5	1	1

7. COURSE CONTENTS

UNIT	TOPIC/Sub-topic	CO	Hrs
I	Introductory The meaning of Intellectual property Competing rationales of the legal regimes for the protection of intellectual property The main forms of intellectual property: copyright, trademarks, patents, designs The competing rationales for protection of rights in: Copyright, Trademarks, Patents, Designs, Trade secrets Other new forms such as plant varieties and geographical indications Introduction to the leading international instruments concerning intellectual property rights: The Berne Convention, Rome Convert Universal Copyright	CO1	08
II	Copyright Act 1957 Historical evolution Meaning of Copyright, Copyright in literary, dramatic and musical works Copyright in sound records and cinematographic films Copyright in computer programs Ownership of copyright, Assignment of copyright Author's special rights Notion of infringement, Criteria of infringement Infringement of copyright by films of literary and dramatic works Importation and infringement Fair use provisions	CO2	06



	Piracy in internet Aspects of copyright justice Remedies, especially, the possibility of Anton pillar injunctive relief in India		
III	Patent Act 1970 Concept of Patent Historical view of patents law in India Patentable inventions with special reference to biotechnology products entailing creation of new forms of life Patent protection for computer programs Process of obtaining a patent: application, examination, opposition and sealing of patents: general introduction	CO3	06
IV	Procedure for filing patents: Patent Co-operation Treaty Some grounds for Opposition The problem of limited locus standee to oppose Wrongfully obtaining the invention Prior publication or anticipation Obviousness and the lack of inventive step Insufficient description Rights and obligations of a patentee Patents as chose in action Duration of patents; law and policy considerations Use and exercise rights Right to secrecy The notion of 'abuse' of patent rights Compulsory license Remedies Infringement, Criteria of infringement Modes of Infringement; the Doctrine of Colorable Variation Defenses in suits of Infringement Injunctions and related remedies	CO4	06
V	Intellectual Property in Trade Marks The rationale of protection of Trade marks as (a) an aspect of commercial and (b) of consumer rights Definition and concept of Trade marks Registration Distinction between Trade mark and property mark The doctrine of honest Current User The doctrine of deceptive similarity Offences relating to Trade Marks, Passing Off, Penalties.	CO5	04

8. IMPLEMENTATION STRATEGY (PLANNING)

12. Teaching Plan

13. Minimum no of assignments.

14. Industry visit



15. Guest/Expert lectures
16. Demonstrations
17. Slides
18. Self-Learning Online Resources

9. SUGGESTED LEARNING RESOURCES

Sr.No.	Title of Book	Author	Publication
1	Intellectual Property Rights and the Law	B. Reddy	Gogia Law Agency
2	of Intellectual Property	Dr. S.R. Myneni	Law House
3	relating to Intellectual Property	L. Wadehra	Universal Law Publishing Co

10. LEARNING WEBSITE & PORTALS

1. <https://ipindia.gov.in/acts-patents.htm>
2. <https://vajiramandravi.com/quest-upsc-notes/intellectual-property-rights/>
3. <https://www.startupindia.gov.in/content/sih/en/intellectual-property-rights.html>
4. <https://www.meity.gov.in/ipr-initiatives>

11. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

10. Test
11. Rubrics for COs Assignment
12. Self-Learning
13. Term Work
14. Seminar/Presentation

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mr. P.S.Dhuri
2	Internal	Mr. N.G.Farkade
3	External	Mr. Ramkumar Maurya
		Rizvi College of Engineering.



1.COURSE DETAILS:

Programme: Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering	Semester: IV
Course: German Language	Course Category : GE
Course Code: GEL230021	Duration: 16 Weeks

2.LEARNING & ASSESSMENT SCHEME:

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
2	-	-	-	01	-	-	-	-	50	-	-	-	50

3.COURSE OBJECTIVE:

Learning aims in the subject German as a foreign language are realized by means of fulfilling the objectives of the ultimate goal which have been set in accordance with the four basic skills: Reading, Listening, Speaking & Writing. The course prepares students to navigate straightforward day-to-day situations, to read simple texts, and to write short, basic paragraphs. The course provides a communicative approach that helps students to express their own experiences while also encountering the cultural and social life of people in German-language regions. It enables students gain greater understanding of a foreign culture and to understand the grammar of the language and apply the same practically to structure their conversations.

4. SKILL COMPETENCY:

- **Communicate in public places**

5. COURSE OUTCOMES (COs): At the end of the semester students will be able to: -

CO. No.	COURSE OUTCOMES
CO1	The student can understand and use everyday expressions and frame very simple sentences, which relate to the satisfying of concrete needs.
CO2	The language introduces learners to diverse cultures and a range of ways of expression



and communication with other speakers of the German language in a variety of contexts.

6.CO- PO, CO – PSO MAPPING TABLE:

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
German Language (GEL230021)	CO1	2		-	-	2	3	1	1	1
	CO2	2	1	-	-	3	-	1	2	2
	CO Avg.	2.00	1.00			2.50	3.00	1.00	1.5	1.5

7.COURSE CONTENTS:

UNIT NO.	Topic/Sub-Topics	CO	Hours
I	<p><u>Theme 1: Self and 3rd Person introduction</u> Skills: Greet each other, say goodbye, ask how we are, how to say email address Grammar: W-Questions, Statements, Verb conjugation and personal pronouns in 1st Vocabulary: Numbers 1-20, Countries and Languages</p> <p><u>Theme 2: Personal Information</u> Skills: talk and write about work and personal matters Grammar: Definite articles, Verb conjugation and personal pronouns in 2nd Person, Yes-No Questions, Plural forms of the nouns Vocabulary: Hobbies, Weekdays, Months & Seasons, Number 20 onwards, Profession</p>	CO1	6
II	<p><u>Theme 3: City Orientation</u> Skills: evaluate a place, ask about facilities and Understand directions, write routes. Grammar: Indefinite articles, negation, Imperative – formal Vocabulary: Places and Buildings (railway station, subway, hotel, restaurants, river, city hall, library etc.)</p>	CO1	3
III	<p><u>Theme 4: Meals & Beverages</u> Skills: Talking about food preferences and eating habits, conversing about eating, to plan shopping, conversation at market, supermarket, mall Grammar: Verb position in a simple sentence, introduction to nominative and accusative case, verb – to like (mogen) and would like to (mochten) Vocabulary: Meals, food, grocery shop, Beverages</p>	CO1	4
IV	<p><u>Theme 5: Daily Routine</u> Skills: describe daily routines, talk about family, apologize for being late, to arrange for appointments. Grammar: Prepositions of time (am, um, von...bis), Possessive pronouns in nominative case, modal verbs- Vocabulary: Daily routine, Time, family members & relatives,</p>	CO2	4
V	<p><u>Theme 6: Contacts</u></p>	CO2	



	Skills: To arrange appointments (formal), to talk about learning languages, to understand the conversations, to read and understand the letters. Grammar: Personal pronouns, definite and indefinite articles in dative case, dative prepositions, possessive pronouns in accusative case. Vocabulary: Standard letters, everyday office life.		4
VI	Theme 8: Apartment & Types of Housing Skills: To describe an apartment, to plan the furnishing of the house, to write a short invitation for Housewarming party, Grammar: Adjectives, case changing prepositions, Vocabulary: Apartments, rooms, colors, furniture and appliances, types of housing	CO2	3
VII	Theme 9: Work Skills: Talk about the past events, opinions about jobs, to understand the telephonic conversations Grammar: Present participle – regular and irregular verbs, Conjunctions – and, but, or Vocabulary: Professions and workplaces, jobs, studies	CO2	3
VIII	Theme 11: Health Skills: To name the body parts, to understand the sports exercises, conversation at the doctor’s clinic, to understand and give health tips Grammar: Imperative – informal, modal verbs – sollen, dürfen, müssen Vocabulary: Body parts, personal Hygiene, diseases, Medicines, Professions	CO2	3
	Total Hours		30

08.IMPLEMENTATION STRATEGY (PLANNING):

6. Teaching Plan
7. Guest/Expert Lectures
8. Demonstrations
9. Self-Learning Online Resources

09.SUGGESTED LEARNING RESOURCES:

Sr. No.	Title of Book	Author	Publication
1	Netzwerk – Deutsch als Fremdsprache A1	-	-

10. LEARNING WEBSITES & PORTALS:

- 1 <http://www.lsa.umich.edu/german/hmr/index.html>
- 2 <https://www.learngermanonline.org/>

11. ASSESSMENT METHODOLOGIES/TOOLS:

- Formative Assessment (Assessment for Learning)
- Term Work (Assignments)

12.COURSE EXPERT COMMITTEE MEMBERS:

Sr. No.	NAME	
1.	Internal	Mr. J. S. Kulkarni



2.	Internal	Mrs. N. G. Kadukar
3.	External	Mrs. Jayanti Vasudeo
		Organization: Centre for international studies ,NMIMS

1.COURSE DETAILS:

Programme: Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering.	Semester: IV
Course: Digital Marketing	Course Category : GE
Course Code: DIM230022	Duration: 16 Weeks

2.LEARNING & ASSESSMENT SCHEME:

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
2	-	-	-	01	-	-	-	-	50	-	-	-	50

3.COURSE OBJECTIVE:

Digital marketing allows businesses to reach a global audience, breaking geographical barriers Compared to traditional marketing methods, digital marketing is often more affordable and offers a higher return on investment. The course allows students to learn digital marketing basics and various tools used in digital marketing.

4.SKILL COMPETENCY:

- **Marketing skills on digital media**

5. COURSE OUTCOMES (COs): At the end of the semester students will be able to: -

CO. No.	COURSE OUTCOMES
CO1	Describe the traditional and digital Marketing
CO2	Plan and create website
CO3	Improve the website's visibility on search engines Search Engine Optimization (SEO)



CO4	Create and share content and use of Email for Digital Marketing
CO5	Using platforms like Facebook, Instagram, and LinkedIn

6.CO- PO, CO – PSO MAPPING TABLE:

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Digital Marketing (DIM230022)	CO1	3	1	-	-	-	-	1	2	-
	CO2	3	2	2	1	-	-	1	2	-
	CO3	3	2	2	1	1	-	2	2	-
	CO4	3	1	2	1	-	1	2	2	-
	CO5	3	2	3	1	1	-	2	2	-
	CO Average	3	1.6	2.25	1	1	1	1.6	2	-

7.COURSE CONTENTS:

UNIT NO.	Topic/Sub-Topics	CO	Hours
I	Introduction to Digital Marketing Introduction to digital marketing Importance of digital marketing Difference between traditional and digital marketing recent trends and current scenario of the industry Digital Marketing Channels: SEO, search advertising, display advertising, social media marketing, affiliate marketing, email marketing, content marketing, and mobile marketing.	CO1	05
II	Planning and Creating a Website Website development basics: How Websites Work: Learn about web servers, browsers, and how they interact. Domain Names and Hosting: Understand how to register a domain and choose a hosting provider. Content Management Systems (CMS): WordPress: The most popular CMS, great for beginners. Other CMS Options: Joomla, Drupal, etc. Responsive Design: Mobile-Friendly Design: Ensure your website looks good on all devices. Media Queries: Techniques to apply different styles based on device characteristics. User experience (UX) design: Principles of UX Design, UI Design Basics	CO2	10
III	Search Engine Optimisation (SEO)	CO3	10



	Introduction to Search Engine Optimisation, Search Engine working On-page SEO – concepts like content research, keyword research, meta tags Off-page SEO – link building Keyword Research Factors affecting the rank of a webpage Keyword Research: Creating Ads, Setting Up Campaigns, Bidding and Budgeting, Targeting, Ad Auctions, Monitoring and Optimization and Tools and Platforms		
IV	Content creation and email marketing Content creation: concept Content bucketing Creating a social media content calendar for a brand Content marketing tools Guest Blogging Influencer Marketing Email Marketing How to build the right subscriber list. Build a database by segmenting based on demographics, mode of acquisition, target group Finessing email marketing tools and software Designing email copies & automating emails Extracting information from email campaign analytics	CO4	05
V	Social Media Marketing Benefits of Social Media Marketing Key Platforms for Social Media Marketing Creating a Social Media Marketing Strategy	CO5	05
	Total Hours		30

8.IMPLEMENTATION STRATEGY (PLANNING):

- 10.Minimum no of assignments
- 11.Guest/Expert Lectures
- 12.Slides
- 13.Self-learning Online Resources

9.SUGGESTED LEARNING RESOURCES:

Sr. No.	Title of Book	Author	Publication
1.	Digital Marketing for Dummies	Ryan Deiss and Russ Henneberry	NA
2.	Digital Marketing	Babu KG Raja Sabarish Anbazhagan	Sultan Chand & Sons
3.	Digital Marketing	Mathur Vibha	PHI Publication

10. LEARNING WEBSITES & PORTALS:

1. <https://www.reliablesoft.net/>
2. <https://digitalmarketinginstitute.com/>



11. ASSESSMENT METHODOLOGIES/TOOLS:

Formative Assessment (Assessment for Learning)

1. Term work
2. Seminar

12. COURSE EXPERT COMMITTEE MEMBERS:

Sr. No.	NAME	
1.	Internal	Mr. Janardan S. Kulkarni, HOD, Computer Engineering
2.	Internal	Mr. Pratik Shah, Lecturer, Computer Engineering
3.	External	Rahil Shah
		Co-Founder: 3Folks Media, Mumbai



1. COURSE DETAILS

Programme: Diploma in Civil ,Mechanical, Electrical, Plastics, Chemical ,Electronics & telecommunications Engineering	Semester: IV
Course: Renewable Energy	Course Category: GE
Course Code: REN230023	Duration:16 Weeks

2. LEARNING AND ASSESMENT SCHEME

Learning Scheme				Credits	Paper Duration (Hrs.)	Assessment Scheme							Total Marks
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)			Theory (Marks)			Based on LL & TL			Based on Self Learning	
CL	TL	LL				FA- TH	SA- TH	Total	FA- PR	SA- PR	SA- OR		
02	-	-	-	01	-	-	-	-	50	-	-	-	50

3. COURSE OBJECTIVE

The objective of this course is to understand present and future scenario of world energy use and aware of renewable energies such as Solar, Wind, Bio and different available non-conventional energy sources.

4. SKILL COMPETENCY

- Usage of energy
- Identify suitable energy sources as per application considering location
- Utilize natural resources for energy generation

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -



CO No.	COURSE OUTCOME
CO1	Understand present and future energy scenario of the world
CO2	Understand various methods of solar energy harvesting.
CO3	Identify various wind energy systems
CO4	Evaluate appropriate methods for Bio energy generations from various Bio wastes.
CO5	Identify suitable energy sources for a location.

6. CO-PO, CO- PSO MAPPING TABLE

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Renewable Energy (REN230023)	CO1	3	1	1	1	2	-	1	1	-
	CO2	2	-	-	-	-	-	-	1	-
	CO3	2	-	-	-	-	-	-	-	-
	CO4	2	-	-	-	-	-	-	-	-
	CO5	2	-	-	-	-	-	-	-	-
	CO Avg.	2.2	1	1	1	2	-	1	1	-

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic	CO	Hours
I	UNIT-I: Introduction: 1.1 World Energy Use; 1.2 Reserves of Energy Resources; 1.3 Environmental Aspects of 1.4 Energy Utilization; 1.5 Renewable Energy Scenario in India and around the World; 1.6 Potentials; 1.7 Achievements / Applications; 1.8 Economics of renewable energy system	CO1	06



II	Unit-II: Solar energy: 1.1 Solar Radiation; 1.2 Measurements of Solar Radiation; 1.3 Flat Plate and Concentrating Collectors; 1.4 Solar direct Thermal Applications; 1.5 Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; 1.6 Solar Cells; 1.7 Solar PV Power Generation; 1.8 Solar PV Applications.	CO2	06
III	Unit-III: Wind Energy: 1.1 Wind Data and Energy Estimation; 1.2 Types of Wind Energy Systems; 1.3 Performance; 1.4 Site Selection; 1.5 Details of Wind Turbine Generator; 1.6 Safety and Environmental Aspects.	CO3	06
IV	Unit-IV: Bio-Energy: 1.1 Biomass direct combustion; 1.2 Biomass gasifiers; 1.3 Biogas plants; 1.4 Digesters; 1.5 Ethanol production; 1.6 Bio diesel; 1.7 Cogeneration;	CO4	06
V	Unit-V: Other Renewable Energy Sources 1.1 Tidal energy; 1.2 Wave Energy; 1.3 Open and Closed OTEC Cycles; 1.4 Small Hydro-Geothermal Energy; 1.5 Hydrogen and Storage; 1.6 Fuel Cell Systems; 1.7 Hybrid Systems.	CO5	06
Total Hours			30

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. Minimum no of practical/assignments.
3. Guest/Expert lectures
4. Demonstrations
5. Slides
6. Self-Learning Online Resources

9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Energy Technology	O.P. Gupta	Khanna Publishing House, Delhi (ed. 2018)



2	Renewable Energy Sources	Twidell, J.W. & Weir, A.	EFN Spon Ltd., UK, 2006.
3	Solar Energy	Sukhatme. S.P	Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997
4	Renewable Energy, Power for a Sustainable Future	Godfrey Boyle,	Oxford University Press, U.K., 1996.
5	Fundamental of Renewable Energy Sources	GN Tiwari and MK Ghoshal	Narosa, New Delhi, 2007
6	Renewable Energy and Environment-A Policy Analysis for India	NH Ravindranath, UK Rao, B Natarajan, P Monga	Tata McGraw Hill
7	Energy and The Environment, Second Edition	RA Ristinen and J J Kraushaar	John Willey & Sons, New York, 2006
8	Renewable Energy Resources	JW Twidell and AD Weir	ELBS, 2006

10. LEARNING WEBSITE & PORTALS

1. <https://www.suzlon.com/>
2. https://www.mahaurja.com/meda/en/grid_connected_power/wind_power
3. <https://earth.org/what-is-tidal-energy/>
4. <https://gpcl.gujarat.gov.in/>
5. <https://sbmurban.org/indore-bio-cng-plant>

11. ASSESMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Term Work
2. Quiz
3. Case study
2. Seminar/Presentation

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mrs. Neeta Kadukar
2	Internal	Mrs. Swapna Naik
3	External	Mr. Dhul shetty
		Organization: Government Polytechnic, Mumbai



1. COURSE DETAILS

Programme: Diploma in Civil, Mechanical, Electrical, Plastics, Chemical, Electronics & telecommunications Engineering		Semester: IV
Course: Indian Music	Course Category: GE	
Course Code: INM230024	Duration:16 Weeks	

2. LEARNING AND ASSESMENT SCHEME

Learning Scheme				Credits	Assessment Scheme								
Actual Contact Hrs./Week			Self-Learning (SL [^]) (Term Work + Assignment) (Hrs)		Paper Duration (Hrs.)	Theory (Marks)			Based on LL & TL			Based on Self Learning	Total Marks
CL	TL	LL				FA-TH	SA-TH	Total	FA-PR	SA-PR	SA-OR		
02	-	-	-	1	-	-	-	-	50	-	-	-	50

3. COURSE OBJECTIVE: To introduce students to the fundamentals of Indian classical music, including its origin, its ancient form and the progression to current form, basic elements of music, theoretical principles, the raga system, its categorisations and how it evolved, and rhythmic patterns, invoking appreciation and love for one of the finest of the arts rooted in our culture, tradition and diaspora.



4. SKILL COMPETENCY

By completing the course on Indian classical music, students will be able to

- Identify, analyze, and understand the form of Khyaal Gayaki, its basic ragas and taals, understanding their structure, mood, and aesthetic nuances with reference to gharanas in last 100 years.
- Prepare a Document of the learnt bandishes of different Ragas in suitable Taals.

5. COURSE OUTCOMES (COs): At the end of the semester student will be able to: -

CO No.	COURSE OUTCOME
CO1	To understand the basic foundations of Indian classical music such as Swara ,Laya, Shrutis.
CO2	To classify and practice different types of Ragas based on Moods, time, bandishes.
CO3	To acquaint with writing the notations of various Raga Bandishes in suitable Taals.
CO4	To understand Dhrupad and Thumri , including its stylistic nuances, structural elements, alaap techniques, and compositional forms

6. CO-PO, CO- PSO MAPPING TABLE -

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Indian Music (INM230024)	CO1	1	-	-	-	-	-	2	-	-
	CO2	2	-	-	-	-	-	3	-	-



CO3	1	-	-	-	-	-	1	-	-
CO4	2	-	-	-	-	-	1	-	-
CO Avg.	1.5	-	-	-	-	-	1.75	-	-

7. COURSE CONTENTS

UNIT NO.	TOPIC/Sub-topic
I	<p>UNIT-I: Hindustani Music - A World of Colour, Romance, and History, Classical of Shastriya - Dhrupad, Khayal and Instrumental Music – A Bird's-eye View Hindustani Music as Raga Sangeet, The Textual Tradition, Swara and Shruti. Tone and Microtone, Swara and Shruti in the Textual Tradition, Tanpura - The King of Overtones, Entering the World of Raga - Raga and Swara. The World of Raga - 2: Strong and Weak Notes. The World of Raga – 3, Ornament, The World of Raga - 4: Paths of a Rags, Raga and Time Association</p>
II	<p>Unit-II: Raga Lakshana or Features of Raga, Defining Raga, Classification of Ragas - the Mela or That System, Classification of Ragas - the Raagaanga System, Classification of Ragas - the Raga Ragini system. Extending the Raga Corpus - Winds from the South, Extending the Raga Corpus - Jod Ragas, Principles of Time in Hindustani Music - Tala and Laya, Some Aspects of Tala and a Few Important Tala-s, Tabla as Keeper of Tala in Khayal Khayal-A Compositional Form, Some Contemporary Composers of Khayal Write Notations of the bandishes learnt in various ragas</p>



III	Unit-III: The chhota Khayal Improvisation in Khayal: Elements of Raga Vistaar, The Eight Limbs of Ashtanga of Khayal and the nature of Tabla accompaniment., A Typical Khayal Presentation, Raga Profiles as Captured in Bandish Gharanas of Hindustan Music - Introduction The Harmonium as a solo and accompanying instrument.
IV	Unit-IV: Acquaint Dhrupad: style and structure, alaap, compositional forms, song texts The Enchanting World of Thumri.

8. IMPLEMENTATION STRATEGY (PLANNING)

Teaching Plan
Minimum no of practical/assignments.
Guest/Expert lectures
Demonstrations
Slides
Self-Learning Online Resources

9. SUGGESTED LEARNING RESOURCES

Sr. No.	Title of Book	Author	Publication
1	Music Contexts: A Concise Dictionary of Hindustani Music	Ashok Rimade,	Bibliophile South Asia, 2006
2	Keywords and Concepts Hindustani Classical Music	Ashok Ranade	Promilla, 2012
3	Music In India: The Classical Traditions	Bonnie C. Wade,	Manohur, revised edition 2021
4	Gandharva Mahavidyalay books for music education	Akhil Bharatiya gandharva Mahavidyalaya	
4	Lost world of Hindustani Music	Kumar Prasad Mukherjee	Penguin India, 2006 Sources on the internet

10. LEARNING WEBSITE & PORTALS (minimum 5)

1. <https://www.swarganga.org/>
2. [https:// www.parrikar.org](https://www.parrikar.org)
- 3 Hindustani music terminology - Wikipedia



4. <https://mohannadkarni.org>

11. ASSESSMENT METHODOLOGIES/TOOLS

Formative Assessment (Assessment for Learning)

1. Read part of Natya Shastra written by Bharat Muni, read books on Lives of Great Musicians, listen to great Musicians perform and particular Basic ragas taught in class.
2. Make a Project documentation and aesthetic presentation of ragas and Bandishes taught in class and its experience
3. Quiz on the material read heard and experienced
4. Assignment: Attend the Music festivals as well as intimate concerts to get the feel of contemporary classical musical scenario.

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME
1	Internal	Mrs. Radhika S. Patwardhan
2	Internal	Mrs. Neeta Kadukar
3	External	Rashmi Manjure
		Faculty at Vrindaban Gurukul, Mumbai

