Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum (Out Come Based)

Department of Electrical Engineering

INSTITUTE VISION

Transform knowledge into work

INSTITUTE MISSION

We are committed to:

- quality education for lifelong learning.

- need based educational programmes through different modes.

- outcome based curriculum implementation.

- development and up gradation of standard laboratory practices.

- promoting entrepreneurial programmes.

- We believe in ethical values, safety and environment friendly practices and teaching learning innovations.

DEPARTMENT VISION

Develop competent electrical professionals and practicing engineers.

DEPARTMENT MISSION

We are committed for quality education through

- continuous up-gradation of the faculties and laboratories.

- development and up gradation of standard, safe laboratory practices.

- creating entrepreneurial awareness.

- developing the consciousness of energy management and renewable energy.

- serving the society

Department of Electrical Engineering

Program Outcomes (POs) -10

1. **Basic knowledge:** An ability to apply knowledge of basic mathematics, science and engineering to solve the engineering problems.

2. **Discipline knowledge**: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

3. **Experiments and practice:** An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

4. **Engineering Tools**: Apply appropriate technologies and tools with an understanding of the limitations.

5. **The engineer and society**: Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.

6. **Environment and sustainability**: Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

7. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

8. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.

9. **Communication:** An ability to communicate effectively.

10. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the context of technological changes.

Department of Electrical Engineering

PROGRAM EDUCATIONAL OBJECTIVES (PEO)

PEO1. The students will practice their Technical skills to meet the need of industry and society.

PEO2. The students will practice their profession with ethics, integrity, safety and social Responsibility with attention to health, environment, team work and effective communication.

PEO3. They will be able to upgrade their knowledge by life-long learning in the context of technological changes to enhance technical and entrepreneurial abilities.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1: The ability to operate, supervise, test and maintain the various machineries, electrical installations and power system equipments.

PSO2: The ability to carry out energy audit, prepare electrical estimates and costing and to read, interpret and implement electrical drawing.

PSO3: The ability to practice profession with attention to energy conservation, ethical principles, safety, environmental aspects and socially beneficial activities.

Government Polytechnic Mumbai

Curriculum Philosophy

(P16 Outcome based Curriculum)

Preface

The quality of technical education is dependent on a well-developed curriculum. The curriculum should not focus only on technical contents but it should impart necessary skills that help students to learn how to cope with new challenges. It should prepare them for lifelong learning once they enter the workforce. It is very necessary that the diploma students should be well updated with the latest technological skills and advancements, to meet industrial demands and contribute to nation building. With this thought we have designed outcome based curriculum keeping in view the latest industry trends and market requirements. Outcome based curriculum will be offered to students 2016 onwards. Outcome based curriculum is student centric rather than teacher centric. It is comprising of basic science and engineering having focus on fundamentals, significant discipline level courses and electives. Inplant training is also included in the curriculum to make the student understand industry requirements, have hands on experience and take up project work relative to industry in their final year. These features will allow the students to develop problem solving approach to face the challenges in real life.

In outcome based education, Programme Outcomes, Programme specific outcomes, Course outcomes are defined first and then course contents are designed to achieve these outcomes. During curriculum implementation the teacher will analyze the contents and then develop the learning experiences which will ensure accomplishment of outcome. The industry experts, being main stake holders are actively involved, while designing the curriculum. Outcomes are validated by industry experts, so it will produce industry ready pass outs and increase the employability of students.

Salient features of this curriculum are

- Outcome based curriculum with well defined outcomes for each course
- Incorporation of Inplant training
- Built in flexibility to the students in terms of elective courses
- Course on Entrepreneurship to encourage entrepreneurial skills
- More weightage for practical's in terms of contact hours to increase skill component
- Introduction of Yoga in first semester to inculcate the habit of physical and mental fitness right at the start

- Introduction of Social work in first semester to inculcate social awareness and values

- Introduction of Spoken Tutorial course in order to inculcate self learning capability in students.

- A list of experiments with clear outcomes.

The New Curriculum has been designed to better meet the needs of the industry considering evolving technological trends and implications for the engineering workforce. This curriculum is also expected to enhance employability skills and develop well trained Diploma Engineers who have the knowledge and the skills to get engineering solutions for real-world problems.

I gratefully acknowledge the time and efforts of all those who contributed to design the curriculum, especially the contributions of chairperson and members of Board of Studies and Programmewise Board of Studies. I acknowledge all the stake holders, aluminies and subject experts.

(Mrs. Swati Deshpande)
Principal
Government Polytechnic Mumbai

Outcome Based Education Philosophy

As the National Board of Accreditation (NBA) is focusing on the adoption of Outcome Based Education (OBE) approach, Government Polytechnic, Mumbai has adopted the OBE approach for design of curriculum P16 to all programmes. NBA adopted Outcome based Model because, OBE is "Student Centric" rather than "Teacher Centric". OBE focuses on the graduate attributes or outcomes after completing an academic programme. Outcome based approach means knowing what you want to achieve and then taking the steps to do so. Starting with a clear picture of what is important for students to be able to do and then organizing the curriculum delivery and assessment to make sure learning happens.

Some Benefits of OBE are

1. Satisfying the need of stake holders
2. More specific and coherent curriculum
3. Student centric

Components of the OBE are

1. Outcome based curriculum: What students should be able to do after learning the curriculum?
2. Outcome based Teaching Learning: Prepare and train the students to achieve the outcomes.
3. Outcome based assessment: Measure what the student has achieved? Indentify which outcome has not attained by the students.
4. Remedial measures: Take the remedial measures so that student can achieve that outcome.

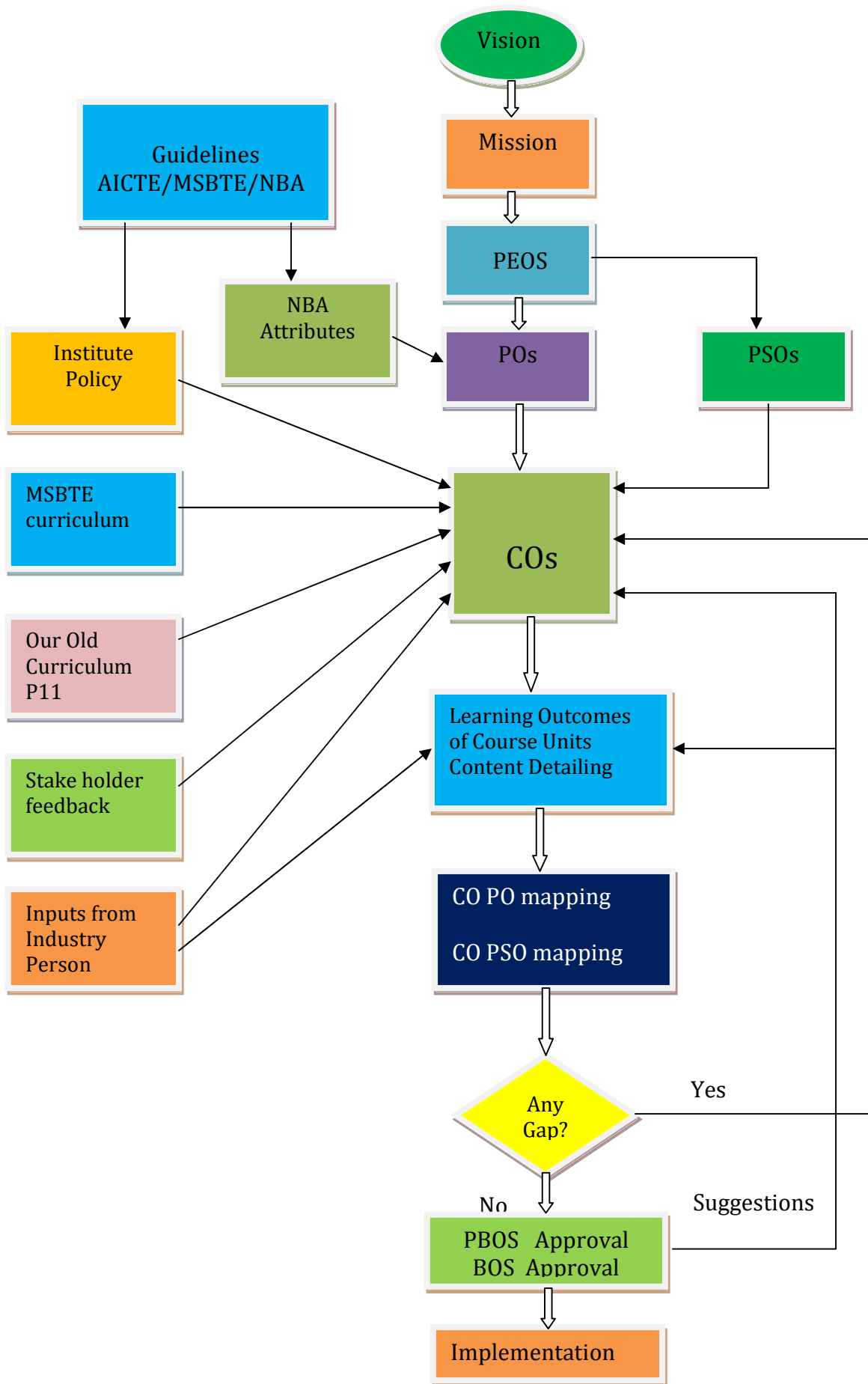**Fig1. Outcome Based Education Philosophy**

Fig. 2 Curriculum Design Process

Figure 1 shows outcome based education philosophy. Vision and mission statements will be finalized first, and then each programme will finalize Programme educational objectives (PEOs). Programme outcomes (POs) are given by NBA. Each programme will finalize their Programme Specific Outcomes (PSOs). Then course outcomes (COs) are finalized and then content detailing of each course will be carried out.

Figure 2 shows our curriculum design process/philosophy. Figure is self explanatory. Important steps are given below. Process starts with formulation of vision mission statements of the institute.

1. Formulation of Vision Mission Statements

Vision Mission statements of the institute are finalized using following steps.

- Bottoms up approach
- Involvement all stakeholders
- Discussion, Brain storming sessions among all stake holders
- Gap analysis or SWOT analysis
- Challenges before the institute
- What are the immediate and long term goals

After following these steps vision and mission statements of the institute is finalized as

Institute Vision

Transform Knowledge into Work

Institute Mission

We are committed for

- Quality education for life long learning
- Need based educational programmes through different modes.
- Outcome based curriculum implementation
- Development and up gradation of standard laboratory practices
- Promoting entrepreneurial programmes

We believe in ethical, safety, environmental friendly practices and teaching learning innovations.

Once, the vision mission statements are finalized. Using the same procedure vision mission statements of each programmes are finalized.

2. Programme Educational Objectives (PEOs)

The Programme educational objectives of a diploma program are the statements that describe the expected achievements of diploma holders in their career, and also in particular, what they are expected to perform and achieve during the first few years after diploma. The PEOs, may be guided by global and local needs, vision of the Institution, long term goals etc. For defining the PEOs the faculty members of the program have continuously worked with all Stakeholders: Local Employers, Industry, Students and the Alumni

3. Programme Outcomes (POs)

Programme outcomes are given by NBA. They are

1. **Basic knowledge:** An ability to apply knowledge of basic mathematics, science and engineering to solve the engineering problems.

2. **Discipline knowledge**: An ability to apply discipline - specific knowledge to solve core and/or applied engineering problems.

3. **Experiments and practice:** An ability to plan and perform experiments and practices and to use the results to solve engineering problems.

4. **Engineering Tools**: Apply appropriate technologies and tools with an understanding of the limitations.

5. **The engineer and society**: Demonstrate knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to engineering practice.

6. **Environment and sustainability**: Understand the impact of the engineering solutions in societal and environmental contexts, and demonstrate the knowledge and need for sustainable development.

7. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

8. **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse/multidisciplinary teams.

9. **Communication:** An ability to communicate effectively.

10. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the context of technological changes.

4. Programme Specific Outcomes (PSOs)

These outcomes are specific to a program in addition to NBA defined POs, namely, Civil, Computer, Electrical, Electronics, Mechanical, Information Technology, Instrumentation, Rubber Technology, Leather Technology, and Leather Goods and Footwear technology.

5. Course Outcomes (COs) and Content detailing

"Statements of observable student actions that serve as evidence of the Knowledge, Skills and Attitudes acquired in a course". Each course is designed to meet (about 4 to 6) Course Outcomes The Course Outcomes are stated in such a way that they can be actually measured. "Blooms Taxonomy" is used for framing course outcomes.

Course Outcome statements are broken down into two main components:

- **An action word** that identifies the performance to be demonstrated;
- **Learning statement** that specifies what learning will be demonstrated in the performance;

Once the COs are finalized, content detailing of each course is done as per the course outcomes. For content detailing inputs are taken from stake holders, MSBTE curriculum and industry persons.

6. CO-PO and CO-PSO mapping

When all COs are finalized, COs are mapped with POs and PSOs. During mapping if it is found that particular PO or PSO has not been addressed by any CO, then it is considered as gap. To remove this gap, again COs are modified. This process will repeat till all POs and PSOs are mapped by COs.

7. Approval in PBOS and BOS meetings.

After CO-PO and CO-PSO mapping, content detailing is done. Then the curriculum is kept for approval in Programme wise Board of studies (PBOS) meeting. Each programme has its own PBOS committee whose structure is as follows.

Head of Department concerned	Chairman
Two senior Lecturers	Members
One expert from the neighboring institute	Member

Nominee from the board of technical Education	Member
One expert from the local industry	Member
Departmental Curriculum Coordinator	Member Secretary

Suggestions given by PBOS members are incorporated in the curriculum and then it is put in front of Board of studies (BOS). Structure of BOS is as follows.

Representative from Industry	Chairman
Principal	Member
Head of All departments	Member
Local Experts of all programmes	Member
Nominee from the board of technical Education	Member
In charge CDC / Academic Coordinator	Member Secretary

Suggestions given by BOS members are incorporated in the curriculum and the finalized curriculum is then offered to the students.

8. Institute Policies

As per the guidelines given by All India Council of Technical Education (AICTE), Maharashtra State Board of Technical Education (MSBTE), Directorate of Technical Education (DTE) and NBA, Institute policies about curriculum design are decided in the meeting of all Heads of the departments.

Being an autonomous institute, we revise our curriculum after every 4 to 5 years. Earlier it was revised in 2011. Curriculum 2011 was objective based curriculum. As per instructions received from AICTE and NBA, **Outcome based curriculum** should be offered to students, we have decided to offer **Outcome based curriculum** in 2016. In 2016 it will be offered to first year and in subsequent years it will be offered to second year and third year. Once the curriculum frame work is finalized at the institute level, as per the demand of the industry, course contents can be changed at any level without disturbing the frame work. This is necessary to satisfy the present demand of the industry and remove the curricula gaps as per the advancement in technology.

 2011 curriculum was of 180 credits. But as per AICTE norms given in APH 2015-16, contact hours per semester should be 525 hours and number of teaching days should be 75 in a semester (7 hours per day i.e. 35 hours per week). Diploma is of 3 years (6 semesters). (35 x 6 = 210).

So we decided to design 2016 curriculum with 200 credits + 10 non credit courses.

Definition of Credit:

1 Hr. Lecture (L) per week 1 credit

1 Hr. Tutorial (T) per week 1 credit

2 Hours Practical (P) per week 2 credit

Civil Engineering, Mechanical Engineering, Rubber Technology, Leather Technology, Leather Goods and Footwear Technology departments are incorporating Inplant training in their curriculum, wherein students will go for Inplant training in the industries during last semester. So their credits will be 190 credits + 10 non credit courses.

For rest of the branches 6 weeks Inplant training is incorporated in the curriculum. 4 week training will be performed after 4th semester during summer vacation and 2 week training will be performed after 5th semester during winter vacation. So their credits will be 200 credits + 10 non credit courses. Credit distribution of both cases is given below.

Curriculum Frame work for (CO, IT, EC, EE, IS)

Year	Semester	Credits	Total Credits Year wise	Total credits
First	**First**	30	60	200
	Second	30		
Second	**Third**	35	70	
	Fourth	35		
Third	**Fifth**	35	70	
	Sixth	35		

Curriculum Frame work for (CE, ME, RT, LT, LGFT)

Year	Semester	Credits	Total Credits Year wise	Total credits
First	**First**	30	65	190
	Second	35		
Second	**Third**	35	70	
	Fourth	35		
Third	**Fifth**	35	55	
	Sixth	20		

Social-emotional learning develops **5 core competencies** in students: self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Yoga and meditation foster these core competencies. Through a yoga and meditation practice, students first

learn to bring awareness to their breath and physical body. By focusing on this connection, student become more able to feel and experience what is happening within the mind and bodies, developing stronger self-awareness. With this thought we have decided to incorporate "Yoga" as a non credit course in first semester for all programmes.

To Inculcate Social awareness, values and environmentally responsible behavior amongst students and to nurture students as citizens with moral, ethical and social values so as to provide service to the society through activities and discharge their obligations towards the society, we decided to incorporate "Social Work" as a non credit course in first semester for all programmes. First year, first semester of all programmes is of 30 credits, so 5 hrs non credit non exam courses are incorporated in curriculum of all programmes as shown below.

Semester	Courses	Hours	Total hours
First Semester	Yoga	2 Hrs	5 Hrs
	Social work	3 Hrs	

In order to inculcate self learning capability in students "Spoken Tutorial" course is incorporated in the curriculum of second semester of CO, IT, EC, EE, IS. Similarly to create awareness about Digital India, a course "Digital India" is incorporated in curriculum of second semester of CO, IT, EC, EE, IS.

First year, second semester of CO, IT, EC, EE, IS programmes is of 30 credits, so 5 hrs non credit non exam courses are incorporated in curriculum of these programmes as shown below.

Semester	Courses	Hours	Total hours
Second Semester	Spoken Tutorial	2 Hrs	5 Hrs
	Digital India	3 Hrs.	

For all courses 70+30 pattern of examination is followed instead of 80+20. Two internal progressive assessment tests are conducted for theory courses in a semester having maximum marks 30. End semester examination of 70 Marks is conducted at the end of the semester. Average of two test marks out of 30 is added to end term marks out of 70. Thus total marks of the course are given out of 100.

After test as well as end term examination bitwise analysis of answer book of each student will be done in order to calculate course outcome attainment. From course attainment, PO and PSO attainment will be calculated. If attainment is not satisfactory remedial measures will be taken by respective department.

Entire curriculum of all Programmes is as per following levels

Level1-   Science and Humanities (10 to 15%)

Level2-   Core Technology (25 to 30%)

Level3-   Applied Technology (45 to 50%)

Level4-   Diversified Courses (5 to 10%)

Level5-   Management courses (3 to 5%)

Course Coding Scheme:-

Course Code abbrevations	Definitions
HU	Humanities
SC	Science
MG	Management
CE	Civil
CO	Computer
EC	Electronics
EE	Electrical
IT	Information Technology
IS	Instrumentation
RT	Rubber
LT	Leather Technology
LG	Leather Goods and Footwear

Course codes are formed as:

First two letters are course code abbreviations. Then two digits "16" refers to 2016 curriculum.

Next digit is level number and last two digits are serial number from that level.

For example: HU16101 (Basics of Communication)

HU-   It belongs to Level 1 Science & humanities

16-   2016 curriculum

1-   Level 1

01-   Sr. No of Level 1 courses.

Department of Electrical Engineering

Salient Features of P-16 Curriculum

➢ Autonomous institute- Freedom to design Curriculum as per the need of Industry/Society

➢ Outcome Based (OBE)

➢ To design Curriculum- Feed back from stakeholders.

➢ More Practical approach

➢ Maintaining PR/TH ratio

➢ Total Diploma Marks - 5000

➢ Total Credits - 200

➢ First Year (Odd/Even Sem) 60 credits

➢ Second & Third Year (Odd/Even Sem) Each 70 credits

➢ For Skill development – Noncredit able courses

➢ Elective Courses in V & VI Sem (Final Year)

➢ 70-30 Pattern (70 End Term Exam & 30 Unit Test (2 UT- Avg.)

Department of Electrical Engineering

200 Credit Scheme P-16 Level Wise Marks Distribution

P-16 curriculum scheme is divided into 5 levels.

➢ Science & Humanities (10 to 15%)

➢ Core Technology Courses (25 to 30%)

➢ Applied Technology Courses (45 to 50%)

➢ Diversified Courses (5 to 10%)

➢ Management Courses (3 to 5%)

Sr. No.	Course Level	Course Code	Credits	% of Course Level	Marks	% of Marks
1	Science & Humanities	HU16101, SC16104, SC16107, HU16103, HU16102, SC16108, SC16106, HU16104,	27	13.5	750	15.0
2	Core Technology Courses	CO16202, CO16203, AM16201, WS16201, EE16202, EC16202, ME16201, EE16208, EE16209, EE16210, ME16211, EE16211, EE16212, EE16213	71	35.5	1600	32.0
3	Applied Technology Courses	EE16301, EE16302, EE16303, EE16304, EE16307, EE16305, EE16306, EE16308, EE16312, EE16309, EE16310, EE16311, EE16313	64	32.0	1600	32.0
4	Diversified Courses	EE16402, EE16401, EE16403, EE16404, EE16405, EE16408, EE16406, EE16407	30	15.0	850	17.0
5	Management Courses	EE16501, MG16501, MG16502	08	4.0	200	4.0
		Total Credits	**200**	**100**	**5000**	**100**

Department of Electrical Engineering

Semester wise Credit and Marks Distribution

Semester	Teaching Scheme (Credits)				Examination Scheme (Marks)						
	L	P	TU	Total	Theory		PR	OR	TW	Total
					TH	TS				
1	13	12	4	29	280	120	100	75	125	700
2	16	12	3	31	280	120	150	50	150	750
Total First Year	**29**	**24**	**7**	**60**	**560**	**240**	**250**	**125**	**275**	**1450**
3	17	12	6	35	310	90	150	100	200	850
4	16	18	01	35	350	150	100	225	75	900
Total Second Year	**33**	**30**	**7**	**70**	**660**	**240**	**250**	**325**	**275**	**1750**
5	18	18	0	36	350	150	100	250	50	900
6	16	14	4	34	350	150	150	150	100	900
Total Third Year	**34**	**32**	**4**	**70**	**700**	**300**	**250**	**400**	**150**	**1800**
TOTAL	**96**	**86**	**18**	**200**	**1920**	**780**	**750**	**850**	**700**	**5000**
	96	**104**			**2700**		**2300**			
Percentage	**48%**	**52%**			**54%**		**46%**			

Total Marks -   5000;

Theory Marks - 2700 (54%);

PR / OR / TW Marks   - 2300 (46%)

Department of Electrical Engineering
P-16 Chart at a Glance for all Semester

First Semester

Sr. No.	Course Code	Course Title	Credits
1	HU16101	Basics of Communication	3
2	SC 16 104	Engineering Physics	5
3	SC16107	Mathematics I	4
4	AM16201	Engineering Mechanics	5
5	CO16 202	C-Programming	4
6	HU16103	Generic Skills	2
7	WS16 201	Workshop Practice	4
8	NC16101	Yoga	--
9	NC16102	Social Work	--
10	CO 16203	Computer Work Shop	2
		Total	**29**

Second Semester

Sr. No.	Course Code	Course Title	Credits
1	HU16102	Communication Skills#	2
2	SC16108	Mathematics II	4
3	SC16106	Chemistry of Engineering Material	5
4	EE16202	Basic Electrical Engineering	8
5	EC16202	Elements of Electronics Engineering	6
6	ME16201	Engineering Drawing- I	6
7	NC16201	Spoken Tutorial course	--
8	NC16202	Digital India	--
		Total	**31**

Third Semester

Sr. No.	Course Code	Course Title	Credits
1	EE 16 208	Electrical Material & Wiring	4
2	EE 16 209	Electrical Measurement	7
3	EE 16 210	Electrical Power Generation#	4
4	ME16 211	Elements of Mechanical Engineering	4
5	HU16 104	Environmental Studies	2
6	EE 16 211	Electrical Circuit & Network	7
7	EE 16 212	DC Machine & Transformer	7
		Total	**35**

Fourth Semester

Sr. No.	Course Code	Course Title	Credits
1	EE 16 501	Professional Practices	2
2	EE 16 301	Maintenance of Domestic Appliances	4
3	EE 16 302	Industrial Measurement	7
4	EE 16 303	Electrical Transmission & Distribution#	5
5	EE 16 304	Utilization of Electrical Energy	5
6	EE 16 307	AC Machines	6
7	EE 16 402	Renewable energy Sources	6
		Total	**35**

Fifth Semester

Sr. No.	Course Code	Course Title	Credits
1	EE 16 213	Computer Aided Electrical Drawing	3
2	EE 16 305	Electrical Energy Conservation & Audit#	6
3	EE 16 306	Switch gear & Protection	5
4	EE 16 308	Project & Seminar-I	4
5	EE 16 401	Power Electronics & Drives	6
6	EE 16 403	Principles of Control System	5
7	(Elective-I) EE 16 404 EE 16 405	a. Illumination Engg. b. Power System Analysis	3
8	EE 16 312	Industrial Training - I	4
Total			**36**

Sixth Semester

Sr. No.	Course Code	Course Title	Credits
1	EE 16 309	Electrical Estimation & Costing	5
2	EE 16 310	Project & Seminar-II	4
3	EE 16 311	Testing & Maintenance of Electrical Equipents	7
4	(Elective-II) EE 16 408 EE 16 406	Microcontroller & Applications Special Machines	5
5	EE 16 407	Industrial Automation	5
6	EE 16 313	Industrial Training - II	2
7	MG 16 502	Entrepreneurship Development	3
8	MG 16 501	Industrial Organization & Management#	3
Total			**34**

Academic Coordinator   Head of Electrical Engg. Dept.   Principal

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

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Programme: Electrical Engineering   **First Semester**   **With effect from June 2016**

Sr. No.	Course Code	Course Title	Award of Class	Compulsory /Optional	Teaching Hours				Credits	Examination Scheme					
					L	P	TU	Total (Hrs)		Theory		PR	OR	TW	Total
										TH	TS				
1	HU16 101	Basics of Communication	--	C	2	---	1	3	3	70	30	--	--	--	100
2	SC16 104	Engineering Physics	--	C	3	2	---	5	5	70	30	--	--	50	150
3	SC16 107	Mathematics I	--	C	3	----	1	4	4	70	30	--	--	--	100
4	AM16 201	Engineering Mechanics	--	C	3	2	---	5	5	70	30	0	25*	25*	150
5	CO16 202	C-Programming	--	C	2	2	----	4	4	0	0	50#	0	--	50
6	HU16 103	Generic Skills	--	C	--	----	2	2	2	--	--	--	50		50
7	WS16 201	Workshop Practice	--	C	--	4	0	4	4	0	0	0	--	50	50
8	CO16 203	Computer Work Shop	--	C	--	2	--	2	2	0	0	50	--	--	50
	NC16 101	Yoga	--	C	--	2	--	2	--	--	--	--	--	--	--
	NC16 102	Social Work	--	C	--	3	--	3	--	--	--	--	--	--	--
			TOTAL		13	17	4	**34**	**29**	280	120	100	75	125	**700**

Abbreviations: L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.

* Indicates assessment by External Examiner, # indicates On-Line Exam

Academic Coordinator   **Head of Department**   **Principal**
                                        (Electrical Engineering)   **Government Polytechnic Mumbai**

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Programme: Electrical Engineering   **Second Semester**   **With effect from June 2016**

Course Code	Course Title	Teaching Hours				Credits	Examination Scheme					
							Theory		PR	OR	TW	Total
		L	P	TU	Total (Hrs)		TH	TS				
HU16 102	Communication Skills	---	---	2	2	2	--	--	--	50*	--	50
SC16 108	Mathematics II	3	----	1	4	4	70	30	--	--	--	100
SC16 106	Chemistry of Engineering Material	3	2	---	5	5	70	30	--	--	50	150
EE16 202	Basic Electrical Engineering	4	4	----	8	8	70	30	50*	--	50	200
EC16 202	Elements of Electronics Engineering	4	2	---	6	6	70	30	50	--		150
ME16 201	Engineering Drawing- I	2	4	----	6	6	--	--	50*	--	50	100
NC16 201	Spoken Tutorial course	--	2	--	2	--	--	--	--	--	--	--
NC16 202	Digital India	--	3	--	3	--	--	--	--	--	--	--
	TOTAL	16	17	3	**36**	**31**	280	120	150	50	150	**750**

Abbreviations: L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.

* Indicates assessment by External Examiner

Academic Coordinator   **Head of Department**   **Principal**

(**Electrical Engineering**)   **Government Polytechnic Mumbai**

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Programme: Electrical Engineering   **Third Semester**   **With effect from June 2017**

Teaching & Examination Scheme for the Students admitted in Second Year in 2017-18

Semester : III

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 208	Electrical Materials & Wiring	--	C	2	0	2	4	0	0	0	75*	25	100
2	EE 16 209	Electrical Measurement	--	C	3	0	4	7	70	30	50*	0	0	150
3	EE 16 210	Electrical Power Generation#	--	C	4	0	0	4	100#	0#	0	0	0	100#
4	ME 16 211	Elements of Mechanical Engineering	--	C	2	0	2	4	0	0	0	0	50	50
5	HU 16 104	Environmental Studies	--	C	0	2	0	2	0	0	0	25*	25	50
6	EE 16 211	Electrical Circuit & Network	--	C	3	2	2	7	70	30	50*	0	50	200
7	EE 16 212	DC Machine & Transformer	--	C	3	2	2	7	70	30	50*	0	50	200
					17	6	12		310	90	150	100	200	
		Total Credits						35		**Total Marks**				850

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
*Indicates assessment by External Examiner. # Indicates on line theory exam.

Academic Coordinator   **HOD (EE)**   **Principal**

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

gpmumbai@gpmumbai.ac.in

Programme: Electrical Engineering   **Fourth Semester**   **With effect from June 2017**

Teaching & Examination Scheme for the Students admitted in Second Year in 2017-18

Semester : IV

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 501	Professional Practices	--	C	0	0	2	2	0	0	0	25	25	50
2	EE 16 301	Maintenance of Domestic Appliances	--	C	0	0	4	4	0	0	0	50^*	50	100
3	EE 16 302	Industrial Measurement	--	C	3	0	4	7	70	30	50^*	0	0	150
4	EE 16 303	Electrical Transmission & Distribution#	--	C	3	0	2	5	$70^\#$	$30^\#$	0	50^*	0	$150^\#$
5	EE 16 304	Utilization of Electrical Energy	--	C	3	0	2	5	70	30	0	50^*	0	150
6	EE 16 307	AC Machines	--	C	3	1	2	6	70	30	50^*	0	0	150
7	EE 16 402	Renewable energy Sources	--	C	4	0	2	6	70	30	0	50^*	0	150
					16	01	18		350	150	100	225	75	
		Total Credits						35			Total Marks			900

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
   *Indicates assessment by External Examiner. # Indicates on line theory exam.

Academic Coordinator   **HOD (EE)**   **Principal**

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

gpmumbai@gpmumbai.ac.in

Programme: Electrical Engineering   **Fifth Semester**   **With effect from June 2018**

Teaching & Examination Scheme for the Students admitted in Third Year in 2018-19

Semester : V

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 213	Computer Aided Electrical Drawing	--	C	1	0	2	3	0	0	0	50	0	50
2	EE 16 305	Electrical Energy Conservation & Audit#	1	C	4	0	2	6	$70^{\#}$	$30^{\#}$	0	50^{*}	0	150
3	EE 16 306	Switch gear & Protection	1	C	3	0	2	5	70	30	50^{*}	0	0	150
4	EE 16 308	Project & Seminar-I	1	C	0	0	4	4	0	0	0	50^{*}	0	50
5	EE 16 401	Power Electronics &Drives	1	C	4	0	2	6	70	30	50^{*}	0	0	150
6	EE 16 403	Principles of Control System	1	C	3	0	2	5	70	30	0	50^{*}	0	150
7	(Elective-I) EE 16 404 EE 16 405	a. Illumination Engineering b. Power System Analysis	1	O	3	0	0	3	70	30	0	0	0	100
8	EE 16 406	Industrial Training - I	--	C			4	4	0	0	0	50^{*}	50	100
					18	0	18		350	150	100	250	50	
Total Credits								36	Total Marks					900

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work. *Indicates assessment by External Examiner. # Indicates on line theory exam.

Academic Coordinator   **HOD (EE)**   **Principal**

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra €

Programme: Electrical Engineering   **Sixth Semester**   **With effect from June 2018**

Teaching & Examination Scheme for the Students admitted in Third Year in 2018-19

Semester VI

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 309	Electrical Estimation & Costing	1	C	3	2	0	5	70	30	0	50*	0	150
2	EE 16 310	Project & Seminar-II	1	C	0	0	4	4	0	0	0	50*	50	100
3	EE 16 311	Testing & Maintenance of Electrical Equipments	1	C	3	0	4	7	70	30	50*	0	0	150
4	(Elective-II) EE 16 408 a. Microcontroller & Applications EE 16 406 b. Special Machines	1	O	3	0	2	5	70	30	50*	0	0	150
5	EE16 407	Industrial Automation	1	C	3	0	2	5	70	30	50*	0	0	150
6	EE16 313	Industrial Training - II	--	C			2	2	0	0	0	25*	25	50
7	MG16 502	Entrepreneurship Development	--	C	1	2	0	3	0	0	0	25*	25	50
8	MG16 501	Industrial Organization & Management[#]	1	C	3	0	0	3	70[#]	30[#]	0	0	0	100
					16	**4**	**14**		**350**	**150**	**150**	**150**	**100**	
		Total Credits						**34**	**Total Marks**					**900**

Abbreviations: **C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.**
*Indicates assessment by External Examiner,   # Indicates on line theory exam.

Academic Coordinator   **HOD (EE)**   **Principal**

Department of Electrical Engineering

Award of Diploma (P-16)

For the award of Diploma in Electrical Engineering programme, Applied Engineering courses of 5th semester and 6th semester will be considered along with their credit and marks weightage.

The details for the award of Diploma in Electrical Engineering programme are expressed in the following table and the related Reaching & Examination scheme is also attached herewith for any further reference.

Award of Diploma	Total Number of Courses	Total Credits	Total Marks
Electrical Engineering	12	58	1550

Department of Electrical Engineering

Award of Class Courses

Following courses are offered for Award of Class for Electrical Engineering Diploma

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra €

Programme: Electrical Engineering	Award of Class Courses	With effect from June 2018

Teaching & Examination Scheme for the Students admitted in Third Year in 2018-19

Semester VI

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 309	Electrical Estimation & Costing	1	C	3	2	0	5	70	30	0	50*	0	150
2	EE 16 310	Project & Seminar-II	1	C	0	0	4	4	0	0	0	50*	50	100
3	EE 16 311	Testing & Maintenance of Electrical Equipments	1	C	3	0	4	7	70	30	50*	0	0	150
4	(Elective-II) EE 16 408 EE 16 406	a. Microcontroller & Applications b. Special Machines	1	O	3	0	2	5	70	30	50*	0	0	150
5	EE16 407	Industrial Automation	1	C	3	0	2	5	70	30	50*	0	0	150
6	MG16 501	Industrial Organization & Management#	1	C	3	0	0	3	70#	30#	0	0	0	100
7	EE 16 305	Electrical Energy Conservation & Audit#	1	C	4	0	2	6	70#	30#	0	50*	0	150
8	EE 16 306	Switchgear & Protection	1	C	3	0	2	5	70	30	50*	0	0	150
9	EE 16 308	Project & Seminar-I	1	C	0	0	4	4	0	0	0	50*	0	50
10	EE 16 401	Power Electronics &Drives	1	C	4	0	2	6	70	30	50*	0	0	150
11	EE 16 403	Principles of Control System	1	C	3	0	2	5	70	30	0	50*	0	150
12	(Elective-I) EE 16 404 EE 16 405	a. Illumination Engineering b. Power System Analysis	1	O	3	0	0	3	70	30	0	0	0	100
					32	02	24		700	300	250	250	50	
		Total Credits						**58**	**Total Marks**					**1550**

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
*Indicates assessment by External Examiner, # Indicates on line theory exam.

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Department of Electrical Engineering

P-16_First Year Electrical Engineering- List of Exemption Courses

(Entry Qualification higher than SSC)

The details of the exemption of courses for the students those who are admitted to First year Electrical Engineering Diploma with higher entry education are expressed in the following table. (If till some cases are special then accordingly the decision will be taken)

Sr. No	Entry Qualification	Course Exemption (Title & Code)	Semester	Credit Exemption	Total Credits Exempted
1	HSC Science (PCM - Electrical Maintenance)	1. Basics of Communication (HU16101)	I	3	27
		2. Engineering Physics (SC16104)	I	5	
		3. Mathematics I (SC16107)	I	4	
		4. Communication Skills (HU16102)	II	2	
		5. Mathematics II (SC16108)	II	4	
		6. Chemistry of Engineering Material (SC16106)	II	5	
		7. Electrical Material and Wiring (EE16208)	III	4	
2	HSC Vocational (Electrical Technology 1,2,3)	1. Basics of Communication (HU16101)	I	3	17
		2. Communication Skills (HU16102)	II	2	
		3. Basic Electrical Engineering (EE16202)	II	8	
		4. Electrical Material and Wiring (EE16208)	III	4	
3	HSC Science (PCMB)	1. Basics of Communication (HU16101)	I	3	25
		2. Engineering Physics (SC16104)	I	5	
		3. Mathematics I (SC16107)	I	4	
		4. Communication Skills (HU16102)	II	2	
		5. Mathematics II (SC16108)	II	4	
		6. Chemistry of Engineering Material (SC16106)	II	5	
		7. Environmental Studies (HU16104)	III	2	
4	ITI (Electrician)	1. Electrical Material and Wiring (EE16208)	III	4	04

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Department of Electrical Engineering

P-16_Direct Second Year Electrical Engineering- List of Backlog Courses

(Directly Admitted to Second Year Electrical Engineering)

The details of the Backlog courses for the students those who are admitted directly to Second year (IIIrd Sem) Electrical Engineering Diploma they have to appear for the Backlog Courses which are expressed in the following table. (If till some cases are special then accordingly the decision will be taken)

Sr. No	Odd / Even Semester	Backlog Courses (Title & Code)	Semester	Credit	Total Credits
1	Odd Sem (During Sem-III)	1. Mathematics I (SC16107) 2. Computer Workshop (CO16203) 3. Basic Electrical Engineering (EE16202)	I I II	4 2 8	14
2	Even Sem (During Sem-IV)	1. C-Programming (CO16202) 2. Mathematics II (SC16108) 3. Elements of Electronics Engineering (EC16202)	I II II	4 4 6	14

The students who are admitted directly to second year, they have to complete their three backlog courses of Sem-I (SC16107 & CO16203) & II (EE16202) during Odd Sem (Sem-III) & three backlog courses of Sem-I (CO16202) & II (SC16108 & EC16202) during Even Sem (Sem-IV).

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Department of Electrical Engineering

The following courses for our department and other department (which courses are designed by our department) represents the equivalence courses for P-11 & P-16 scheme

Equivalence Courses for other Programmes

Sr. No.	Programme	P-11 Scheme		P-16 Scheme	
		Course Code	Course Title	Course Code	Course Title
01	Computer Engg.	EE11 211	Fundamentals of Electrical Engg.	EE16 201	Fundamentals of Electrical Engg.
02	Electronics Engg.	EE11 211	Fundamentals of Electrical Engg.	EE16 201	Fundamentals of Electrical Engg.
03	Electronics Engg.	EE11 311	Electrical Machines	Yet to be designed by our Dept.	
04	Information Technology	EE11 211	Fundamentals of Electrical Engg.	EE16 201	Fundamentals of Electrical Engg.
05	Instrumentation Engg.	EE11 211	Fundamentals of Electrical Engg.	EE16 201	Fundamentals of Electrical Engg.
06	Instrumentation Engg.	EE11 311	Electrical Machines	EE16 206	Electrical Machines
07	Mechanical Engg.	EE11 212	Electrical Technology	EE16 203	Electrical Technology

Equivalence Courses for Electrical Engg. Programmes

Sr. No.	P-11 Scheme		P-16 Scheme	
1.	Course Code	Course Title	Course Code	Course Title
2.	CO 11 201	Computer Fundamentals	CO 16 203	Computer Workshop
3.	SC 11 110	Basic Mathematics	SC 16 107	Mathematics-I *
4.	SC 11106	Applied Physics	SC 16 104	Engineering Physics
5.	ME 11 206	Elements of Mechanical Engg.	ME 16 211	Elements of Mechanical Engg.
6.	HU 11 101	Communication Skills	HU 16 101	Basics of Communication
7.	HU 11 103	Generic Skills	HU 16 103	Generic Skills
8.	WS 11 201	Workshop Practice	WS 16 201	Workshop Practice
9.	AM 11 201	Engineering Mechanics	AM 16 201	Engineering Mechanics
10.	CO 11 203	Programming Language-C	CO 16 202	C-Programming
11.	HU 11 102	Communication Practice	HU 16 102#	Communication Skills#
12.	ME 11 201	Engineering Graphics	ME 16 201	Engineering Drawing-I
13.	SC 11 108	Applied Chemistry	SC 16 106	Chemistry of Engineering Material
14.	SC 11 111	Engineering Mathematics	SC 16 108	Mathematics-II*
15.	EC 11 203	Basic Electronics	EC 16 202	Elements of Electronics Engineering**
16.	SC 11 122	Applied Mathematics	------	*
17.	EC 11 312	Applied & Digital Techniques	-----	**
18.	MG 11 511	Entrepreneurship Development	MG 16 503	Entrepreneurship Development

19.	MG 11 513	Business management & Administration	MG 16 504#	Industrial Organization & Management#
20.	EE 11 201	Basic Electrical Engg.	EE16 202	Basic Electrical Engg.
21.	EE 11 202	Electrical and Electronics Measurement	EE 16 209	Electrical Measurement
22.	EE 11 304	Electrical Power Generation	EE 16 210#	Electrical Power Generation#
23.	EE 11 310	Professional Practices – I	EE 16 501	Professional Practices
24.	EE 11 205	Electrical Workshop & Appliances	EE 16 301	Maintenance of Domestic Appliances
25.	EE 11 203	Electrical Circuit & Network	EE 16 211	Electrical Circuit & Network
26.	EE 11 204	Electrical Drawing & Circuit Simulation	EE 16 213	Electrical Drawing
27.	EE 11 206	Instrumentation & Control	EE 16 302	Industrial Measurement
28.	EE 11 302	Electrical Machine – I	EE 16 212	DC Machine & Transformer
29.	EE 11 305	Electrical Transmission & Distribution	EE 16 303#	Electrical Transmission & Distribution#
30.	EE 11 306	Utilization of Electrical Energy	EE 16 304	Utilization of Electrical Energy
31.	EE 11 303	Electrical Machines – II	EE 16 307	AC Machines
32.	EE 11 307	Switchgear & Protection	EE 16 306	Switchgear & Protection
33.	EE 11 308	Testing & Maintenance of Electrical Equipments	EE 16 311	Testing & Maintenance of Electrical Equipments
34.	EE 11 312	Project and Seminar Stage –I	EE 16 308	Project and Seminar –I
35.	EE 11 402	Micro Controller and Applications (Elective)	EE 16 407	Micro Controller and Applications (Elective)
36.	EE 11 408	Energy Conservation & Audit (Elective)	EE 16 309	Energy Conservation & Audit
37.	EE 11 309	Electrical Estimation and Costing	EE 16 305	Electrical Estimation and Costing
38.	EE 11 401	Power Electronics & Drives	EE 16 401	Power Electronics & Drives
39.	EE 11 405	Industrial Automation (Elective)	EE 16 403#	Industrial Automation#
40.	EE 11 313	Project and Seminar Stage –II	EE 16 310	Project and Seminar-II

*Indicates that students from P-11 scheme has to clear any two Mathematics (Basic Mathematics, Engg. Mathematics & Applied Mathematics). He will be exempted from the remaining Mathematics & will be awarded the credits from P-11 scheme.

** Indicates that students from P-11 scheme has to clear any one from Basic Electronics (EC 11 203) & Applied & Digital Technique (EC 11 312). He will be exempted from the remaining Course & will be awarded the credits from P-11 scheme.

#Indicates On-Line Examination for the said courses.

                                                    Head of Department Electrical Engg.

Department of Electrical Engineering

Equivalence Courses for P-11 to P-16 Scheme

This is to inform you that following table represents equivalent courses for P-11 scheme to P-16 scheme.

P-11 Scheme		P-16 Scheme		
Course Code	Course Title	Course Code	Course Title 2016 Scheme	Semester
EC 11 203	Basic Electronics	EC 16 202	Elements of Electronics Engineering	Second
SC 11 122	Applied Mathematics	SC 16 108	Mathematics-II	Second
EC 11 312	Applied Electronics and Digital Techniques	EC 16 202	Elements of Electronics Engineering	Second
MG 11 511	Entrepreneurship Development	MG 16 502	Entrepreneurship Development	Sixth

Head of Electrical Engineering
Govt. Polytechnic, Mumbai

To,
The Controller of Examination,
Govt. Polytechnic, Mumbai

Department of Electrical Engineering

Reference: - GPP/EE/Equivalence/P-11 P-16/2017-18/651   dated 20/03/2018

As per the above reference the following courses of Electrical Engg. Department represents the Equivalence courses for P-11 & P-16 scheme.

Sr. No.	Programme	P-11 Scheme		P-16 Scheme	
		Course Code	Course Title	Course Code	Course Title
01	Electrical Engg.	CO11 201	Computer Fundamentals	CO16 203	Computer Workshop
02	Electrical Engg.	CO11 302	Programming Language-C	CO16 202	C-Programming

Head of Department Electrical Engg.
Government Polytechnic, Mumbai

Department of Electrical Engg

Detention Implementation 2016 (P16 Scheme)

Applicable for students admitted from year 2016 onwards

- At the end of the year if a student is detained in any course, he/she is not allowed for admission in next year. Student is not allowed in higher year with detention in lower year.

- If a student is detained in Odd semester of any year, he/she will be allowed to re register for detained courses in even semester of same year along with regular courses of even semester. (Limited to 2 detained courses).

- However, if a student is detained in odd or even semester of current year, he/she will be allowed to reregister for these detained courses (maximum 2 courses) in summer vacation. A special semester called vacation semester will be run for such students. Dept. will make necessary arrangements in the departments.

- Such students has to pay additional fees for this, which is minimum Rs 1000 and Maximum Rs 10000, per course depending on number of students and remuneration of the faculty.

- Vacation semester will be of 4 weeks duration and will start after end term examination of even term, and students will appear for examination of vacation semester courses in reexamination of even term exam.

- Maximum 2 courses can be registered

- Remuneration per course to staff will be paid as per following rates.
  Visiting Lecturer Rs 500/- per hour for theory and Rs 500/- per practical (Maximum Rs 15000/-) Lab assistant: Rs 3000/- and Peon: Rs 2000/-

- Whenever students do registration of detained courses, he/she needs to pay additional fees for that.

- Such student has to pay additional fees, which is minimum Rs 1000 and Maximum Rs 10000, per course depending on number of students and remuneration of the faculty.

- Remuneration to staff will be paid as per given above

- Registration for such semester depends on willingness of students.

If a student is failed in any course of first year, he/she will not be allowed for third year admission.

Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum
[Out Come Based (OBE)]

Semester-I
(Course Contents)

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

gpmumbai@gpmumbai.ac.in

Programme: Electrical Engineering   **First Semester**   **With effect from June 2016**

Sr. No.	Course Code	Course Title	Award of Class	Compulsory /Optional	Teaching Hours				Credits	Examination Scheme					
					L	P	TU	Total (Hrs)		Theory		PR	OR	TW	Total
										TH	TS				
1	HU16 101	Basics of Communication	--	C	2	---	1	3	3	70	30	--	--	--	100
2	SC16 104	Engineering Physics	--	C	3	2	---	5	5	70	30	--	--	50	150
3	SC16 107	Mathematics I	--	C	3	----	1	4	4	70	30	--	--	--	100
4	AM16 201	Engineering Mechanics	--	C	3	2	---	5	5	70	30	0	25*	25*	150
5	CO16 202	C-Programming	--	C	2	2	----	4	4	0	0	50#	0	--	50
6	HU16 103	Generic Skills	--	C	--	----	2	2	2	--	--	--	50	--	50
7	WS16 201	Workshop Practice	--	C	--	4	0	4	4	0	0	0	--	50	50
8	CO16 203	Computer Work Shop	--	C	--	2	--	2	2	0	0	50	--	--	50
	NC16 101	Yoga	--	C	--	2	--	2	--	--	--	--	--	--	--
	NC16 102	Social Work	--	C	--	3	--	3	--	--	--	--	--	--	--
			TOTAL		13	17	4	**34**	**29**	280	120	100	75	125	**700**

Abbreviations: L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.

   * Indicates assessment by External Examiner, # indicates On-Line Exam

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          (Electrical Engineering)   **Government Polytechnic Mumbai**

Programme : CE/ME/EE/IS/EC/CO/IF/LG/LT									
Course Code: **HU16101**				Course Title: **Basics of Communication**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
2	**1**	**-**	**3**	**70 (3 Hrs.)**	**30**	**---**	**---**	**---**	**100**

Rationale:

English is the global language today. The basic knowledge of this language is essential for everyone. It is necessary for the Engineering and Technology related students to cope up with the challenges of the modern world with the help of English. The major part of their work experience needs certain knowledge of this language. At worksite, on the shop floor or fields, they might be required to take the instructions from superiors and to pass them on to subordinates. To write letters, circulars, memos, notice and reports will be an important task for them. While designing the curriculum of communication skills and communication practice the probable needs of the future technicians are kept in view.

Course Outcomes:

Student should be able to

CO1	Make use of the basic concepts of grammar and communication techniques.
CO2	Interpret positive feedback at various situations by using appropriate body language.
CO3	Write letters circulars, memos, notices and reports to communicate.
CO4	Apply proper communication technique to cope up with the challenges of the modern world.
CO5	Adopt appropriate approach to take instructions from seniors and pass it on to the subordinates.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Basics of Grammar:** Articles, Tense, Transformation of Sentences**,** Affirmative and negative**,** Interrogative and assertive , Exclamatory and assertive **,** Degrees of comparison**,** Direct indirect speech**,** Voice**,** Types of sentences
2	**Theory and methods of communication:** Meaning and definitions of communication, Elements of communication, Communication cycle**,** Methods of communication, verbal: Oral, Written, Non verbal: Body language ii) Visuals
3	**Types and Barriers of communication:** Formal - upward, downward, vertical, horizontal, diagonal. Informal, grapevine, Barriers of communication: Mechanical, Physical, Language, Semantic, Psychological, Status
4	**Application Letters:** Job application, Resume / CV / Bio-Data, Application for loan, (home loan, car loan, education loan)
5	**Business correspondence & Office drafting:** Memorandum, notice, circular, Enquiry and quotation, Order and complaint
6	**Report writing :** Need of report writing, Principles of effective report writing, Types of reports: Individual & committee report, Accident report Feasibility and survey report, Report on fall in sales and production

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Basics of Grammar:	06	4	4	4	12
2	Theory and methods of communication	06	2	4	6	12
3	Types and Barriers of communication	04	2	4	6	12
4	Application Letters	06	4	4	6	14
5	Business correspondence & Office drafting	04	2	4	6	12
6	Report writing	06	2	2	4	08
	Total	**32**	**16**	**22**	**32**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	1	Grammar related written worksheet.	02
2	2	Dialogue between two students (observing the basics of grammar.) on a formal situation	02
3	2	Dialogue between two students (observing the basics of grammar.) on a informal situation	02
4	2.3	Presentation of communication cycle (4 students)	02
5	3	Presentation on different types of barriers and remedies. (04 students)	02
6	3	Presentation on the given situation with the help of body language and visuals (4 students)	02
7	4	Writing a letter to the editor of a newspaper for social cause.	01
8	4	Writing a job application with bio data.	01
9	5	Activity on business correspondence and office drafting	01
10	6	Report writing	01
		Total	**16**

References/Books

Sr.No.	Author	Title	Publication
1	Meenakshi Raman Sangita Sharma	Communication Skills	Oxford Higher Education
2	Homai Pradhan D.S.Bhende Vijaya Thakur	Business Communication	Himalaya Publishing House
3	Curriculum Development Centre	A Course in Technical English	Somaiya Publications Pvt.Ltd.

Course Curriculum Development Committee:
   a. **Internal Faculty**
      1) Smt. S.S. Kulkarni
      2) Mrs. K.S. Pawar

   b. **External Faculty :-** 1) Mr. Sandeep Barde

Academic Coordinator   **Head of Department**   **Principal**
                                         (Science)   **Government Polytechnic**
                                                                            Mumbai

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
1	01	01	01	01	03	03	03	03	03	03
2	01	02	02	02	03	03	03	03	03	03
3	01	01	01	01	02	01	02	03	03	03
4	03	03	03	03	03	03	03	03	03	03
5	03	03	03	03	03	03	03	03	03	03

CO Vs PSO Matrix

Electrical Engg.

CO/PSOs		PSO1	PSO2	PSO3
CO1	Make use of the basic concepts of grammar and communication techniques.	01	01	02
CO2	Interpret positive feedback at various situations by using appropriate body language.	02	02	03
CO3	Write letters circulars, memos, notices and reports to communicate.	01	02	03
CO4	Apply proper communication technique to cope up with the challenges of the modern world.	03	03	03
CO5	Adopt appropriate approach to take instructions from seniors and pass it on to the subordinates.	03	03	03

Unit number and COs

Sr. No.	Unit No	Topic Title	COs
1	1	Basics of Grammar:	CO1, CO4
2	2	Theory and methods of communication	CO1, CO2, CO4, CO5
3	3	Types and Barriers of communication	CO2, CO4, CO5
4	4	Application Letters	CO3, CO4, CO5
5	5	Business correspondence & Office drafting	CO3, CO4, CO5
6	6	Report writing	CO3, CO4, CO5

Programme : **Diploma in CE/EE/EC/ME/CO/IF/IS/LG/LT/RT Engineering**									
Course Code: **SC16104**				Course Title: **Engineering Physics**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	**-**	**2**	**5**	**70 (3 Hrs.)**	**30**	**-**		**50**	**150**

Rationale:

The subject is included under the category of science. The special feature of the subject is to develop the laboratory skill using principles of scientific phenomenon. This course will serve to satisfy the need of the technical student for his development in technical field. Deep thought is given while selecting the topics related to all programmes which will develop intellectual skills of the students. Ultimately the focus of the course is on psychomotor skill.

Course Outcomes:

After the completion of course, students will be able to

CO1	Know the physical quantities accurately, to measure using different instruments and to interpret the results from observations and calculations.
CO2	Know the physical properties of the various materials that are used by the engineer and to understand the principle and laws of physics.
CO3	Know the basic facts in Physics viz, force, elasticity, viscosity, surface tension, waves and light and to apply the knowledge to correlate the properties of materials, their engineering uses and applications.
CO4	Classify and develop laboratory skills including the use of variety of physics apparatus, the compilation of data, its interpretation and analysis.
CO5	Achieve refined presentation skills through the presentation of coherent and comprehensible written accounts of laboratory work.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Physical Measurements and Units** 1.1 Fundamental Physical quantities, examples. 1.2 Derived physical quantities, examples. 1.3 Definition and requirements of unit 1.4 System of units, C. G. S., M. K. S. and S. I. units. 1.5 Rules to write the unit and conventions of units and numerical. 1.6 Error – Definition, types of errors and minimization of errors.

2	**Motions:**
	
	2.1 Linear motion –Definition, equation of motions: $v = u + at$,
	    $s = ut + \frac{1}{2}at^2$, $v^2 = u^2 + 2as$ and numerical.
	
	2.2 Periodic motions- a) Oscillatory motion, b) Vibratory motion, c) Spin motion,
	   d) S.H.M. (only definition and examples), e) Circular motion.
	
	2.3 Circular motion :
	  a) Introduction of the terms: Time period, frequency, amplitude, wavelength, phase. Uniform circular motion, Radius vector, linear velocity, Angular velocity , Angular acceleration,
	   b) Relation between linear velocity and angular Velocity, Radial or centripetal acceleration (derivation), Three equations of motion (no derivations) Centripetal and Centrifugal force, examples and applications.
	  c) Banking of Roads, its necessity and applications. Numericals based on the topic

3	**General Properties of Matter:**
	
	3.1 Elasticity:
	  3.1.1 Elastic, plastic and rigid substances, their examples.
	  3.1.2 Types of deformations.
	  3.1.3 Definition of elasticity, stress, strain and its types.
	  3.1.4 Hooke's Law and elastic limit.
	  3.1.5 Stress versus Strain curve when the wire is under continuously increasing stress, yield point, breaking point.
	  3.1.6 Young's Modulus, bulk modulus and modulus of rigidity – Definition, explanation and numerical.

	3.1.7 Factor of safety.
	3.1.8 Applications of elasticity.
	3.2 Viscosity :
	3.2.1 Concept and Definition of viscosity, velocity gradient.
	3.2.2 Newton's law of viscosity, Co-efficient of viscosity, unit of viscosity
	3.2.3 Stokes' law, terminal velocity, derivation of Stokes' formula.
	3.2.4 Streamline flow, turbulent flow, critical velocity, examples.
	3.2.5 Reynolds' number and its significance.
	3.2.6 Applications of viscosity and numerical.
	3.3 Surface Tension :
	3.3.1 Concept of surface tension.
	3.3.2 Adhesive and cohesive forces, examples.
	3.3.3 Laplace's Molecular theory of surface tension
	3.3.4 Angle of contact, its significance.
	3.3.5 Expression for surface tension by capillary rise method.
	3.3.6 Effect of impurity and temperature.
	3.3.7 Applications of surface tension.
	3.3.8 Numericals.
4	**Sound and Acoustic :**
	4.1 Sound Waves :
	4.1.1 Wave motion, types of waves – progressive, longitudinal and transverse waves.
	4.1.2 Characteristics of longitudinal and transverse waves andcomparison.
	4.1.2 Free or natural vibrations and forced vibrations, resonance – definition and examples.
	4.1.3 Newton's formula for velocity of sound and Laplace's correction.
	4.1.4 Effect of temperature , pressure & humidity on velocity ofsound and numerical.
	4.1.5 Determination of velocity of sound by resonance method**.**
	4.2 Acoustics :
	4.2.1 Definition of echo, reverberation , reverberation time and acoustic
	4.2.2 Sabine's formula for reverberation time no (derivation)
	4.2.3 Factors affecting acoustics of sound.
	4.2.4 Acoustical planning of building.
	4.2.5 Numericals.

5	**Optics and Optical Fibers :**
	
	5.1 Optics :
	
	    5.1.1 Revision of reflection and refraction of light.
	
	    5.1.2 Laws of refraction, Snell's law.
	
	    5.1.3 Determination of refractive index.
	
	    5.1.4 Dispersion, dispersive power, Prism formula (no derivation)
	
	    5.1.5 Critical angle, Total internal reflection. Examples and applications.
	
	    5.1.6 Numericals.
	
	5.2 Optical Fibers :
	
	    5.2.1 Principle of propagation of light through optical fiber.
	
	    5.2.2 Structure of optical fiber.
	
	    5.2.3 Concept of numerical aperture and acceptance angle (formula).
	
	    5.2.4 Types of optical fiber.
	
	    5.2.5 Method of production of optical fiber.
	
	    5.2.6 Applications (electronics and medical) and comparison with electrical cable for communication.

6	**Nanotechnology, Laser and Ultrasonic:**
	
	6.1 Nanotechnology :
	
	    6.1.1 Introduction to nanotechnology.
	
	    6.1.2 Definition of nanoscale, nanometer and nanoparticles, nanotechnology.
	
	    6.1.3 Definition and examples of nanostructured materials.
	
	    6.1.4 Methods of production of nanomaterial-
	
	        a. Top down approach.
	
	        b. Bottom up approach.
	
	    6.1.5 Techniques for the measurement of nanoparticles.
	
	    6.1.6 Applications of nanotechnology in different fields -
	
	        a. electronics, b. automobile, c. medical, d. textile,e. cosmetics,
	
	        e. environmental, f. space and defense.
	
	6.2 LASER and Ultrasonic :
	
	a) LASER
	
	    6.2.1a) LASER introduction,
	
	    6.2.1b) Properties of laser,
	
	    6.2.1c) Spontaneous and stimulated emission,
	
	    6.2.1d) Population inversion, Optical pumping,
	
	    6.2.1e) Types of LASER,He-Ne Laser- construction and method of production.
	
	    6.2.1f) Applications of LASER.

	b) Ultrasonic:
	6.2.2a) Ultrasonic waves and infrasonic waves.
	6.2.2b) Audible range of soundwave,
	6.2.2c) Piezoelectric effect and magnetostriction effect.
	6.2.2d) Methods for the production of ultrasonic wave (any one),
	6.2.2e) Properties of ultrasonic wave.
	6.2.2f) Applications for distance measurement, hidden flaws detection, signaling, drilling holes, metal cutting.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Physical Measurements and Units	6	2	2	4	8
2	Motion	8	2	4	2	12
3	General properties of matter	10	3	3	2	15
4	Optics and Fiber optics	8	3	3	2	12
5	Sound and Acoustics	6	3	3	2	8
6	Nano Technology, Laser and Ultrasonic.	10	3	3	2	15

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes:This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments**/Assignments:**
(Minimum TEN experiments should be completed by each student)

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	1	To measure the dimensions of given objects and to determine their volume using Vernier caliper.	2
2	1	To measure the dimensions of given objects and to determine their volume using micrometer screw gauge.	2
3	2	To determine Acceleration due to gravity by simple pendulum	2
4	3	To determine coefficient of viscosity of liquid by Stokes' method.	2
5	3	To determine coefficient of viscosity of liquid by Poiseullie's method.	2
6	3	To determine the surface tension of liquid using capillary rise method.	2
7	3	To determine the Young's modulus of elasticity of wire using Young's apparatus.	2
8	4	To determinerefractive index by pin method.	2

9	4	To determine refractive index by total internal reflection.	2
10	4	To determine refractive index using spectrometer	2
11	5	To determine velocity of sound by resonance method.	2
12	5	To determine sound absorption coefficient of different materials.	2
13	6	Flaws detection using ultrasonic waves.	2
14	6	Experiments on LASER	2
15	6	To plot the characteristics of photo cell.	2
16	All	Showing Video on different applications related to umits,	2
		Total	**32**

Notes: *If possible videos should be shown on different topics- especially on topics – LASER, Ultrasonic, TIR, Refractive index and on spectra.*

References/ Books:

Sr.No.	Name of Book	Author	Publisher
1	Applied Physics	Manikpure&Deshpande	S.Chand& Company
2	Applied Physics	B.G.Bhandarkar	Vrinda Publication
3	Optics & Optical Fibers	BrijlalSubhramanyan	
4	Engineering Physics	Gaur and S.L.Gupta	S.Chand& Company
5	Resnick and Halliday	Physics	Tata McGraw Hills
6	H.C.Varma	Physics part I & II	
7	D.S.Mathur	Properties of Matter	
8	Dr. A. U. Warad	Basic Physics	

Course Curriculum Development Committee:

    i. **Internal Faculty:-** Dr. A. U. Warad.

    ii. **External Faculty :**- Mrs. S. A. Thorat

Academic Coordinator   **Head of Department**   **Principal**
                             (Science)   **Govt. Polytechnic, Mumbai**

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	1	1	-	-	-	-	-	-
CO2	1	2	2	1	-	-	-	-	-	-
CO3	3	2	2	3	-	-	-	-	-	-
CO4	2	2	3	1	-	-	-	-	-	-
CO5	1	1	1	-	-	1	-	-	-	-

CO Vs PSO matrix

Electrical Engg:

	CO/PSOs	PSO1	PSO2	PSO3
CO1	Know the physical quantities accurately, to measure using different instruments and to interpret the results from observations and calculations.	--	1	--
CO2	Know the physical properties in the various materials that are used by the engineer and to understand the principle and laws of physics.	--	--	--
CO3	Know basic facts in Physics viz, force, elasticity, viscosity, surface tension, waves and light and to apply knowledge to correlate the properties of materials, their engineering uses and applications.	--	--	1
CO4	Classify and develop laboratory skills including the use of variety of physics apparatus, the compilation of data, its interpretation and analysis.	--	1	1
CO5	Achieve refined presentation skills through the presentation of coherent and comprehensible written accounts of laboratory work.	--	1	-

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Physical Measurements and Units	CO1,CO4,CO5
2	2	Motion	CO1,CO3,CO4
3	3	General properties of matter	CO1,CO2,CO3,CO4
4	4	Optics and Fibre optics	CO2,CO3,CO4
5	5	Sound and Acoustics	CO2,CO3,CO4
6	6	Nano Technology, Laser and Ultrasonic.	CO2,CO3,CO4

Programme : **CE/ME/EE/IS/EC/CO/IF/LG/LT**									
Course Code:**SC16107**				Course Title:**Mathematics-1**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	**1**	**-**	**4**	**70 (3 Hrs.)**	**30**	**-**	**-**	**-**	**100**

Rationale:

This subject is kept under the branch of science. This subject intends to teach student basic facts, concepts, principle and procedure of mathematic as a tool to analyze Engineering problems and as such lays down foundation for understanding the engineering and core technology subjects.

Course Outcomes:

Student will be able to:

CO1	Identify the basic principles of of mathematics about the field analysis of any engineering problem.
CO2	Apply rules, concept and properties to solve the basic problems.
CO3	Establish the relation between two variables.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Logarithms:** 1.1 Definition of logarithm(Natural and Common logarithm) 1.2 Laws of logarithm 1.3 Change of base rule& simple examples based on laws. 1.4 Application of concept.
2	**Determinants:** 2.1 Definition of determinant 2.2 Expansion of determent of order 2&3 2.3 Crammer's rule to solve simultaneous equations in 3 unknowns 2.4 Application of concept.
3	**Matrices:** 3.1 Definition of a matrix of order m x n 3.2 Types of matrices 3.3 Algebra of matrices - equality, addition, subtraction, multiplication & scalar multiplication. 3.4 Transpose of matrix. 3.5 Minor , co-factor of an element.

	3.6 Adjoint & inverse of a matrix by adjoint method. 3.7 Solution of a simultaneous equations by matrix inversion method. 3.8 Application of concept.

4	**Trigonometry:**
	    4.1 Trigonometric ratios of allied angles, compound angles, multiple
	        angles (2A, 3A), Sub multiple angles
	    4.2 Factorization and De-factorization Formulae
	    4.3 Inverse Circular function (definition and simple problems).

5	**Straight line:**
	    5.1 Slope & intercept of straight line.
	    5.2 Equation of straight line in slope point form, slope
	        intercept form, two point form, two intercept form,
	        General equation of straight line.
	    5.3 Angle between 2 straight lines; condition of parallel &
	        Perpendicular lines.
	    5.4 Intersection of two lines.
	    5.5 Length of perpendicular from a point on the line &
	        Perpendicular distance between parallel lines.

6	**Vectors:**
	    6.1 Definition of vector , position vector
	    6.2 Algebra of vectors(Equality, addition ,subtraction and scalar
	 multiplication)
	    6.3 Dot (Scalar) product & Vector (Cross) product with properties.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Logarithms	03	02	04	00	06
2	Determinants	03	00	04	00	04
3	Matrices	14	06	08	06	20
4	Trigonometry	14	06	08	06	20
5	Straight line	10	04	04	06	14
6	Vectors	04	00	02	04	06
	Total	**48**	**18**	**30**	**22**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes:*This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

List of Tutorials:
Note:1)Tutorials are to be used to get enough practice.
2)Make group of 20 student and for each group minimum 10 problems are to be given.

Sr. No.	Unit	Tutorials	Approx. Hours
1	1	Logarithms	02
2	2	Determinants	02
3	3	Matrices(Algebra of matrices)	02
4	3	Matrices(Adjoint , inverse& solution of equation using matrix inversion method	02
5	4	Trigonometric ratio of allied, compound, multiple and sub multiple angles.	02
6	4	Factorization and De-factorization formulae	02
7	4	Inverse trigonometric ratios	01
8	5	Straight line	02
9	6	Vectors	01
		Total	**16**

References/ Books:

Sr.No.	Name of Book	Author	Publisher
1	Mathematics for polytechnic students	S.P. Deshpande	Pune Vidyarthi Graha Prakashan
2	Mathematics for polytechnic students (Volume I)	H. K. Das	S .Chand Prakashan
3	Companions to basic math's	G. V. Kumbhojkar	Phadke Prakashan
4	Applied Math's	N. Raghvendra Bhatt Late Shri R Mohan Singh	Tata McGraw Hill Publication

Course Curriculum Development Committee:
   a. **Internal Faculty**
         i. Miss.J.J.Ratnanai.
         ii. Mr.V.S.Patil
   b. **External Faculty**
         i. Prof.P.S.Dave

Academic Coordinator   **Head of Department**   **Principal**
                                          (Science)   **Govt. polytechnic, Mumbai**

Course Name:- Mathematics I　　　　　　　　**Course Code:-SC16107**

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	--	--	02	02	01	01	01	--	--	--
CO2	03	02	03	02	01	--	02	--	--	--
CO3	03	02	01	01	02	02	02	--	--	--

CO Vs PSO matrix

Electrical Engg.

CO/PSOs		PSO1	PSO2	PSO3
CO1	Identify the basic principles of of mathematics about the field analysis of any engineering problem.	01	02	--
CO2	Apply rules, concept and properties to solve the basic problems.	01	02	02
CO3	Establish the relation between two variables.	02	01	--

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Logarithms	CO1,CO2
2	2	Determinants	CO2,CO3
3	3	Matrices	CO1,CO2,CO3
4	4	Trigonometry	CO1,CO2,CO3
5	5	Straight line	CO2,CO3
6	6	Vectors	CO1,CO2

Programme : **Diploma in Civil/Mechanical/Electrical Engineering**								
Course Code: **AM16201**				Course Title: **Engineering Mechanics**				
Compulsory / Optional: **Compulsory**								
Teaching Scheme and Credits				Examination Scheme				
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	-	2	5	70 (3 Hrs.)	30	-	25*	25*	150

* TW & OR shall be based on the practicals done during the semester

Rationale:

In day to day life we come across different structures and at times design of the structures analysis plays an important role. Perfect analysis is possible only when one knows the types and effect of forces acting on the structure. This subject provides knowledge about the different types of forces/loads and their effects while acting in different conditions/systems. It is a branch of Applied Science where laws of physics are applied to solve engineering problems. Broadly speaking Engineering Mechanics can be classified in two categories-Static and Dynamics. In this course, an attempt has been made to apply different laws of science to solve Statics and Dynamics problems. An attempt is also made to strengthen the knowledge of students, so as to make the path for applied technological subjects smoother and logical.

Course Outcomes:

Student should be able to

AM16 201.1	Identify the different forces & its effects on objects, motion of bodies, and friction with applications.
AM16 201.2	Apply the principles of equilibrium to Engineering problems
AM16 201.3	Compare & analyze the simple machines
AM16 201.4	Interpret the concept of centroid and centre of gravity
AM16 201.5	Analyze and solve the rectilinear & circular motion, work, energy and power problems

Course Content Details:

Unit No	Topics / Sub-topics
1	**Simple Machines:** 1.1 Definitions and formulae, if any, of simple machine, compound machine, load , effort, mechanical advantage, velocity ratio, input of a machine, output of a machine, efficiency of a machine, ideal machine, ideal effort and ideal load, load lost in friction, effort lost in friction

		1.2 Analysis: Law of machine, maximum mechanical advantage and maximum efficiency of a machine, reversibility of a machine, condition for reversibility of a machine, self locking machine.
		1.3 Identification, use and velocity ratio for following simple machines :
		Simple axle and wheel, differential axle and wheel, Weston's differential pulley block, single purchase crab, double purchase crab, worm and worm wheel, geared pulley block, screw jack, calculation of mechanical advantage, efficiency
2	**Force systems:**	
	2.1 Fundamentals and Force systems:	
	Definitions of mechanics, Engineering mechanics, statics, dynamics, Kinetics, Kinematics, rigid body, classification of force system according to plane coplanar and non coplanar, sub classification of coplanar force system- collinear, concurrent, non concurrent, parallel, like parallel, unlike parallel, general etc. Definition of a force, S.I. unit of a force, representation of a force by vector and by Bow's notation method. Characteristics of a force, effects of a force, principle of transmissibility.	
	2.2 Resolution of a force and Moment of a force:	
	Definition, Method of resolution, along mutually perpendicular direction and along two given direction. Definition of moment, S. I. unit, classification of moments, sign convention, law of moments Varignon's theorem of moment and it's use, definition of couple, S.I. unit, properties of couple with example.	
3	**Composition of Forces:**	
	3.1 Analytical method:	
	Definition of Resultant force, methods of composition of forces, Law of parallelogram of forces, Algebraic method for determination of resultant for concurrent and non concurrent, parallel coplanar force system.	
	3.2 Graphical method:	
	Space diagram, vector diagram, polar diagram, and funicular polygon. Resultant of concurrent and parallel force system only.	
4	**Equilibrium**:	
	4.1 Equilibrant and Lami's Theorem:	
	Definition of equilibrant, relation between resultant and equilibrant, equilibrant of concurrent and non-concurrent force system. Analytical and graphical conditions	

	of equilibrium for concurrent, non-concurrent and parallel force system, free body and free body diagram. Statement and explanation of Lami's theorem, Application of Lami's theorem for solving various engineering problems.
5	**Friction:** 5.1 Definition: Friction, limiting frictional force, coefficient of friction, angle of friction, angle of repose, relation between angle of friction, angle of repose and coefficient of friction. Cone of friction, types of friction, laws of friction, advantages and disadvantages. 5.2 Equilibrium of body on Horizontal and inclined plane: Equilibrium of body on horizontal plane subjected to horizontal and inclined force. Equilibrium of body on inclined plane subjected to forces applied parallel to the plane only. Concept of ladder fraction.
6	**Centroid and Centre Of Gravity:** 6.1 Centroid: Definition of centroid. Moment of an area about an axis. Centroid of basic geometrical figures such as square, rectangle, triangle, circle, semicircle and quarter circle. Centroid of composite figure with not more than three geometrical figures. 6.2 Center of gravity: Definition, center of gravity of simple solids such as cylinder, sphere, hemisphere, cone, cube, and rectangular block. Centre of gravity of composite solids with not more than Two simple solids. (Hollow solids are not expected.)
7	**Dynamics** 7.1 Rectilinear motion: Velocity, average velocity, uniform velocity, speed, displacement, acceleration, retardation, motion under uniform acceleration & V-T diagram 7.2 Curvilinear motion: Simple circular motion, Angular displacement, Angular velocity, Angular acceleration and retardation 7.3 Work, power & energy: Workdone, force-displacement diagram Workdone in stretching the compound spring, Torque, workdone by torque.

	I.H.P., B.H.P. of engine - Equation of H.P. in terms of torque and R.P.M. - Engineering Problems on it. Kinetic and potential energy & Engineering problems on it

Simple numerical problems on all topics

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Simple Machines	06	02	04	04	10
2	Force Systems	06	02	02	04	08
3	Composition of forces	06	02	02	04	08
4	Equilibrium	06	02	02	04	08
5	Friction	06	02	04	04	10
6	Centroid and Centre Of Gravity	06	04	04	00	08
7	Dynamics	12	04	06	08	18
	Total	**48**	**18**	**24**	**28**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Practicals:

Sr. No.	Unit	Experiment	Approx. Hours
1	1	To find MA, VR, Efficiency, Ideal Effort, Effort lost in friction for various loads and establish law of machine. Calculate maximum efficiency and also check the reversibility of machines for the following: a. Differential axle and wheel b. Single purchase crab or Double purchase crab c. Weston's differential pulley block or worm geared pulley block d. Simple Screw jack	10
2	2	Verify law of moments.	02

3	4	Verify law of polygon of forces	02
4	4	Verify of Lami's theorem	02
5	4	Verify the Equilibrium of parallel forces – simply supported beam reactions	04

6	3	Graphical solutions for the following on A4 Size Graph Paper
		
		  a. Concurrent force system : Two problems
		  b. Parallel force system : Two problems
		
		Engineering/Numerical problems on work, power and energy
			12

		Total	**32**

Notes: *If possible an industrial visit should be arranged or videos should be shown of different applications of this course.*

References/ Books:

Sr. No.	Author	Title	Publisher
01	R.S.Khurmi	Engineering Mechanics	S. Chand & Company Ltd.
02	Shames and Rao	Engineering Mechanics	Pearson Education.
03	R.C.Hibbeler	Engineering Mechanics	Pearson Education.
04	S. Ramamruthum	Applied Mechanics	Dhanpat Rai & Sones, Delhi.

Course Curriculum Development Committee:

  a. **Internal Faculty**

      i. Dr. D. K. Gupta.

      ii. Mrs. S. S. Chavan

      iii. Mrs. Meera Ansarwadekar.

  b. **External Faculty**

      i. Mr. Sandip Ransur (Lecturer, SBM Ploytechnic, Ville Parle)

Academic Coordinator   **Head of Department**   **Principal**

                              (Civil Engineering)   **Govt. Polytechnic Mumbai**

CO Vs PO matrix

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
AM16 201.1	3	3	3	3	1	1	1	1	1	3
AM16 201.2	3	3	3	2	1	1	1	1	1	2
AM16 201.3	3	3	3	3	1	2	1	1	1	3
AM16 201.4	2	2	1	1	1	1	1	1	1	1
AM16 201.5	2	1	1	1	1	1	1	1	1	1

CO Vs PSO matrix

CO/PSOs		PSO1	PSO2	PSO3
AM16 201.1	Identify the different forces & its effects on objects, motion of bodies, and friction with applications.	3	3	1
AM16 201.2	Apply the principles of equilibrium to Engineering problems	3	2	1
AM16 201.3	Compare & analyze the simple machines	3	3	1
AM16 201.4	Interpret the concept of centroid and centre of gravity	3	2	1
AM16 201.5	Analyze and solve the rectilinear & circular motion, work, energy and power problems	3	2	1

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Simple Machines	AM16 201.1, AM16 201.2, AM16 201.1
2	2	Force Systems	AM16 201.1, AM16 201.2
3	3	Composition of forces	AM16 201.1, AM16 201.2
4	4	Equilibrium	AM16 201.1, AM16 201.2
5	5	Friction	AM16 201.1, AM16 201.2
6	6	Centroid and Centre Of Gravity	AM16 201.1, AM16 201.2, AM16 201.4
7	7	Dynamics	AM16 201.1, AM16 201.5

Programme : **Diploma in Electrical Engineering**									
Course Code: **CO16101**				Course Title: C Programming					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
2	-	2	4			50*		25	75

*External Examiner

Rationale:

'C' is the most widely used computer language, which is being taught as a core subject. C is general-purpose structural language that is powerful, efficient and compact, which combines features of high-level language and low-level language. It is closer to Man and Machine both. Due to this inherent flexibility and tolerance it is suitable for different development environments. Due to these powerful features C has not lost its importance and popularity in recently developed and advanced software industry, C can also be used for system level programming so to develop Operating System like application. C is still considered as first priority programming language.

This subject covers from the basic concept of C to the pointers and files in C. This subject will act as "Programming Concept developer" for students.

Course Outcomes:
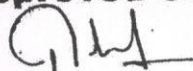
Student should be able to

CO1	Understand the basic terminology used in computer programming
CO2	Write, compile and debug programs in C language.
CO3	Use different data types in a computer program.
CO4	Design programs involving decision structures, loops and functions.
CO5	Implement concept of array,string,structure
CO6	Understand Pointer and file handling

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to C-Programming** Introduction, History of C,Features of C,Structured Programming concept, Data type & expression, Character Set in C,Variable & data types, Primary & Secondary data type, Arithmetic, Relational & Logical Operators, Constant & keywords Operators & expressions, Hierarchy of operators, Data type conversion
2	**Basic Input output** C program structure, Input and output using printf()and scanf(),character I/O

3	**Control Structure** Decision making & branching, If Statement, If else statement, Nesting of if- else, The switch statement, Ternary operator, Go to statement, While loop, Do while loop, For loop, Use of break and continue statements	
4	**Arrays and String** One dimension, two dimension and multidimensional arrays, Array declaration Array initialization, Operation on array, String input/output, Array of strings	
5	**Structures** Basic Concept, Structure declaration, initialization, Structure within structure Array of Structure, Union	
6	**Functions** Concept of library functions, String functions (comparison, concatenation, length) User-defined functions, Local & global variables, Parameter passing, Storage classes	
7	**Pointers** Basic concept, Pointer & arrays, Pointer & functions, Pointer arithmetic	
8	**File Management** Basic concept ,Types of files: Text and Binary files, Operations on file, File functions	

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours
1	**Introduction to C-Programming**	03
2	**Basic Input output**	02
3	**Control Structure**	06
4	**Arrays and String**	05
5	**Structures**	05
6	**Functions**	05
7	Pointers	04
8	**File Management**	04
	Total	32

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List of experiments/Assignments:

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1		Program based on Input/output statement	02
2		Program based on arithmetic expression	01
3		Program based on if statement	01
4		Program based on if else statement	02
5		Program based on switch statement	02
6		Program based on While loop	01
7		Program base on Do. While loop	01
8		Program based on For loop	02
9		Program based on one dimensional arrays	01
10		Program based on two dimensional arrays	02
11		Program based on string operations	02
12		Program based on arrays of structure	03
13		Program based on function	04
14		Program based on pointer	04
15		Program based on File handling	04
		Total	**32**

References/ Books:
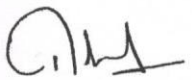
Sr. No.	Name of Book	Author	Publisher
1	Programming in 'C'	Balaguruswami	Mc Graw Hill
2	Programming in 'C'	Gottfried	Shaum's Series
3	Let us C	Y. Kanetkar	BPB Publication
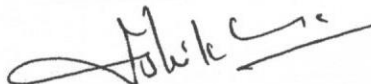
Course Curriculum Development Committee:
a. **Internal Faculty:**
   i) Bhalerao Moreshvar H.(Lecturer in Computer Engineering)

b. **External Faculty**
   ii) Bangal Satish V.(HOD SV Polytechnic,Borivali)

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(R. A. Patil)   (Electrical Engineering)   Govt. Polytechnic Mumbai

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Programme : ME/CE/EC/CO/IF/IS/EE/RT/LT/LGFT									
Course Code:**HU16103**				Course Title: **Generic Skills**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
-	2	-	2	-	-	-	50		50

Rationale:
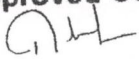
The inclusion of this course is need of the day. The technicians along with technology must learn the generic skills to be successful technician. The subject is included under the category of humanities. The role of subject is to make the student aware of its importance in the society to inform him/her about technical education system, the institute (library, various dept, curriculums etc.) to help him/her with essential etiquettes & manners.

Course Outcomes: Student should be able to,
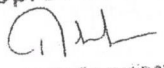
CO1	Identify his/her role in various areas of life.
CO2	Know the various areas in technical education system.
CO3	Know importance of curriculum, MIS, IS, etc
CO4	Exhibit his/her behavior in proper manner
CO5	Develop & adopt self study techniques.
CO6	Follow rules & regulation strictly & become a law abiding citizen.

Course Content Details:

Unit No	Contents
1	**Social Aspects:** 1.1 Role of an individual in the family, in the institute, in the society. 1.2 Social responsibilities & rights of an individual. 1.3 Role of a diploma holder in the present day scenario.
2	**Technical education in Maharashtra:** 2.1 Definition of technical education its types, structure (ITI, Diploma & Degree) 2.2 Governance in Technical Education (MSBTE, Autonomous & private – structure, fees, faculty, exam, evaluation etc.)

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3	**Awareness of curriculum:** 3.1 Definition of curriculum . Steps observed in its design. 3.2 Objectives, rationale, core subjects, other subjects and credit system.
4	**MIS (Management Information System) :** 4.1 Definition, its working, applications & relevance in the present day scenario. 4.2 MIS applied to exam section, student registration, subject registration, exam registration. 4.3 Department related applications: Work related to office, library & others.
5	**Library :** 5.1 Introduction to library, its functioning, its role in an institute. 5.2 Facilities available in library, search facility for books on internet, concept of digital library. 5.3 Lectures by librarian on Library functioning 5.4 Knowing library ethics.
6	**Health Awareness and Social mannerism:** 6.1 Introduction to health and hygiene (WHO- definition) Definition, its importance. 6.2 Mannerisms– In the Institute: Overall discipline including pitch and tone of voice ,accent, body language, dressing sense. In the Laboratory : Handling of tools and equipments and its Maintenance. In the Classroom: Peer sensitivity and relationship, body posture and attentivity norms. 6.3 Seminar culture –Etiquettes to be observed while attending seminars, And presenting seminar. 6.4 Party and Ceremonial functions
7	**Self Study Techniques :** 7.1 Extraction / Collection of information from various sources. 7.2 Importance of soft skills . Listening, reading & writing skills 7.3 Safety precautions in laboratories and, workshop.
8	**Self Presentation** 8.1 Resume – 8.1.1 Resume writing tips 8.1.2 Types of resumes

Sr. No.	Unit	Assignment	Approx. Hours
1	1	Define role and responsibility of individual in the family	04
2	1	State in brief the role of diploma holder in industry.	02
3	2	Draw organization chart / hierarchy in Technical Education System of Maharashtra State Understand about Autonomous and State Governed Curriculum Scheme.	03
4	3	Enumerate in detail steps observed in designs of curriculum	03
5	3	To develop good learning habits, abilities and attitudes for enjoy learning.	04
6	4	To know MIS system and its effect on efficiency of the system.	03
7	5	Functioning of Library and Concept of digital library.	03
8	6	Significance of hygiene for maintaining health.	02
9	7	Development of Listening, Reading and Writing Skills.	04
10	7	Safety precautions in various laboratories and workshop.	02
11	8	Resume writing techniques.	02
		Total	32

References/ Books:

Sr.No.	Name of Book	Author	Publisher
1	Generic Skills	A.K.Gupta	S.K.Kataria
2	Generic skill Development Manual.		MSBTE, Mumbai
3	Lifelong learning in Global Knowledge Economy. Challenge for Developing countries.		World Bank Publication

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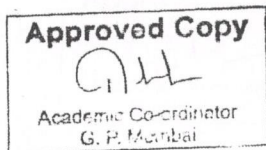
Government Polytechnic, Mumbai

Course Curriculum Development Committee:

    a. **Internal Faculty:** 1) Mr. S. V. Joshi - HOD Of Mechanical Engg.
                                2) Mr . R. A. Kulkarni - Workshop Superintendent
                                3) Mrs. M. P. Deshpande - Lecturer in Electronics Engg.

    b. **External Faculty:** 1) Mr . S.G.Deshpande
                                  2) Mr.U.M. Kantute

Academic Coordinator	**Head of Department**	**Principal**
(R A Patil)	**Mechanical Engineering**	**Govt. Polytechnic Mumbai**
	H.O.D.	
	Dept. of Mechanical Engineering	
	Govt. Polytechnic, Mumbai-51	

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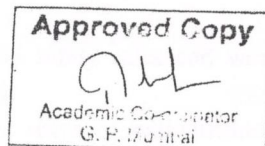
Programme : ME/CE/EC/EE/IS/LG/LT/RT									
Course Code: **WS16 201**				Course Title: **Workshop Practice**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
-	-	4	4	-	-	-	-	50	50

Rationale:

Workshop practice is the backbone of the real industrial environment which helps to develop and enhance relevant technical hand skills required by the technician working in the various engineering industries and workshops. The knowledge of basic shops like Wood working, Fitting, Welding, Plumbing and Sheet Metal Shop is essential for technicians to perform their duties in industries. Irrespective of engineering stream, the use of workshop practices in day to day industrial as well domestic life helps to solve various minor but critical problems. Working in workshop develops the attitude of working in a group and the basis for safety awareness is created. This foundation course intends to impart basic know-how of various hand tools and their use in different sections of manufacturing. The students are advised to undergo each skill experience with remembrance, understanding and application with special emphasis on attitude of enquiry to know why and how for the various instructions and practices imparted to them in each shop. Furthermore the demonstration of CNC Machine will give feel of advancement in industry.
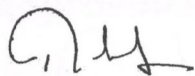
Course Outcomes: Student should be able to,

CO1	Lay-outing of shops & Sketching of jobs, tools & equipments.
CO2	Select appropriate tools, machinery, equipment and consumables for given application.
CO3	Use & Operate hand tools, equipment and machinery in different shops.
CO4	Prepare the simple jobs as per specification & drawing.
CO5	Maintain workshop related tools, equipment and machineries.

Course Content Details:

Unit No	Topics / Sub-topics
1	*1.1 Introduction to workshop :-* *1.2* Workshop layout, Importance of various sections/shops of workshop, Types of jobs done in each shop. *1.3* Causes of accidents, general safety rules and work procedure in workshop, Safety signs and symbols, First Aid. *1.4* Fire, Causes of Fire, Basic ways of extinguishing the fire. Classification of fire, Firefighting equipment, fire extinguishers and their types. *1.5* Issue and return system of tools, equipment and consumables.
2	*Smithy and Forging:-* *2.1* Sketching, understanding the specifications, materials, various applications and methods used in Smithy and Forging shop along with use of tools like anvil, hammers, swage block, tongs, chisels, flatters etc;

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	2.2 Demonstration of Smithy and Forging operations like bending, setting down, bulging, upsetting etc; 2.3 Preparation of smithy & forging job. 2.4 Safety precautions & Personal Protective Equipments.
3	**Carpentry Section:-** 3.1 Types of woods and their applications. 3.2 Types of carpentry hardware's and their uses. 3.3 Sketching, understanding the specifications, materials, various applications and methods used in Carpentry shop along with use of tools like saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule, etc; 3.4 Demonstration of carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, etc; 3.5 Preparation of wooden joints. 3.6 Safety precautions & Personal Protective Equipments.
4	**Welding Section:-** 4.1 Types, sketching, understanding the specifications, materials and applications of arc & gas welding accessories and consumables. 4.2 Demonstration of metal joining operations like arc welding, soldering and brazing. Show effect of current and speed. Also demonstrate various welding positions. 4.3 Demonstrate gas cutting operation. 4.4 Preparation of metal joints. 4.5 Safety precautions & Personal Protective Equipments.
5	**Fitting Section:-** 5.1 Sketching, understanding the specifications, materials, various applications and methods used in fitting, marking, measuring, work holding, cutting & finishing tools. 5.2 Demonstration of various fitting operations such as chipping, filing, scraping, grinding, sawing, marking, drilling, tapping, etc; 5.3 Preparation of male- female joint. 5.4 Safety precautions & Personal Protective Equipments.
6	**Plumbing:-** 6.1 Types, specification, material and applications of pipes. 6.2 Types, specifications, material, applications and demonstration of pipe fitting tools. 6.3 Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling, etc; 6.4 Types and application of various spanners such as flat, fix, ring, box, adjustable, etc. 6.5 Preparation of pipe fitting jobs. 6.6 Concept and conversions of SWG and other gauges in use. Use of wire gauge. 6.7 Safety precautions & Personal Protective Equipments.
7	**Lathe and CNC Operations:-** 7.1 Working principle of lathe along with sketch and procedure for its general maintenance. 7.2 Demonstration of Lathe machine operation like plain turning, taper turning, threading, chamfering, etc; 7.3 Simple job demonstration for a group on CNC Machine.

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Sr. No.	Unit	Practical Exercises/Practical's/Experiments	Approx. Hours
		SUGGESTED LIST OF EXERCISES/PRACTICAL/EXPERIMENTS	
1	1	- Causes of accidents, general safety rules and work procedure in workshop, Safety signs and symbols, First Aid. - Perform mock drill session in group of minimum 10 students for Extinguishing fire.	06
2	2	- Prepare job involving operations like bending, setting down, bulging, upsetting etc; e.g. Pegs (Square/round), Hook, Hammer tongue, Agro equipment etc (Individually)	12
3	3	- Prepare two wooden joints as per given drawings. (Individually)	12
4	4	- Prepare lap joint/butt joint using either arc / gas welding as per given drawing. (Individually)	12
5	5	-Prepare one male-female type fitting job as per given drawings (Individually)	16
6	6	- Demonstration of Lathe Machine & CNC machine operations.	06
		Total	64

SUGGESTED STUDENT ACTIVITIES: - List of proposed student activities like,
a. Follow safety practices.
b. Practice good housekeeping.
c. Function as a team member.
d. Maintain tools and equipment.
e. Follow ethics & maintain discipline.
f. Prepare work diary based on practical performed in workshop. Work diary consist of job drawing, operations to be performed, required raw materials, tools, equipments, date of performance with signature of the teacher.
g. Prepare journals consisting of free hand sketches of tools and equipments in each shop, detail specifications and precautions to be observed while using tools and equipments.
h. Prepare/Download specifications of followings: a) various tools and equipment in various shops. b) Precision equipment in workshop c) Various machineries in workshop.
i. Undertake a market survey of local dealers for procurement of workshop tools, equipment machineries and raw material.
j. Visit any fabrication/wood working/sheet metal/forging workshop and prepare a report.

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Workshop Technology-I.	Hazra and Chaudhary	Media promoters & Publisher private limited.
2	Workshop Technology-I.	W.A. J. Chapman	Taylor & Francis.

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3	Workshop Practice Manual For Engineering Diploma & ITI Students	Hegde, R.K.	Sapna Book House, 2012, ISBN:13: 9798128005830
4	Workshop familiarization.	E.Wilkinson	Pitman engineering craft series.
5	Mechanical workshop practice.	K.C. John	PHI.
6	Workshop practice manual.	K.Venkata Reddy	B.S.Publications.
7	A Course in Workshop Technology	Raghuwanshi, B.S.	Dhanpat Rai sons, New Delhi ; 2006, 2011, ISBN: 10-0000017108

List of Software/Learning Websites:

http://www.asnu.com.au b. c.
http://www.abmtools.com/downloads/Woodworking%20Carpentry%20Tools.pdf d.
http://www.weldingtechnology.org e. http://www.newagepublishers.com/samplechapter/001469.pdf
http://www.youtube.com/watch?v=TeBX6cKKHWY g.
http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related h.
http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu i. http://www.piehtoolco.com
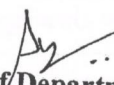http://sourcing.indiamart.com/engineering/articles/materials-used-hand-tools/

Course Curriculum Development Committee:
   a. **Internal Faculty**
      i. Mr. R. A. Kulkarni (Workshop Superident, G.P. Mumbai.)
      ii. Dr. V. P. Rathod (LME, G. P. Mumbai.)
      iii. Mr. S. P. Kadam. (LME, G. P. Mumbai.)
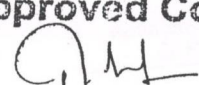   b. **External Faculty**
      i. Mr. G. S. Dharme (Workshop Superident, Fr. Agnel Polytechnic, Bandra (W), Mumbai.

Academic Coordinator

Head of Department
(Mechanical Engineering)

Principal
Govt. polytechnic Mumbai

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Programme Code: Computer Engineering

Course Code: C016203	Course Title: Computer Workshop

Compulsory / Optional: C

Teaching Scheme and Credits				Duration of Examination			Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	TH	TS	PR	OR	TW	Total
--	----	02	02	---	----	02	-----	-----	50		--	50

(*) indicates assessment by Internal and External examiners

Rationale

The aim of the subject is to teach the basic working of Electronic and computer components .The students will be able to select the proper peripheral as per their specification and requirement. The subject is practical oriented and its will help to student identify Electronic and Computer Components.

Course Outcomes:

CO1	Identify and test various electronic components.
CO2	Handle different electronic instruments
CO3	Identify computer peripherals.
CO4	Interface peripherals with computer system.

1

Unit No	Topic/ Sub-topics
01	**Introduction To Electronic Components and Instruments** 1.1 Computer workshop lab. Electronic Tools & instruments. safety precaution, soldering and de- soldering technique etc. 1.2 Use of analog and digital multi- meters for measurement Of voltage, current & resistance. 1.3 Identification of active and passive components with color codes and Verifying their values with multi-meters / LCR meters.
02	**Study of CROs** 2.1 To study Front Panel of CRO. 2.2 Testing of Component using CRO. 2.3 To observe Different waveform using Function Generator
03	**Introduction to Computer Hardware** **3.1 Block diagram of a computer** • Identification of Mother Board ,Components and slots • Types of Processors and their specifications(Xeon, and -AMD ,dual core, core2 duo,i3,i5,i7) • RAM(DDR, DDR1,DDR2,DDR3) • ROM • Catche memory (hard disk drive and processor) **3.2 Type Interfaces/connectors** • IDE connector ,SATA connector, ps/2 connector, serial (com)port, usb connector , parallel (lpt) port
04	**Components of Computer System** 4.1 SMPS 4.2 Motherboard 4.3 CD/ DVD ROM Drive 4.4 HDD(Internal/External)
05	**Peripherals : (Input /Output Devices) of Computer Systems Plug and Play Devices -** **5.1 Display Systems (Monitor)** • Types and Features of CRT, TFT, LCD, LED **5.2 Keyboard** • Introduction

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Computer Workshop

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CO16203

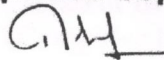|	
	• Classification **5.3 Mouse** • Introduction • Types **5.4 Joystick** **5.5 Light Pen**

06	**Peripherals : (Input /Output Devices) of Computer Systems Installable Devices -**
	6.1 Printer
	• Introduction
	• Types of Printer (Dot Matrix , Laser, Network printer, High speed printer, Color printer)
	
	6.2 Scanner
	• Introduction
	• Scanner Types
	
	   • Hand held scanner
	   • Flatbed scanner
	   • Special scanner(ICR/OMR technology)
	   • Application
	   • Characteristics

07	**Storage Devices** **7.1 HARD DISK(PATA,SATA)** **7.2 CD /DVD Drives,Blue-ray disks** **7.3 External device (Pen drive , Memory card ,External HD, NIC)** **7.4 Different latest Add on Cards and Installation –(eg. LAN Card, Sound card ,VGA card, Firewire card ,TV Tuner Card, etc.)**

Suggested Specification Table with Hours and Marks (Practical)

Unit No	Topic Title	Teaching Hours	Distribution of Practical Marks
01	Introduction To Electronic Components and Instruments	05	
02	Study of CROs	04	
03	Introduction to Computer Hardware	05	
04	Components of Computer System	04	
05	Peripherals : (Input /Output Devices) of Computer Systems Plug and Play Devices -	05	Not Applicable
06	Peripherals : (Input /Output Devices) of Computer Systems Installable Devices	05	
07	Storage Devices	04	
	Total	32	

List of Practical's:-

1.	Identification and Demonstration Electronic Components.
2.	Identification and Demonstration Electronic Instruments.
3.	Prepare charts for symbols of components, devices, Electromechanical switches, connectors.
4.	Demonstration of Multi-Meters.
5.	Demonstration of CRO.
6.	Demonstration of Function Generator.
7.	Identification Components of Computer System.
8.	Demonstration of monitor.
9.	Demonstration of different keyboards.
10.	Demonstration of different Mouse.

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4

11.	Demonstration & Installation of Printer.
12.	Demonstration & Installation of Scanner.
13.	Demonstration of Storage Devices (Internal/External) .
14.	Select a small Electronic Circuit for a group 3-4 students Solder the component on PCB and Test the circuit.
15.	Identification Components on Motherboard.

Reference Books:

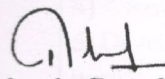| Sr. No.	Book Title	Author	Publication
01	Electronic Component And Materials	Madhuri Joshi	Shroff Publication
02	Hardware And Networking	Vikas Gupta	Comdex Publication
03	Electronic Components	Dr. K. Padamanabhan, P. Swaminathan	Laxmi Publications
04	Modern Computer Hardware	Manahar Lotia	BPB Publications

Course Curriculum Development Committee:

　　a) Internal Faculty:
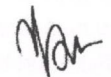
　　　　　i)Aswar Varsha M.(Lecturer in Computer Engineering)
　　　　　ii)Kalyankar A. D. (Lecturer in Computer Engineering)
　　　　　iii)Nagargoje S.R.(Lecturer in Computer Engineering)

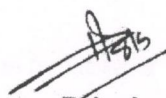　　b) External Faculty:

　　　　　i) Bangal Satish V.(HOD SV Polytechnic,Borivali)

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Academic Coordinator
G. P. Mumbai

5

Academic Coordinator
(R. A. Patil)

Head of Department
(Computer Engineering)

Principal
Govt. Polytechnic Mumbai

Programme : **Diploma in CO /CE/ EE/EC/ IF/IS/LT/ME/RT/LGFT**									
Course Code: NC16102				Course Title: **Social Work**					
Compulsory / Optional: Compulsory									
Teaching Scheme				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
--	---	3	3	---	---	---	---	---	---

Rationale :

The programme aims to inculcate social welfare in students, and to provide service to society without bias. NSS volunteers work to ensure that everyone who is needy gets help to enhance their standard of living and lead a life of dignity. In doing so, volunteers learn from people in villages how to lead a good life despite a scarcity of resources. it also provides help in natural and man-made disasters by providing food, clothing and first aid to the disaster victims.

Course Outcomes:

After the completion of the course student will be able to

CO1	Understand the community in which they work & themselves in relation to their community
CO2	Identify the needs and problems of the community and involve them in problem-solving. Acquire leadership qualities and democratic attitudes.
CO3	Develop sense of social and civic responsibility, gain skills in mobilizing community.
CO4	Develop capacity to meet emergencies and natural disasters and practice national integration and social harmony

Course Content Details:

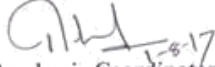| Unit No	Topics / Subtopics	Hours
1	**Institute Level Activity:** 1.1 Tree Plantation 1.2 Play Ground Forming 1.3 Energy Audit 1.4 Nature Awareness 1.5 Tree Counting 1.6 Hunting Hazard	05

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Academic Co-ordinator
G. P. Mumbai

Social Work

Course code : NC16102

2	**Institute Organized Initiative:**	15
	1.1 Energy Consumption	
	1.2 Save Girl Child	
	1.3 Road Safety	
	1.4 Child Labour	
	1.5 Drug Addiction	
	1.6 Road Show	
	1.7 Child Marriage	
	1.8 Poster Making	
	1.9 Dowry	
	1.10 Unemployment	
3	**Visit Arrangement:**	15
	1.1 Visit to Old Age Home	
	1.2 Visit to any Village	
	1.3 Visit Orphanage (Children Home)	
4	**Metropolitan Level Activity :**	05
	1.1 Blood Donation Camp	
	1.2 Health Checkup Camp	
	1.3 General Awareness	
	1.4 New Technology	
	1.5 Woman's Empowerment	
5	**National Administration Initiative For Natural/Artificial calamities:**	05
	1.1 Earthquake	
	1.2 Flood	
	1.3 Storm	
	1.4 Draught	
	1.5 Heavy Rain Fall	

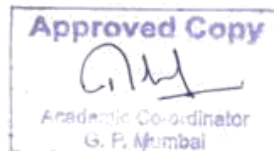**Course Curriculum Development Committee:**
1. Mrs. S.R.Nagargoje (Lecturer in Electronics)
2. Mrs. S.D.Kapse(Lecturer in Instrumentation)
3. Mrs.S.B.Puri(Lecturer in Electronics)

Academic Coordinator
(Dr. R A. Patil)

Head of Department
Department of Computer Engineering

Principal
Govt. Polytechnic Mumbai

Social Work

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Academic Co-ordinator
G. P. Mumbai

Course code : NC16102

Programme : **Diploma in CE/CO/EC/EE/IS/IT/LT/LGFT/ME/RT**									
Course Code: **NC16101**				Course Title: **Yoga**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
-	-	**02**	**02**	-	-	-	-	-	-

Rationale:

Teenage is that period of our life when we are stuck between school, exams, sports, tuition and many other activities which result in our mental and health disorders. Adolescence is an important time for the development of mental health. Nowadays student's life revolves around academic activities, assignment help, to score good grades in the examination, performing better at the workplace and a lot of other hectic activities. They don't get much time for themselves or to relax their mind. To get first in the race of life, they lack somewhere behind and alleviate more and more stress for themselves. Yoga and meditation directly helps in contributing to improve mental focus and concentration among students. Yoga soothes our mind and body and helps to eliminate social and academic stress from students. Breath and movement combine yoga which helps in soothing cramped and jammed bodies. It also helps students in proper concentration while completing assignments and day to day work.

Course Outcomes:
Student should be able to

CO1	**Psychomotor Outcomes:** 1) Demonstrate proficiency at the poses covered in class (at a basic level) 2) Increase their dynamic flexibility 3) Apply forces and exert themselves using rarely used muscle groups 4) Perform proper breathing techniques 5) Perform each difficult pose to the greatest extent of their ability
CO2	**Cognitive Outcomes:** 1) Identify poses using the sanskrit name 2) Categorize poses from a list by increasing level of difficulty 3) Sequence three poses according to a practice 4) List the correct progressions into a given pose 5) Identify some of the major muscles used in any given pose
CO3	**Affective/Social Outcomes:** 1) Work quietly without disturbing classmates 2) Fun participating in the activity 3) Motivated to continue the activity outside of class 4) Assist a partner when called upon to help them with poses 5) Develop a greater sense of body self esteem and appreciation for the art of yoga

Course Content Details:

Unit No	Topics / Sub-topics	Teaching Hours
1	**The Origin and Philosophy of Yoga** 1.1 What is Yoga? 1.2 Brief history and development of Yoga 1.3 The Fundamentals of Yoga 1.4 Yogic practices for health and wellness 1.5 General Guidelines for Yoga Practice 1.6 Food for thought 1.7 How Yoga can help?	2
2	**Loosening Practices** **2.1** Neck bending **2.2** Shoulder's movement **2.3** Trunk movement **2.4** knee movement **2.5** Effective breathing techniques **2.6** Knowledge of asanas specific to desired health benefits	2
3	**Yogasanas (Standing Postures)** **3.1** Taḍasana **3.2** Vrksasana **3.3** Pada-Hastasana **3.4** Ardha Cakrasana 3.5 Trikonasana	6
4	**Yogasanas (Sitting Postures)** 4.1 Bhadrasana 4.2 Vajrasana 4.3 Ardha Ustrasana 4.4 Ustrasana 4.5 Sasakasana 4.6 Uttana Madhukasana 4.7 Marichyasana	6
5	**Yogasanas (Prone Postures)** 5.1 Makarasana 5.2 Bhujangasana 5.3 Salabhasana	4
6	**Yogasanas (Supine Postures)** 6.1 Setubandhasana 6.2 Uttanapadasana 6.3 Ardhahalasana 6.4 Pavanmuktasana 6.5 Savasana	4

7	**Kapalabhati**			**2**
8	**Pranayama**			**2**
	7.1 Anuloma vilo ma pranayama			
	7.2 Sitali Pranaya ma			
	7.3 Bhramari Pranayama			
9	**Dhyana and Sankalp a**			**2**

References/ Books:

Sr. No.	Book Title	Author	P ublication
1	Common Yoga Protoco l	Ministry of Ayurvedan Yoga & naturopathy, unani, siddha and Homeopathy (AYUSH)	G overnment of India
2	Adiyogi: The Source of Yoga	Sadhguru and Arundhathi Subramaniam	H arper Collins P ublication
3	Yoga: The Iyengar Wa y	Silva Mehta, Mira Mehta, Shyam Mehta	A .A. Knopf
4	Asanas; Popular Yoga	Swami Kuvalayananda	P opular Prakashan

Reference Sites:

http://ayush.gov.in/event/commo n-yoga-protocol-2017

http://web.uvic.ca/~thopper/Pe3 52/2003/Lisa%20Jen%20&%20Mark%20Yoga/index.html

http://www.wikihow.com/Do-Y oga-for-Absolute-Beginners

Course Curriculum Developm ent Committee:
  a. **Internal Faculty**
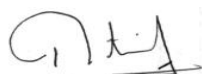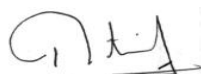
  Ms. Pooja L. Chelani (Lecturer, Computer Engineering, Govt. Polytechnic Mumbai)

  Ms. Usha C. Khake (Lecturer, Computer Engineering, Govt. Polytec hnic Mumbai)

  Ms. Sadaf A. H. Shaikh (Lecturer, Information Technology, Govt. Po lytechnic Mumbai)

  b. **External Faculty**

  Mrs. Mandeep Kaur (Yoga and Meditation Teacher Brahmavidya C ourse, Mumbai)

Academic Coordinator   **Head of Department**   **Principal**

(Information Technology)   **Govt. Poly technic Mumbai**

Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum
[Out Come Based (OBE)]

Semester-II
(Course Contents)

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

gpmumbai@gpmumbai.ac.in

Programme: Electrical Engineering   **Second Semester**   **With effect from June 2016**

Course Code	Course Title	Teaching Hours				Credits	Examination Scheme					
		L	P	TU	Total (Hrs)		Theory		PR	OR	TW	Total
							TH	TS				
HU16 102	Communication Skills	---	---	2	2	2				50*		50
SC16 108	Mathematics II	3	----	1	4	4	70	30				100
SC16 106	Chemistry of Engineering Material	3	2	---	5	5	70	30			50	150
EE16 202	Basic Electrical Engineering	4	4	----	8	8	70	30	50*		50	200
EC16 202	Elements of Electronics Engineering	4	2	---	6	6	70	30	50			150
ME16 201	Engineering Drawing- I	2	4	----	6	6			50*		50	100
NC16 201	Spoken Tutorial course		2		2							
NC16 202	Digital India		3		3							
	TOTAL	16	17	3	**36**	**31**	280	120	150	50	150	**750**

Abbreviations: L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.

* Indicates assessment by External Examiner

Academic Coordinator   **Head of Department**   **Principal**
          (Electrical Engineering)   **Government Polytechnic Mumbai**

Programme : **CE/ME/EC/CO/IF/IS/EE/LG/LT/RT**									
Course Code: **HU16102**				Course Title: **Communication Skills**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
	2	**-**	**2**	**-**	**-**	**-**	**50***	**-**	**50**

*External Examiner

Rationale:

The medium of instruction in the technological field is English, so it is necessary for the students of Engineering and Technology to learn and express through English language. These students are the future technicians, must be able to face the interview, handle the questions and present them in a proper way, acquire confidence to participate in the group discussion, introduced with the modern communication technology and be able to use these Medias for effective communication.

Course Outcomes:

Student should be able to

CO1	Develop the ability of listening and conversation skills.
CO2	Learn the social etiquettes and manners.
CO3	Acquire the practical knowledge of interview.
CO4	Participate in group discussion.
CO5	Identify the need of public speech and new techniques of communication.
CO6	Enable the students to be a good team leader

Course Content Details:

Unit No	Topics / Sub-topics
1	**Listening Skills :** Importance of good listening, Types of listening, Effective listening, How to overcome the obstacles in good listening
2	**Social etiquettes :** Business ethics, Telephone / Mobile etiquettes, E-mail etiquettes, Table manners & respect, Small talk and punctuality
3	**Conversation skills :** How to begin the conversation, Proper use of body language, Tone, voice and pauses, Use of proper grammar and words, How to end the conversation
4	**Interview Skills :** Introduction, Types of Interview, Preparing for an interview, Mock interview

5	**Group Discussion :** Need and importance of group discussion, Emotional stability, Communication with knowledge, Logical conclusion, Role of moderator in the group discussion	
6	**Public Speech :** Welcome Speech, Farewell Speech, Guest's introduction, Vote of thanks	

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	1	Development of listening skills.	02
2	1	Teacher will read out a passage thrice. And the students will listen carefully following the guidelines and answer the questions.	04
3	2	Presentation of conversation on telephone / mobile (2 students)	04
4	2	Presentation of table manners and etiquettes.	04
5	3	Conversation on the given situation	04
6	4	Mock interview (6 students)	04
7	5	Group Discussion (6 students + 1 moderator)	04
8	6	Public speech	01
9	6	Presentation of welcome and farewell speech	02
10	6	Guest's introduction speech and vote of thanks	02
		Total	**32**

References/Books

Sr.No.	Author	Title	Publication
1	Meenakshi Raman Sangita Sharma	Communication Skills	Oxford Higher Education
2	Homai Pradhan D.S.Bhende Vijaya Thakur	Business Communication	Himalaya Publishing House
3	Curriculum Development Centre	A Course in Technical English	Somaiya Publications Pvt.Ltd.

Course Curriculum Development Committee:
   a. **Internal Faculty**
                1) Smt. S.S. Kulkarni
                2) Mrs. K.S. Pawar
   b. **External Faculty :-** 1) Mr. Sandeep Barde

Academic Coordinator   **Head of Department**   **Principal**
                                          (Science)   **Government Polytechnic**
                                                                              Mumbai

CO VS. PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
1	1	2	2	1	3	3	3	3	3	3
2	1	1	1	1	3	3	3	3	3	3
3	1	1	2	2	2	3	3	3	3	3
4	1	1	1	2	3	3	3	3	3	3
5	2	2	2	2	3	3	3	3	3	3
6	2	2	2	2	3	3	3	3	3	3

CO Vs PSO Matrix

Electrical Engg.

CO/PSOs		PSO1	PSO2	PSO3
CO1	Develop the ability of listening and conversation skills.	1	1	2
CO2	Learn the social etiquettes and manners.	1	1	2
CO3	Acquire the practical knowledge of interview.	1	1	2
CO4	Participate in group discussion.	1	1	2
CO5	Identify the need of public speech and new techniques of communication.	2	2	3
CO6	Enable the students to be a good team leader	2	2	3

Unit Number and COs

Sr. No.	Unit No	Topic Title	COS
1	1	Listening	CO1
2	2	Social etiquettes	CO2
3	3	Conversation skills	CO1, CO6
4	4	Interview Skills	CO3
5	5	Group Discussion	CO4
6	6	Public Speech	CO5, CO6

Programme Code: CE/ME/ EE/IS/EC/CO/IF/RT									
Course Code:**SC16108**				Course Title: **Mathematics-II**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	**1**	**-**	**4**	**70 (3 Hrs.)**	**30**	**-**	**-**	**-**	**100**

Rationale:

The study of mathematics is necessary to develop in the student, the skills essential for Studying engineering subjects. The subject is an extension of basic mathematics of first semester, which is a pre requisite, for engineering studies.

Course Outcomes:

Student will be able to:

CO1	Define the basic principles of function, limits, derivatives, complex number and relations between two variables.
CO2	Apply rules, concept and properties to solve the problems.
CO3	Classify various types of statistical data.

Course Content Details:

Unit No	Topics / Sub-topics

1	**1.** *Function*
	    1.1 Concept of function, domain and range,
	    1.2 Type of functions (Only definitions).

2	**2.** *Limit*
	   2.1 Concept of limit
	   2.2 Limit of Algebraic, Trigonometric, Logarithmic and
	       Exponential functions with simple example.

3	**3**. *Derivatives*
	    3.1 Definition of the derivative.
	    3.2 Derivatives of standard function.(No proof by first principle)
	    3.3 Differentiation of sum, difference, product and quotient of two or more
	          functions
	    3.4 Differentiation of composite, inverse, implicit, parametric, exponential
	          and logarithmic functions with simple example.
	    3.5 Second order derivative.

4	**4** *APPLICATION OF DERIVATIVES*
	    4.1 Geometrical meaning of derivative
	    4.2 Tangents & Normals to the curve,
	    4.3 Maxima & minima of the functions
	    4.4 Radius of Curvature.

5	**5.** *STATISTICS* 5.1 Basic definitions-raw data, variate,frequency,cumulative frequency 5.2 Classification of data, class interval, mid value, length of the interval 5.3 Measure of central tendency – (mean, median & mode) 5.4 Mean deviation, Standard deviation, Coefficient of variance
6	**6** *Complex number* 6.1 Definition & Algebra of complex numbers 6.2 Geometrical representation of complex number 6.3 Modulus & amplitude of complex number 6.4 Polar form of complex number 6.5 De moivre's theorem (no proof) , roots of complex number 6.6 Exponential form of complex number, Circular & Hyperbolic functions of complex numbers, relation between Circular & Hyperbolic functions, real & imaginary parts of Circular & Hyperbolic functions
7	**7.** *Numerical Analysis* 7.1 Solution of Algebraic equations using – i) Bisectional method ii) Regular – Falsi method , iii) Newton- Raphson method 7.2 Solution of simultaneous equation (i) Gauss elimination method (ii) Jacobi's method (iii) Gauss-Seidal method

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Function	04	02	02	00	04
2	Limits	08	04	02	04	10
3	Derivatives	13	04	04	06	14
4	Application of derivatives	07	00	04	04	08
5	Statistics	12	04	04	06	14
6	Complex number	12	02	04	04	10
7	Numerical analysis	08	02	04	04	10
	Total	**48**	**18**	**24**	**28**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Tutorials:
Note:1)Tutorials are to be used to get enough practice.
2)Make group of 20 student and for each group minimum 10 problems are to be given.

Sr. No.	Unit	Tutorials	Approx. Hours
1	1	Function	01
2	2	Limits	02
3	3	Derivatives	01
4	3	Derivatives	02
5	3	Derivatives	01
6	4	Application of derivatives	01
7	5	Statistics	01
8	5	Statistics	02
9	6	Complex number	01
10	6	Complex number	02
11	7	Numerical analysis.	02
		Total	**16**

References/ Books:

Sr.No.	Name of Book	Author	Publisher
1	Mathematics for polytechnic students	S.P. Deshpande	Pune VidyarthiGrahaPrakashan
2	Mathematics for polytechnic students (Volume I)	H. K. Das	S.ChandPrakashan
3	Companion to basic maths	G. V. Kumbhojkar	PhadkePrakashan
4	Applied Maths	N. Raghvendra Bhatt Late Shri R Mohan Singh	Tata McGraw Hill Publication

Course Curriculum Development Committee:
  a. **Internal Faculty**
           i. Miss.J.J.Ratnanai.
          ii. Mr.V.S.Patil
  b. **External Faculty**
           i. Prof. P. S. Dave

Academic Coordinator   **Head of Department**   **Principal**
                                (Science)   **Govt. Polytechnic Mumbai**

Course Name:-Basic Mathematics Course Code:-SC16107

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	--	--	02	02	01	01	01	--	--	--
CO2	03	02	03	02	01	--	02	--	--	--
CO3	03	02	01	01	02	02	02	--	--	--

CO Vs PSO matrix

Electrical Engg.

CO/PSOs		PSO1	PSO2	PSO3
CO1	Define the basic principles of function, limits, derivatives, complex number and relations between two variables.	01	02	--
CO2	Apply rules, concept and properties to solve the problems.	01	02	02
CO3	Classify various types of statistical data.	02	01	--

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Function	CO1,CO2
2	2	Limits	CO1,CO2
3	3	Derivatives	CO1,CO2
4	4	Application of derivatives	CO1,CO2
5	5	Statistics	CO1,CO2,CO3
6	6	Complex number	CO1,CO2
7	7	Numerical analysis	CO1,CO2

Programme : **EE/EC/IF/IS/CO**									
Course Code:**SC16106**				Course Title: **Chemistry of Engineering materials**					
Compulsory / Optional: Compulsory									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	**-**	**2**	**5**	**70 (3 Hrs.)**	**30**	**-**	**-**	**50**	**150**

Rationale:

The subject is offered as one of the foundation subjects as it belongs to the category of basic sciences. The subject helps to understand and select different materials, their compositions, their properties and uses. The subject helps in reinforcing basic knowledge gained by students to apply and solve day to day problems related to the various engineering fields. This will provide input for better understanding of other foundation and technology subjects.

Course Outcomes: Student should be able to:

CO1	Identify and classify various materials used by them.
CO2	Select suitable substance, metal/alloy for a particular use.
CO3	Adopt methods of safety and precaution to aid preventive measures.
CO4	Develop problem solving attitude towards given problems related to the field of study.
CO5	Apply acquired knowledge to solve core engineering and technological problems.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Atomic structure** 1.1 Introduction of atom, Fundamental Particles, Proton, Neutron, Electron; their mass, charge, location. and symbol 1.2 Atomic number and atomic mass number. (Definition, symbol, fundamental nature, difference between. Atomic no. and atomic mass no.) Numerical based on atomic number & atomic mass number. Orbits, Orbital, quantum no. and their significance 1.3 Rules governing filling up of atomic orbitals, Aufbau's Principle, Pauli's exclusion principle, Hund's rule. Electronic configuration of inert gases. Electronic configuration of atoms up to atomic number 20, Isotopes and isobars and their differences, etc.

	1.4 Valency and chemical bonding.
	Valency: Definition, & examples.
	Types of valency: Electro valency & co-valency Examples.
	1.5 Electrovalent bond: Definition, Formation, examples.
	Formation of NaCl , $MgCl_2$, MgO,$CaCl_2$,CaO,$Alcl_3$.
	1.6 Co-valent bond : Definition & formation
	Formation of following molecules
	Single bond : Hydrogen, Chlorine, Water , Ammonia, Hydrogen Chloride, Methane.
	Double bond : Oxygen, Carbon dioxide, Ethylene.
	Triple Bond : Nitrogen, Acetylene.
	1.7 Distinction between electrovalent and covalent compounds.
2	**Electrochemistry**
	2.1 Definition of Electrochemistry, Electrolytes: Definition, Types.
	Differences between Atom and ion. Definition of ionization & electrolytic dissociation, Arrhenius theory, Degree of ionization with factors affecting it.
	2.2 Terms related to Electrolysis (resistance, conductance, potential difference, their units)
	Mechanism of electrolysis. Examples of: mechanism of electrolysis of NaCl in fused & in aqueous state, electrolysis of $CuSo_4$ using Cu and Pt electrodes.
	2.3 Faradays First law of electrolysis and its mathematical derivation.
	Faradays second law of electrolysis& its mathematical derivation, Numerical based on laws of Faraday.
	2.4 Application of Electrolysis, electro- refining, Electroplating.
	2.5 PH value : Definition ,Formula, PH scale, its salient
	Features, Numerical based on PH, Applications of PH related to Engg. field. (Corrosion of bridges, Electroplating Sewage treatment, City water supply).
	CASE STUDY RELATED TO PH/ ELECTROLYSIS PROCESS
3	**Cells and batteries**
	3.1 Conductors: Definition, types (Metallic & Electrolytic) Difference between the two,
	3.2 Ohm's law, charge & discharge of cells, closed circuit voltage, open circuit voltage , Electrochemical couple, separator, electromotive force (EMF),

	3.3 Cells Definition, types (Electrolytic & Electrochemical), differences between them
	3.4 Classification of electrochemical cell (Primary & secondary cells) Definition & Difference between the two.
	3.5 Primary cells: Lac lance cells, Dry cells, Daniel cells.
	3.6 Secondary cells: Lead acid storage cell (Construction working charging & discharging)
	Nickel- cadmium cell (Construction working charging & discharging)
	Battery : Definition, Example
	CASE STUDY: PRIMARY CELLS/ SECONDARY CELLS
4	**Metallurgy & alloys**
	4.1 Metals & their characteristics, (hardness, ductility, malleability, toughness, brittleness, tensile strength, weldability, casting, forging, soldering)
	Occurrence of metals (native state and combined state, examples) ,
	definition of Mineral, Ore, Gangue, Flux, Slag, Metallurgy.
	4.2 Process of extraction of metal from ore i.e
	Flowchart of metallurgy.
	Different steps of metallurgy.
	A) Grinding and pulverization
	B) Concentration (definition)
	a. Physical method (to be taught in detail)
	• Gravity separation
	• Magnetic separation
	• Froth floatation
	b. Chemical method
	• Calcination
	• Roasting (difference between the two)
	C) Reduction by
	a. Smelting (in detail: definition, diagram, description and zones of blast furnace, products of blast furnace)
	b. Aluminothermic (only definition)
	c. Electrolysis (only definition)
	D) Refining:

	• Definition and Name of different methods (Poling, Liquation, Distillation, electro-refining)
	
	4.3 Important ores of iron, Copper, Zinc, Aluminum,
	
	4.4 Physical properties and uses of some metals along with chemical properties Ex :- Fe, Cu, Al, Cr, Ni, Sn, Pb, Zn, Co, Ag, W
	
	4.5 Definition of alloy: purposes of preparation of Alloy. Preparation of binary alloy by fusion method
	
	4.6 Some useful alloys : composition, properties and uses
	
	    1 Brass
	
	    2. Duralumin
	
	    3. Solder: Wood's metal
	
	    4. Babbit metal.
	
	ACTIVITY: PREPARATION OF METALLURGY FLOWCHARTS / VAROUS METHODS OF CONCENTRATION

5	**Semiconductors & Insulators**
	
	    5.1**.** Semiconductors: Definition, Example, properties & uses of silicon & Germanium **,** formation of semiconductor.
	
	    5.2.Insulators : Definition, Example: air; silicone fluids : Definition, Example, properties & uses
	
	    5.3 Superconductors: Definition, Example, properties & uses.

6	**Corrosion.**
	
	    6.1 Definition of corrosion, Types of corrosion (Atmospheric & Electrochemical Corrosion)
	
	    6.2 Mechanism of atmospheric corrosion, types of oxides formed, (stable, unstable, volatile, with examples), factors affecting atmospheric corrosion.
	
	    6.3 Electrochemical corrosion / immersed corrosion
	
	    • Definition, types of cells formed (galvanic cells & concentration cells, examples of both cell formations).
	
	    • Mechanism of immersed /electrochemical corrosion (hydrogen evolution mechanism & oxygen absorption mechanism, diagram, explanation and chemical equations of both mechanisms).

	• Factors affecting immersed corrosion (Ph value, hydrogen over voltage, solubility of corrosion products, irregularities on surface, etc.)
	
	 6.4 Protection of metals from Corrosion :- only definition:
	    i. purification of metals
	    ii. alloy formation
	    iii. cathodic protection
	    iv. controlling external conditions
	    v. protective coatings
	       a) organic coating(by paints and varnishes),
	       b) inorganic coating (metallic oxides)
	       c) metallic coating (detail)
	
	 6.5 Protective metallic coatings (definition, process, application, diagram)
	    a. hot dipping(galvanizing & tinning)
	    b. sherardizing
	    c. metal spraying
	
	 ACTIVITY : VIEWING THE PROCESSES DESCRIBED ABOVE

7	**Lubricants**
	 7.1 Definition of lubricant, example, various functions of a lubricant, classification of lubricants (solid, semi-solid and liquid) examples, conditions under which each lubricant is used.
	
	 7.2 Lubrication: definition and types.
	    Types of lubrications: (Definition, diagram & description of each type.)
	 • Fluid film
	 • Boundary,
	 • Extreme pressure lubrication.
	
	 7.3 Characteristic of good lubricants, requirements of an ideal lubricant
	    A) Physical Characteristics
	       • Viscosity
	       • Viscosity index
	       • Oiliness
	       • Volatility

	• Flash point & Fire Point
	• Cloud and Pour point
	B) Chemical Characteristics
	• Acidity /Neutralization no.
	• Emulsification
	• Saponification value
	7.4 Selection of lubricant for a particular machine depending upon its working condition (Table showing machines, their working condition, nature of lubricant needed, type of lubrication used).
	ACTIVITY: SELECTION OF LUBRICANT BASED ON NATURE OF MACHINE
8	**Engineering. Materials**
	8.1 Plastic
	• definition , example
	• Polymerization: definition different methods of Polymerization addition and condensation.
	• Addition polymerization : definition formation of polyethylene Polytetrafluoroethylene PVC , polystyrene etc.,
	• Condensation-polymerization: definition and examples (formation Of Bakelite , nylon-66 etc).
	• Types of plastic: thermosoftening ,thermosetting plastics, Differences between them.
	• Compounding of plastic , Materials needed for it (pigments, fillers, Plasticizers accelerators etc.,)
	• Properties and engineering applications
	8.2 Rubber :
	• Definition of rubber (elastomer).
	• Natural rubber : Basic unit in natural rubber(isoprene)
	• Occurrence & Processing of Latex .Limitations of natural rubber,
	• Vulcanization Of rubber: Definition. process, examples
	• Synthetic rubber: need for it, various examples (Buna-S, Buna –N, Thiokol, neoprene, butyl rubber)

- Properties of rubber (elasticity, tack, shock absorbance, rebound, tensile strength, related uses)

8.3 Insulators (definition, examples)

- Teflon(PTFE): Preparation, Properties and uses

- Ceramics : properties and uses

8.4 Adhesives

- Phenol Formaldehyde resin : Preparation, Properties, Uses

- Urea Formaldehyde resin : Preparation, Properties, Uses

- Epoxy resin :   Properties, Uses

8.5 Conducting Polymers :   Properties, Uses

8.6 Liquid Crystal Polymers : Properties, Uses

8.7 XLPE Cross polyethylene: Properties, Uses

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Atomic Structure	06	04	04	00	08
2	Electrochemistry	06	02	04	02	08
3	Cells and batteries	05	02	04	02	08
4	Metallurgy and alloys	06	04	02	02	08
5	Semi conductors and insulators	04	02	04	02	08
6	Corrosion	06	02	04	02	08
7	Lubricants	06	02	04	02	08
8	Engineering materials	09	04	08	02	14
	Total	**48**	**22**	**34**	**14**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes:This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments: (any 12 experiments)

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	1	Tour of chemistry laboratory &safety measures.	02
2	2	To find out the electrochemical equivalent of copper	02
3	2	To find out PH of different solutions using Lovibond comparator, PH paper, PH meter	02
4	3	To Prepare Daniel Cell and note its EMF.	02

5	4	To Find out the percentage of Cu. from the given alloy sample	02
6	1,4	Qualitative analysis of any three salt solutions.	02
7	1,4	Solution 1	02
8	1,4	Solution 2	02
9	1,4	Solution 3	02
10	3,5	Compare electrode potentials of different electrodes using a standard electrode and help determine which metal corrodes faster	02
11	6	To study corrosion of aluminum rod/ in acidic and an alkaline medium and plot a graph of the cell.	02
12	7	Determination of coefficient of viscosity of given Oil by Ostwald's viscometer	02
13	7	To find out acid value of given lubricant oil by titration with KOH.	02
14	8	Preparation of phenol formaldehyde resin and to study its properties and uses	02
15	2	To find out end point of titration between weak acid and weak base using conductivity meter	02
16	8	Preparation of urea-formaldehyde resin and to study its properties and uses	02
		Total	**32**

References/ Books:

Sr.No.	Name of Book	Author	Publisher
3	Engineering Chemistry	M. M. Uppal	Khanna Publisher, Delhi
1	Polytechnic Chemistry	V. P. Mehta	Jain Brothers, New Delhi.
2	Applied Chemistry	P. C. Jain & Monica Jain	DhanpatRai and Sons, New Delhi
4	Chemistry in Engineering and Technology Volume I and II	J. C. Kurlacose J. Jairam	Tata Mcgraw hill.

Course Curriculum Development Committee:
   a. **Internal Faculty**
      i. Mrs. J.V. Iyengar (Lecturer in Chemistry)
      ii. Head of Departments of EC, EE, CO, IF, IS

Academic Coordinator   **Head of Department**   **Principal**
                              (Science)   **Govt. polytechnic Mumbai**

Course Name:-Chemistry of materials   Course Code:-SC16106

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	2	2	2	1	1	-	-	-	1
CO2	3	2	2	2	-	2	1	1	-	1
CO3	3	3	2	2	1	2	-	1	-	1
CO4	3	2	2	1	-	2	1	1	-	1
CO5	3	3	1	1	1	2	-	1	-	1

CO Vs PSO matrix

Electrical Engg.

	CO/PSOs	PSO1	PSO2	PSO3
CO1	Identify and classify various materials used by them.	1	2	1
CO2	Select suitable substance, metal/alloy for a particular use.	2	2	--
CO3	Adopt methods of safety and precaution to aid preventive measures.	2	2	2
CO4	Develop problem solving attitude towards given problems related to the field of study.	2	2	--
CO5	Apply acquired knowledge to solve core engineering and technological problems.	1	1	1

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Atomic structure	CO1, CO5
2	2	Electrochemistry	CO1, CO2, CO5
3	3	Cells and batteries	CO1, CO2, CO5
4	4	Metallurgy and alloys	CO1, CO2, CO4
5	5	Semiconductors and insulators	CO2, CO5
6	6	Corrosion	CO2, CO3, CO4
7	7	Lubricants	CO1, CO2, CO3
8	8	Engineering materials	CO1, CO2, CO5

Programme : **Diploma in Electrical Engineering**								
Course Code: **EE16202**			Course Title: **Basic Electrical Engineering**					
Compulsory / Optional: **Compulsory**								
Teaching Scheme and Credits				Examination Scheme				
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	-	4	8	70 (3Hrs.)	30	50	--	-	150

RATIONALE : The Diploma Course in Electrical Engineering mainly involves the study of Electrical machines, equipments and instruments. In order to understand the working principle, construction, operation and applications of the various Electrical machines, equipments and instruments; the basic concepts, rules and laws of Electrical and Magnetic Circuits must be studied and understood by the students of Electrical Engineering Course. This subject will help the students to study, understand and comprehend the fundamentals of various facts, the basic concepts, rules and laws of Electric and Magnetic Circuits.

Course Outcomes :

Student should be able to

CO1	Find out effect of current in different application.
CO2	Find out the current and voltages in series or parallel connected circuit.
CO3	Demonstrate the mutually induced emf. With direction.
CO4	Connect storage batteries to increase voltage level or current level.

Course Content Details:

Ch.No.	Topics / Sub-topics
1	**Basic Concepts:** 1.1 Concept of Electric Current. 1.2 Concept of Electric Potential, Potential Difference (P D) and Electro-Motive-Force (EMF). 1.3 Concept of Resistance, - Laws of Resistance, - Concept of Resistivity and Conductivity, - Effect of Temperature on Resistance, Temp. co-efficient of Resistance (simple numerical) 1.4 Classification of Electric Current: -Direct Current (DC)-Alternating Current(AC) 1.5 Sources of Electric Current (DC) - Concept of Voltage Source: Ideal and Practical - Concept of Current Source: Ideal and Practical - Source Conversion. (simple numerical) 1.6 Effects of Electric Current Heating Effect, Magnetic Effect, Chemical Effect with applications 1.7 Concept of Electrical Work, Power and Energy. Their SI units (simple numerical) 1.8 Types of Resistors and their Applications. - Carbon Composition

	- Deposited Carbon - High Voltage Ink Film - Metal Film - Metal Glaze 1.14. Wire Wound - Cermet

2	**D.C. Circuits:**
	2.1 Ohm's Law, Concept of Voltage drop and Terminal Voltage.
	2.2 Resistance in Series, Voltage Division Formula.
	2.3 Resistance in Parallel, Current Division Formula. (Simple Numerical)
	2.4 Calculations of Equivalent Resistance of simple Series, Parallel and Series Parallel Circuits.(Simple Numerical)
	2.5 Duality Between Series and Parallel Circuits.
	2.6 Definitions of terms Related to Electric Circuits, Circuit Parameters, Linear Circuit, Non-linear Circuit, Bi-lateral Circuit, Uni-lateral Circuit, Electric Network, Passive Network, Active Network, Node, Branch, Loop, Mesh.
	2.7 Kirchhoff's Laws
	  - Kirchhoff's Current Law
	  - Kirchhoff's Voltage Law
	  (Simple Numerical with maximum two equations)

3	**Capacitors:**
	3.1 Electrostatics: Static Electricity, Absolute & Relative Permittivity of a Medium, Coulombs Laws of electrostatics, Electric Field, Electrostatic induction, Electric Flux, Electric flux Density, electric potential & energy, potential Difference, Breakdown voltage & dielectric strength.
	3.2 Concept and Definition of Capacitor
	3.3 Parallel Plate Capacitor:
	  - Uniform Di-electric Medium
	  - Medium Partly Air.
	  - Composite Medium. (Simple Numerical)
	3.4 Capacitors in Series, Capacitors in Parallel
	3.5 Calculations of Equivalent Capacitance of simple Series, Parallel and Series Parallel Combinations of Capacitors. (Simple Numerical)
	3.6 Energy Stored in Capacitor. (No Derivation only Simple Numerical)
	3.7 Charging and Discharging of Capacitor(No Derivation only Simple Numerical)
	3.8 Types of Capacitors and their Applications. Electrolytic , Non-Electrolytic (Paper, Mica, Plastic)

4	**Magnetic Circuits:**
	4.1 Magnetism: Absolute and Relative Permeabilities of a Medium, Laws of Magnetic Force, Magnetic field strength, Flux & Flux Density.
	4.2 Magnetic Circuit - Ohm's law of Magnetic Circuit.
	4.3 Definitions Concerning Magnetic Circuit.
	  - Magneto-Motive-Force (MMF), Ampere Turns (AT), Reluctance, Permeance, Reluctivity.
	4.4 Comparison Between Electric and Magnetic circuit.
	4.5 Composite Series Magnetic Circuit.
	4.6 Parallel Magnetic Circuit.
	4.7 Calculations of Amp.-Turns for simple Series, . (Simple Numerical)
	4.8 Concept of Leakage Flux, Useful Flux & Fringing.
	4.9 Magnetisation Curve (B - H Curve)
	  - Magnetisation Curve for Magnetic and Non-Magnetic Materials.

	- Magnetic Hysteresis, Hysteresis Loop. - Hysteresis Loops for Hard & Soft Magnetic Materials. - Area of Hysteresis Loop, Hysteresis Loss. (No Derivation and No Numerical) 4.10 Types of Magnets and their applications. Permanent Magnet, Electromagnet.

5	**Electromagnetic Induction:**
	5.1- Relation Between Magnetism and Electricity.
	5.2- Production of Induced E.M.F. and Current.
	5.3- Faraday's Laws of Electromagnetic Induction. Faraday's First Law, Faraday's Second Law (No Numerical) Cork Screw Rule
	5.4 Induced E.M.F: Statically Induced E.M.F., Dynamically Induced E.M.F. (Simple Numerical)
	5.5 Direction of Induced E.M.F. and Currents.
	  - Fleming's Right Hand Rule
	  - Lenz's Law
	  - Self Induced E.M.F., Mutually Induced E.M.F.
	5.6 Self Inductance
	5.7 Coefficient of Self-induction (L), (Simple Numerical)
	5.8 Mutual Inductance
	5.9 Coefficient of Mutual Inductance (M) (Simple Numerical)
	5.10 Coefficient of Coupling
	5.11 Inductances in Series and parallel. (No Derivation and No Numerical)
	5.12 Types of Inductors and their Applications.
	  - Air Cored Inductors
	  - Iron Cored Inductors
	  - Ferrite Cored Inductors.
	5.13 Energy Stored in Magnetic Field (No Derivation and No Numerical)
	5.14 Concept of DOT and UNDOT for coil

6	**LAMPS & BATTERIES** CONSTRUCTION & WORKING OF LAMPS 6.1 Energy Efficient lamp – CFL , LED 6.2 Storage Batteries: 6.3 Concept of Cell and Battery. 6.4 Electrical Characteristics of Batteries. 6.5 E.M.F., Terminal Voltage, Internal Resistance, Ampere-Hour Capacity, Efficiency: AH Efficiency and Watt - Hr Efficiency. 6.6 Necessity of Series Connection of Batteries. And Parallel Connection of Batteries. 6.7 Maintenance of Lead Acid Batteries. 6.8 Applications of Storage Batteries.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Basic Concepts:	10	02	04	04	10
2	D.C. Circuits:	12	04	04	08	16
3	Capacitors:	10	02	04	04	10
4	Magnetic Circuits:	12	04	04	04	12
5	Electromagnetic Induction:	12	04	04	04	12
6	Lamps & Batteries.	08	02	04	04	10
	Total	**64**	**18**	**24**	**28**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Experiments

Sr. No.	Unit	Experiment	Approx. Hours
1	1	Find the effect of temperature on resistance of copper conductor.	02
2	1	Measurement of voltage, current and resistance by suitable meters.	02
3	2	Verify Kirchoff's current law.	02
4	2	Verify Kirchoff's voltage law.	02
5	2	To determine the equivalent resistance (Req.) of Series connected resistances.	02
6	2	To determine the equivalent resistance (Req.) of Parallel connected resistances.	02
7	2	Demonstration of wave form of DC and AC current on suitable equipment.	02
8	2	Demonstration of Rheostat as a current regulator & potential divider .	02
9	3	To plot the charging and discharging curves of a capacitor and determine the time constant.	02
10	3	Demonstrate different types of capacitors.	02
11	4	To plot the B H curve for magnetic material and determine the relative Permeability.	02
12	4	Demonstrate different types of magnets.	02
13	5	To verify Faraday's First Law of electromagnetic Induction (For Dynamically & Statically Induced EMF).	02
14	5	Demonstrate different types of inductors.	02
15	6	Demonstration of series & parallel connection of storage batteries.	02
16	6	Demonstration of charging of storage batteries.	02
		Total	**32**

Notes: *If possible videos should be shown of different applications of this course.*

References/ Books:

Sr. No.	Author	Title	Publisher
01	B.L.Theraja A.K.Theraja	A Text Book Of Electrical Technology vol-I	S. Chand & Co.
02	V.N.Mittle	Basic Electrical Engg.	Tata McGraw-Hill
03	Edward Hughes	Electrical Technology	Pearson Education, New Delhi
04	V.K.Mehta	Electrical Technology	S. Chand & Co.

Websites:
1. www.google.co.in
2. www.electrical4u.com/
3. electrical-engineering-portal.com

Course Curriculum Development Committee :
    a) Internal Faculty: A.K.Dhulshette

    b) External Faculty: i) Mr. Ibrahim I.A. Fakih   Divisional Engg. BEST
                                   ii) Mr. H.B.Chaudhari   Assistant Prof. VJTI.

Academic Coordinator   **Head of Department**   **Principal**
                               (Electrical Engineering)   **Govt. Polytechnic Mumbai**

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	1	2	2	-	2
CO2	3	3	3	2	3	-	-	2	-	2
CO3	2	3	3	3	3	3	2	2	-	-
CO4	3	3	3	3	3	2	-	2	-	2

CO Vs PSO matrix

	CO	PSO1	PSO2	PSO3
CO1	Find out effect of current in different application.	1	1	3
CO2	Find out the current and voltages in series or parallel connected circuit.	3	1	3
CO3	Demonstrate the mutually induced emf. With direction.	3	1	-
CO4	Connect storage batteries to increase voltage level or current level.	3	1	3

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Basic Concepts:	1
2	2	D.C. Circuits:	2
3	3	Capacitors:	2
4	4	Magnetic Circuits:	1,3
5	5	Electromagnetic Induction:	1,3
6	6	Lamps & Batteries.	1,2,4

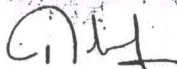| Programme : **EE**									
Course Code:**EC16202**				Course Title: **Elements of Electronics Engineering**					
Compulsory / Optional: Compulsory									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	-	2	6	70 (3 Hrs.)	30	50	-	-	150

Rationale:

This course is one of the core subject and it covers fundamentals of electronics. Therefore it is necessary for the students of electronics and related branches to study. It includes basic principles, construction of semiconductor devices, their biasing techniques and simple applications. Student will be able to analyze and apply knowledge of this subject.

Course Outcomes: Student should be able to:

CO1	Learn the fundamentals of electronics.
CO2	Know the principle of diodes and transistors. Understand the construction and materials used for diodes and transistors.
CO3	Identify the components from their configuration and sketch their symbols.
CO4	Evaluate the characteristics of electronic components
CO5	Assemble, test and analyze basic circuits such as rectifiers, amplifiers, clipper, oscillator etc.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Semiconductor Theory:** 1.1 Review of atomic structure, Effect of Heat on atomic structure. Concept of Energy band theory, Classification of material on the basis Energy band theory: Conductor, Insulator, Semiconductor. 1.2 Intrinsic and Extrinsic Semiconductors, P-type and N-type Semiconductors. Majority and minority charge carriers. 1.3 P-N Junction formation, Concept of depletion layer and barrier Potential. 1.4 Biasing of PN Junction: Forward and reverse biased. Reverse breakdown: Avalanche breakdown. Reverse Saturation current. 1.5 PN junction Diode: V-I characteristics, Diode current Equation, Effect of temperature, Static and dynamic resistance. 1.6 Comparison of Si and Ge Diode. Packages of Diode. 1.7 Definition of following terms: Forward voltage and Forward

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		Current, PIV, Power dissipation of diode, Junction Capacitance, Barrier / Knee Voltage.
		1.8 Testing of Diode using multimeter, Application of Diode.
2		**Diode applications:**
		2.1 Review of Transformer: Step Up, Step down (Not for exam)
		2.2 Rectifier: Definition , Types, Circuit diagram, waveforms and Working of(a) Half wave rectifier (b) Full Wave rectifier (Centre Tapped) (c) Bridge rectifier.
		2.4 Definition of following terms: Ripple factor, efficiency of Rectifier, TUF.
		2.5 Comparison of Rectifiers.
		2.6Filters: Waveform and working of Capacitor, Choke input And Π-type filters circuit for rectifiers (Refer 2.2)
		2.7Diode as clipper and clamper
		(a) Circuit diagram, waveform and working of positive, negative clipper (series and shunt)
		(b) Circuit diagram, waveform and working of positive, negative clamper.
3		**Special Diodes :**
		Symbol, construction, characteristics, working, application and general specification of the following diodes:
		3.1 Zener Diode. Application of Zener diode as regulator.(series and shunt)
		3.2 Block diagram of regulated power supply, Definition of load Regulation, line regulation. (Simple numerical on end expression, no derivation to be asked in the exam)
		3.3Light Emitting Diode, Calculation of series resistance.
		3.4Photo Diode.
4		**Transistor Fundamentals:**
		4.1 Bipolar Junction Transistor: Two diode analogy of transistor, Packages and terminal identification of Transistor.
		4.2Symbol, Construction and working of PNP and NPN transistors.
		4.3 Transistor configuration: CE, CB, CC modes.
		4.4 Characteristics of transistors in CE configuration. Expression of collector current, Concept of collector leakage current. Relation between α and β.

(Simple numerical on end expression, no derivation to be asked in the exam)

4.5 Concept of Early Effect.

4.6 Transistor Parameters/ Ratings: Maximum collector current, Maximum collector voltage, Maximum Base current, Maximum power dissipation, Operating frequency range, Current gain (hfe).

4.7 Importance of Heat sink.

4.8 Differentiate faulty and good Transistor.

5	**BJT biasing:**

5.1 Introduction: Need of biasing, DC Operating point and load line, factors contributing to thermal instability, Effect of temperature (Thermal runway), Stability Factor

5.2 Transistor biasing: Circuit and analysis of biasing network such as Fixed bias, Collector feedback bias, Emitter Bias, Voltage divider bias. (Simple numerical on the end expression such as stability factor, current gain is expected).

5.3 Application of Transistor as a Switch

5.4 Single stage Common Emitter (CE) amplifier: Working and frequency response.

6	**Field Effect Transistor:**

6.1 Introduction, Symbol, Packages and terminal identification of FET (N channel, P channel)

6.2 JFET: Formation of depletion region, Operation, Output and Transfer characteristics.

6.3 JFET Parameters, relation between JFET parameters.

6.4 Comparison between BJT and FET.

7	**Introduction to Oscillators:**

7.1 Need and condition for oscillators (Barkhausen criteria)

7.2 Types of feedback : Positive and Negative

7.3 Type of oscillator: RC phase shift oscillator and Hartley oscillator, working, frequency expression and applications.

8	**Digital Electronics:**

8.1 Number Systems:

a) Binary numbers, Octal numbers, Hexadecimal numbers:

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Conversion of one number system to another system (including Fractional point number)

8.2 Logic Gates and Families:

a) AND, OR, NOT, NAND, NOR, EX-OR, EX-NOR gate: Truth table, equation, symbol, IC numbers, Block diagram of logic IC's (Students must be made aware of pin diagram of logic gates.)(pin diagram should not be asked for exam)

b) NOR & NAND as Universal gate.

8.3 Flip-flop:

a) S-R Flip-flop using NOR and NAND.

b) Types of triggering: Edge, level

c) Clocked S-R flip flop, D flip flop, JK flip flop, T flip flop. (Diagram, Symbol, Truth table, operation and application)

8.4 Counters:

a) Classification of counters: Synchronous & Asynchronous/ripple

b) MOD-n asynchronous counter, 3 bit UP/DOWN ripple (asynchronous) counter: Circuit diagram, working and waveform.

8.5 MUX/DEMUX:

a) Realization and working of 2 : 1, 4 : 1 , 8 : 1 multiplexer using logic gates

b) Realization and working of 1: 2, 1: 4 , 1 : 8 De-multiplexer using logic gates.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Semiconductor Theory	10	02	04	02	08
2	Diode Applications	10	02	04	02	08
3	Special Diodes	04	02	04	02	08
4	Transistor Fundamentals	08	02	05	04	11
5	BJT Biasing	08	02	06	00	08
6	Field Effect Transistor	05	02	03	00	05
7	Introduction to Oscillators	03	02	02	00	04
8	Digital Electronics	16	08	06	04	18
	Total	64	22	34	14	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
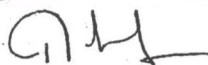
Notes: This specification table shall be treated as a general guideline and actual distribution of

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marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments: (any 12 experiments)

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	1	To construct and test the V-I characteristic of semiconductor P-N diode. Find out static, dynamic resistance and knee voltage of P-N diode. State the maximum output current and PIV of diode.	02
2	2	To construct and test half wave rectifier with and without filter and observe input and output waveforms. Measure input voltage, peak voltage, peak to peak voltage, R.M.S voltage, Average voltage.	02
3	2	To construct and test Full wave Center tapped rectifier with and without filter and observe input and output waveforms. Measure input voltage, peak voltage, peak to peak voltage, R.M.S voltage, Average voltage.	02
4	2	To construct and test Bridge Full wave rectifier with and without filter and observe input and output waveforms. Measure input voltage, peak voltage, peak to peak voltage, R.M.S voltage, Average voltage.	02
5	2	To construct and test clipper circuit (Positive, negative). Observe input and output waveform. Measure input voltage, peak voltage, and peak to peak voltage.	02
6	3	To construct and test the V-I characteristic of Zener diode.	02
7	3	To construct and test Zener regulator. Find out load and line regulation.	02
8	3	To construct and test the V-I characteristics of LED. Find out static and dynamic resistance of LED.	02
9	4	To construct and test input and output characteristics of BJT and Calculate input resistance and output resistance of BJT in CE Mode.	02
10	5	To construct and test the frequency response of single stage CE amplifier and Calculate gain bandwidth product of given circuit.	04
11	6	To construct and test the output characteristic of FET. Label and interpret the various parameters on it.	02
12	8	To construct, test and verify truth table of AND, OR, NOT, NAND, NOR, Ex-OR and Ex-NOR gate.	02
13	8	To construct, test and verify truth table of RS/JK flip flop using ICs.	02
14	8	To construct, test and verify MUX/DEMUX.	02
15	8	To construct, test MOD-n asynchronous/synchronous counter and verify its operations.	02
		Total	**32**

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References/ Books:
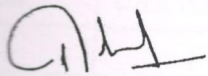
Sr.No.	Name of Book	Author	Publisher
1	A text book of Applied Electronics	R. S. Sedha	S. Chand and Co. Ltd.
2	Electronic Devices and circuits	Allen Mottershead	Prentice Hall of India Ltd.
3	Basic Electronics	Bernard Grob	McGraw Hill
4	Principles of Electronics	V. K. Mehta	S. Chand and Co. Ltd.
5	Electronic Device and circuit	G. K. Mitthal	Khanna publishers
6	Electronic Principles	Albert Malvino	Tata McGraw Hill
7	Basic Electronic and Linear circuit	N. N. Bhargava, S. C. Gupta	Tata McGraw Hill

Course Curriculum Development Committee:

a. **Internal Faculty**

      i. Mr.S.R.Aher

     ii. Ms. Monali B. Ghodke

    iii. Ms.Avanti S.Pawar

b. **External Faculty**

      i.Mr.Ghadyalji

Academic Coordinator
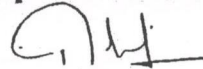
(R. A. Patil)

Head of Department

Principal
Govt. polytechnic Mumbai

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Academic Co-ordinator
G. P. Mumbai

Course Name:- Elements of Electronics Engineering   **Course Code:-EC16202**

CO Vs PO matrix
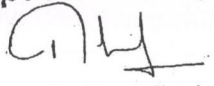
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-
CO3	-	2	1	-	-	-	-	-	-	-
CO4	3	2	1	2	-	-	-	-	-	-
CO5	-	3	3	-	-	-	-	-	-	-

CO Vs PSO matrix

	CO/PSOs	PSO1	PSO2	PSO3
CO1	Learn the fundamentals of electronics.	3	-	-
CO2	Know the principle of diodes and transistors. Understand the construction and materials used for diodes and transistors.	2	1	-
CO3	Identify the components from their configuration and sketch their symbols.	-	3	2
CO4	Evaluate the characteristics of electronic components	-	-	-
CO5	Assemble, test and analyze basic circuits such as rectifiers, amplifiers, clipper, oscillator etc.	-	3	2

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Semiconductor Theory	CO1,CO2, CO3,CO4
2	2	Diode Applications	CO1, CO2,CO3, CO5
3	3	Special Diodes	CO1, CO2, CO3
4	4	Transistor Fundamentals	CO1, CO2, CO3,CO4
5	5	BJT Biasing	CO2, CO5
6	6	Field Effect Transistor	CO1, CO2, CO3
7	7	Introduction to Oscillators	CO1, CO2
8	8	Digital Electronics	CO1

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Programme : ME/CE/EC/CO/IF/IS/EE/RT/LT/LGFT									
Course Code: ME16201				Course Title: **Engineering Drawing - I**					
Compulsory / Optional: Compulsory									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
2	-	4	6	-	-	50*	-	50	100

* Assessment by both internal & external examiner.

Rationale:

Engineering drawing is the graphical language of engineers, designers, planners, supervisors and technicians to express their thoughts, ideas and concepts used in it. Engineering drawing offers students an insight into the methods of exploring engineering problems. It imbibes the principles of accuracy and exactness with regard to the information necessary for the production of an engineering component. This preliminary course aims at building a foundation for the further course in drawing and other allied subjects. This subject is useful in developing imagination, drafting and sketching skills of students.
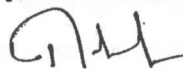
Course Outcomes: Student should be able to,

CO1	Effectively use drawing instruments for enhancing speed and accuracy in drawing.
CO2	Construct different engineering curves and know their applications.
CO3	Draw Orthographic Projections of solids with given orientation.
CO4	Visualize three dimensional objects and draw Isometric Projections.
CO5	Draw the free hand sketches of different thread forms, bolts, screws and nuts.

Course Content Details:

Unit No.	Topics / Sub-topics
1	**Principles of Drawing** : Drawing Instruments and their uses, Standard sizes of drawing sheets (ISO-A series), Letters and numbers (single stroke vertical), Convention of lines and their applications, Scale (reduced, enlarged & full size), Dimensioning as per SP-46 (Latest edition), Simple geometrical constructions, Redrawing figures using above geometrical construction.

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|	
2	**Engineering curves & Loci of Points:** To draw an ellipse by Arcs of circle method & Concentric circles method, To draw a parabola and hyperbola by Directrix and focus method. To draw involutes of circle & pentagon, To draw a cycloid, Loci of points of Single slider crank mechanism with given specifications.
3	**Orthographic projections:** Introduction to Orthographic projections, Conversion of pictorial view into Orthographic views (first angle projection method only) – elevation, plan and end view, Types of sections and Conversion of pictorial view into sectional orthographic views. (Complete object involving slots, threads, ribs etc;.)
4	**Isometric projections:** Isometric scale, comparison of true scale with isometric scale, Conversion of orthographic views into isometric view/projection. (complete object involving slots, ribs, holes etc.;)
5	**Freehand Sketches:** Draw neat & proportionate free hand sketches of given elements and understands its function and use. Different types of thread forms, nuts, bolts, screws and foundation bolts (Rag, Eye and Lewis type).

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Practical Marks			
			R Level	U Level	A Level	Total Marks
1	Principles of Drawing	04	06	-	-	06
2	Engineering curves & Loci of Points	08	-	08	-	08
3	Orthographic projections	08	-	-	14	14
4	Isometric projections	08	-	-	14	14
5	Freehand Sketches	04	08	-	-	08
	Total	32	14	08	28	50

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

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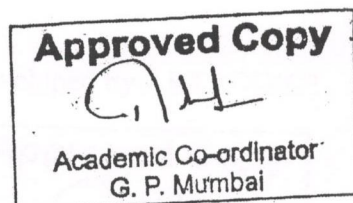
List of Sheets/Assignments:

Sr. No.	Unit No.	Sheets /Assignment	Approx. Hours
1	1	Drawing types of lines, problems on redraw figures & geometrical construction.	08
2	2	Engineering curves & Loci of Points (Minimum four problems)	08
3	3	Orthographic projection of objects by first angle method of projection. (Minimum two problems)	10
4	3	Orthographic projection with section of objects using first angle method of projection. (Minimum two problems)	10
5	4	To draw Isometric planes, Isometric projections with Isometric scale. (Minimum two objects)	10
6	4	To draw Isometric views of objects including slots, holes and sloping faces. (Minimum two objects)	10
7	5	Free hand sketches of different types of thread forms, nuts, bolts and screws.	08
		Total	64

Assignment:– *Assignments on above five topics to be given.*

Note: *Practical examination will be conducted based on the question bank provided.*

References/ Books:
1. Books:

Sr. No.	Name of Book	Author	Publisher
1	Engineering Drawing	N. D. Bhatt	Charotar Publishing House 2010
2	Engineering Drawing	Amar Pathak	Dreamtech Press, 2010
3	Engineering Drawing	D. Jolhe	Tata McGraw Hill Edu., 2010
4	Text Book on Engineering Drawing	K. L. Narayan, P. Kannaiah	Scitech Publications, 24th Reprint August 2011
5	Engineering Drawing and Graphics + AutoCAD	K. Venugopal	New Age Publication, Reprint 2006.
6	Engineering Drawing practice for schools and colleges	IS Codes SP – 46.	-

2. Video Cassettes / CD's

1. Instructional / Learning CD developed by ARTADDICT.

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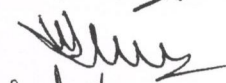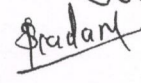
Academic Co-ordinator

Course Curriculum Development Committee:
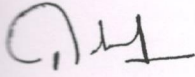
a. **Internal Faculty**

       1. Dr. S. B. Mahagaonkar (LME, G. P. Mumbai)

       2. Mr. K. B. Salunke (LME, G. P. Mumbai)

       3. Mr. S. P. Kadam (LME, G. P. Mumbai)

b. **External Faculty**

       1. Mr. K. V. Patil (LME, G. P. Thane)

Academic Coordinator
(R. A. Patil)

Head of Department
(Mechanical Engineering)

Principal
Govt. polytechnic Mumbai

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Academic Co-ordinator
G. P. Mumbai

Programme : **Diploma in CO /CE/ EE/EC/ IF/IS/LT/ME/RT/LGFT**									
Course Code: **NC16102**				Course Title: **Social Work**					
Compulsory / Optional: Compulsory									
Teaching Scheme				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
--	---	3	3	---	---	---	---	---	---

Rationale :

The programme aims to inculcate social welfare in students, and to provide service to society without bias. NSS volunteers work to ensure that everyone who is needy gets help to enhance their standard of living and lead a life of dignity. In doing so, volunteers learn from people in villages how to lead a good life despite a scarcity of resources. it also provides help in natural and man-made disasters by providing food, clothing and first aid to the disaster victims.

Course Outcomes:

After the completion of the course student will be able to

CO1	Understand the community in which they work & themselves in relation to their community
CO2	Identify the needs and problems of the community and involve them in problem-solving. Acquire leadership qualities and democratic attitudes.
CO3	Develop sense of social and civic responsibility, gain skills in mobilizing community.
CO4	Develop capacity to meet emergencies and natural disasters and practice national integration and social harmony

Course Content Details:

Unit No	Topics / Subtopics	Hours
1	**Institute Level Activity:** 1.1 Tree Plantation 1.2 Play Ground Forming 1.3 Energy Audit 1.4 Nature Awareness 1.5 Tree Counting 1.6 Hunting Hazard	05

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Social Work

Course code : NC16102

2	**Institute Organized Initiative:** 1.1 Energy Consumption 1.2 Save Girl Child 1.3 Road Safety 1.4 Child Labour 1.5 Drug Addiction 1.6 Road Show 1.7 Child Marriage 1.8 Poster Making 1.9 Dowry 1.10 Unemployment	15
3	**Visit Arrangement:** 1.1 Visit to Old Age Home 1.2 Visit to any Village 1.3 Visit Orphanage (Children Home)	15
4	**Metropolitan Level Activity :** 1.1 Blood Donation Camp 1.2 Health Checkup Camp 1.3 General Awareness 1.4 New Technology 1.5 Woman's Empowerment	05
5	**National Administration Initiative For Natural/Artificial calamities:** 1.1 Earthquake 1.2 Flood 1.3 Storm 1.4 Draught 1.5 Heavy Rain Fall	05

Course Curriculum Development Committee:
1. Mrs. S.R.Nagargoje (Lecturer in Electronics)
2. Mrs. S.D.Kapse(Lecturer in Instrumentation)
3. Mrs.S.B.Puri(Lecturer in Electronics)

Academic Coordinator
(Dr. R A. Patil)

Head of Department
Department of Computer Engineering

Principal
Govt. Polytechnic Mumbai

Social Work

Course code : NC16102

Programme : **Diploma in Computer Engineering**								
Course Code: **NC16202**				Course Title: **Digital India**				
Compulsory / Optional: **Compulsory.**								
Teaching Scheme and Credits				Examination Scheme				
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
	03		03						

*External Examiner

Rationale: The Digital India programme is a flagship programme of the Government of India with a vision to transform India into a digitally empowered society and knowledge economy. In order to transform the entire ecosystem of public services through the use of information technology. the Government of India has launched the Digital India programme with the vision to transform India into a digitally empowered society and knowledge economy.

Course Outcomes:

Student should be able to:

CO1	Describe Digital India Mission
CO2	Know the Digital Financial Services.
CO3	Interact with people in society to share thoughts about Digital India
CO4	Create Digital Locker Sign in and other Digital Services

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Digital India** 1.1 Vision and Mission of Digital India 1.2 Digital India Initiative 1.3 Approach and Methodology for Digital India Programme 1.4 Management Structure for Digital India Programme **1.5** Pillars of Digital India
2	**e-Governance** 2.1 Definition of e-Governance, 2.2 Pillars of e-Governance, 2.3 Infrastructure for e Governance, 2.4 Mission Mode Projects (At least 5), 2.5 Familiarization with terminology like change management, processing engineering, Govt. Processing engineering and Governance, 2.6 e Governance project life cycle, electronically delivery of services, messaging system and case study of any 5 public utility portal related with the Department (especially, public grievance redressal system, RTI, Vigilance, Department working and financial inclusion, linkage with Aadhar etc.)

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NC16202

3	**Electronic Commerce**
	3.1 Digital Literacy to understand the concept of Online Banking Make bill payments, Make money transaction through online banking,
	3.2 book train and bus tickets,
	3.3 Seek information on agricultural operations and land records, and interact with employment exchange, municipalities, grampanchayat, police and passport offices.
4	**Digital Financial Services**
	4.1 Cards
	4.2 USSD (Unstructured Supplementary Service Data)
	4.3 AEPS stands for Aadhar Enabled Payment System
	4.4 UPI (Unified Payments Interface)
	4.5 e-Wallet
	Case Study On BHIM APP
5	**Digital Locker**
	5.1 Sign Up with Internet/ Mobile.
	5.2 Sync your Aadhaar
	5.3 Get documents from Issuers
	5.4 Share documents with Requesters
6	**Everything Digital**
	6.1 National Digital Library of India
	6.2 Digital Marketing
	6.3 Digital Education
	6.4 E Governance App Store
	Case Study on aaplesarkar website/App

Course Curriculum Development Committee:

1. Mr. M.H.Bhalerao(Lecturer in Computer Engg)
2. Ms. A.J.Bhat(Lecturer in Computer Engg)
3. Ms.V.S.Pawar(Lecturer in Electronics)

Academic Coordinator
(Dr. R. A. Patil)

Head of Department
(Computer Engineering)

Principal
Govt. polytechnic Mumbai

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G. P. Mumbai

Digital India   NC16202

Programme : Diploma in Computer Engineering									
Course Code: NC16202				Course Title: Digital India					
Compulsory / Optional: Compulsory.									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
	03		03						

*External Examiner

Rationale: The Digital India programme is a flagship programme of the Government of India with a vision to transform India into a digitally empowered society and knowledge economy. In order to transform the entire ecosystem of public services through the use of information technology, the Government of India has launched the Digital India programme with the vision to transform India into a digitally empowered society and knowledge economy.
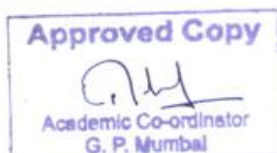
Course Outcomes:

Student should be able to:

CO1	Describe Digital India Mission
CO2	Know the Digital Financial Services.
CO3	Interact with people in society to share thoughts about Digital India
CO4	Create Digital Locker Sign in and other Digital Services

Course Content Details:

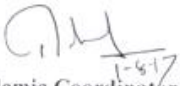| Unit No	Topics / Sub-topics
1	**Introduction to Digital India** 1.1 Vision and Mission of Digital India 1.2 Digital India Initiative 1.3 Approach and Methodology for Digital India Programme 1.4 Management Structure for Digital India Programme **1.5** Pillars of Digital India
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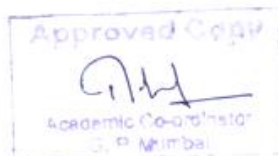| 3	**Electronic Commerce**
	3.1 Digital Literacy to understand the concept of Online Banking Make bill payments, Make money transaction through online banking,
	3.2 book train and bus tickets,
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	4.2 USSD (Unstructured Supplementary Service Data)
	4.3 AEPS stands for Aadhar Enabled Payment System
	4.4 UPI (Unified Payments Interface)
	4.5 e-Wallet
	Case Study On BHIM APP
5	**Digital Locker**
	5.1 Sign Up with Internet/ Mobile.
	5.2 Sync your Aadhaar
	5.3 Get documents from Issuers
	5.4 Share documents with Requesters
6	**Everything Digital**
	6.1 National Digital Library of India
	6.2 Digital Marketing
	6.3 Digital Education
	6.4 E Governance App Store
	Case Study on aaplesarkar website/App

Course Curriculum Development Committee:
1. Mr. M.H.Bhalerao(Lecturer in Computer Engg)
2. Ms. A.J.Bhat(Lecturer in Computer Engg)
3. Ms.V.S.Pawar(Lecturer in Electronics)

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Principal
Govt. polytechnic Mumbai

Approved for

Academic Co-ordinator
G P Mumbai

Digital India   NC16202

Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum
[Out Come Based (OBE)]

Semester-III
(Course Contents)

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

gpmumbai@gpmumbai.ac.in

Programme: Electrical Engineering   **Third Semester**   **With effect from June 2017**

Teaching & Examination Scheme for the Students admitted in Second Year in 2017-18

Semester : III

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory/ Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 208	Electrical Materials & Wiring	0	C	2	0	2	4	0	0	0	75*	25	100
2	EE 16 209	Electrical Measurement	0	C	3	0	4	7	70	30	50*	0	0	150
3	EE 16 210	Electrical Power Generation#	0	C	4	0	0	4	70#	30#	0	0	0	100#
4	ME 16 211	Elements of Mechanical Engineering	0	C	2	0	2	4	0	0	0	50*	0	50
5	HU 16 104	Environmental Studies	0	C	0	2	0	2	0	0	0	25*	25	50
6	EE 16 211	Electrical Circuit & Network	0	C	3	2	2	7	70	30	50*	0	50	200
7	EE 16 212	DC Machine & Transformer	0	C	3	2	2	7	70	30	50*	0	50	200
					17	6	12		280	120	150	150	150	
	Total Credits							35	**Total Marks**					850

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
   *Indicates assessment by External Examiner. # Indicates on line theory exam.

Academic Coordinator   **HOD (EE)**   **Principal**

Programme Code: EE												
Course Code: EE 16 208				**Course Title: Electrical Materials and Wiring**								
Compulsory / Optional: Compulsory												
Teaching Scheme and Credits				**Duration of Examination**			**Examination Scheme**					
TH	TU	PR	Total	TH	TS	PR	TH	TS	PR	OR	TW	Total
02	--	02	04	--	--	--	--	--	--	75*	25	100
(*) indicates assessment by External examiners												

Rationale:

Basic knowledge of materials used in electrical engineering is essential for an electrical engineer. Also the knowledge of wiring accessories, wiring methods is vital for an electrical engineer. This subject is intended to develop skills of wiring and testing in the electrical wiring installations. This subject also gives insight of Electrical Engineering Materials.

Course Outcomes:

EE 16 208.1	List Physical , Mechanical and Electrical properties of electrical conducting materials
EE 16 208.2	List Thermal , Mechanical and Electrical properties of electrical insulating materials
EE 16 208.3	Classify insulating materials based on temperature withstanding ability
EE 16 208.4	Categorize magnetic materials
EE 16 208.5	Make up different types of wiring

Contents:

01	**Classification of electrical materials.**
1.1	Importance of Materials in Electrical Engineering
02	**Conducting Materials (Physical, Mechanical and Electrical properties):**
2.1	Current Carrying Conducting Materials(Copper, Aluminum, Bronze and Iron)
2.2	Non Current Carrying Conducting Materials(Cast iron, Cast Steel,etc)
03	**Insulating Materials(Thermal , Mechanical and Electrical properties):**
3.1	Classification on basis of state of materials as solid ,liquid gaseous insulating materials (Introduction and applications)
3.2	Classification on the basis of temperature withstanding ability such as Y (O), A, E, B, F,H and C type with list of insulating materials in each type.
3.3	Effect of Nano Technology on properties of materials
04	**Magnetic Material (Introduction and Applications)**
4.1	Classification of magnetic material as Paramagnetic, Diamagnetic and Ferromagnetic material
	• C.R.G.O. Silicon Steel
	• H.R.G.O. Silicon Steel
	• Amorphous Metal
05	**Wiring**
5.1	Classification of electrical installations
5.2	General requirements of electrical installation

5.3	Reading & interpretation of electrical engineering drawings & symbols related to installations
5.4	Types of Wires – PVC, CTS, TRS , Lead Sheathed, flexible, multicore, single strand, multi-strand
06	**Methods of Wiring and Different types of Wiring systems**
6.1	Methods of Electrical Wiring systems w.r.t taking connection
6.2	Joint Box or Tee or Jointing system
6.3	Loop-in or Looping system
	6.3.1 Advantages of loop-in method of wiring
	6.3.2 Disadvantages of loop-in method of wiring
6.4	Different types of Electrical wiring systems
6.5	Cleat Wiring
	6.5.1 Advantages of Cleat wiring
	6.5.2 Disadvantages of Cleat wiring
6.6	Casing and Capping wiring
	6.6.1 Advantages of Casing and Capping wiring
	6.6.2 Disadvantages of Casing and Capping wiring
6.7	Batten wiring (CTS/ TRS)
	6.7.1 Advantages of Batten wiring
	6.7.2 Disadvantages of Batten wiring
6.8	Lead sheathed wiring
6.9	Conduit wiring
	6.9.1 Surface conduit wiring
	6.9.2 Concealed conduit wiring
6.10	Types of Conduit
	6.10.1 Metallic conduit
	6.10.2 Nonmetallic conduit
6.11	Advantages of Conduit wiring system
6.12	Disadvantages of Conduit wiring system
6.13	Comparison between different Wiring systems

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Classification of electrical materials	2				
2	Conducting Materials (Physical, Mechanical and Electrical properties)	6				
3	Insulating Materials(Thermal , Mechanical and Electrical properties)	6				
4	Magnetic Material (Introduction and Applications)	6				
5	Wiring	4				
6	Methods of Wiring and Different types of Wiring systems	8				
	Total	32				

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Practical's: - Out of following 10 practicals are compulsory

Sr,No.	Unit	Experiment/Assignment	Approx-Hours
1	5	Identify the different types of fuses with their applications.	2
2	5	Draw diagrams of different wiring accessories.	4
3	5	Identify samples of different types of wires.	2
4	6	Build wiring circuit for one lamp controlled by one switch	2
5	6	Build a sample staircase wiring	2
6	6	Build a sample godown wiring	2
7	6	Build a sample cleat wiring	2
8	6	Build a sample Casing Capping wiring	2
9	6	Build a sample batten wiring	2
10	6	Build a sample Conduit wiring	2
11	6	Trace and draw a electrical installation of a classroom	2
12	6	Trace and draw a electrical installation of a laboratory / workshop	2
13	2	Identify the current carrying conducting material in at least five electrical accessories / devices.	2
14	4	Identify the magnetic material in a given electrical motor, Electric choke/ballast.	2
15	3	Identify the name and class of insulation of insulating material in any five electrical accessories / equipment/ instrument/ device	2

Reference Books:

a) Books

Sr. No.	Book Title	Author	Publication
1	An introduction to Electrical Engineering Materials	C.S.Indulkar	S.Chand, New Delhi
2	Electrical Wiring estimating and costing	S.L.Uppal	Dhanpat Rai and Sons

b) Softwares/ Websites

1. http://www.electricaltechnology.org/2015/09/types-of-wiring-systems-electrical-wiring-methods.html

Course Curriculum Development Committee:

   a. **Internal Faculty**

        i. Dr.M.S.Narkhede

        ii. Dr.P.N.Padghan

   b. **External Faculty**

        i. Dr.S.V.Bhangale (Lecturer, Government Polytechnic , Nashik)

Academic Coordinator   **Head of Department**   **Principal**
                             Electrical Engineering Dept.   **Govt. Polytechnic Mumbai**

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 208.1	1	2	--	--	--	--	--	--	--	--
EE 16 208.2	1	2	--	--	--	--	--	--	--	--
EE 16 208.3	1	2	--	--	--	--	--	--	--	--
EE 16 208.4	1	2	--	--	--	--	--	--	--	--
EE 16 208.5	3	2	3	1	--	1	--	--	--	--

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE 16 208.1	--	1	1
EE 16 208.2	--	1	1
EE 16 208.3	--	1	1
EE 16 208.4	--	1	1
EE 16 208.5	3	--	3

Enter correlation levels 1, 2 or 3 as defined below:

1: Slight (Low)   2: Moderate (Medium)   3: Substantial (High) *If there is no correlation, put "-"*

Programme Code: **EE**								
Course Code: **EE 16 209**		Course Title: **Electrical Measurement**						
Compulsory / Optional: **Compulsory**								
Teaching Scheme and Credits				Examination Scheme				
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	**--**	**4**	**7**	**70(3 Hrs)**	**30**	**50***	**--**	**--**	**150**

Rationale:

This is the subject where the concepts, facts, principles and applications of electrical measurements are studied. These are necessary for experimentation in electrical engineering and also for achieving high degree of accuracy in experimentation. This course is necessary for applications in the field of measurements.

Course Outcomes:

EE 16 209.1	Define terminology used in electrical measuring instruments.
EE 16 209.2	Demonstrate various constructional parts of electrical measuring instruments with working principles.
EE 16 209.3	Measure electrical quantities with various instruments.
EE 16 209.4	Explain calibration procedure of electrical measuring instruments.
EE 16 209.5	Select suitable measuring instruments for particular application.

Unit No.	Topics/ Sub Topics:

1	**Basic Concepts:**
	1.1 Purpose of measurement & significance of measurement.
	1.2 Various effects of electricity employed in electrical measuring instruments.
	1.3 Characteristics of Instruments: <u>Static</u>- Accuracy, Precision, sensitivity, resolution, Static error, Repeatability, Drift, Dead zone. <u>Dynamic</u>- speed of response, Lag, Fidelity, Dynamic error.
	1.4 Types of static error- Gross, Systematic, Random.
	1.5 Classification of instruments based on –
	    a) Electrical effects.
	    b) Nature of operation.
	    c) Limits of permissible errors.
	1.6 Different types of torque in Analog Instruments.

2	**Measurement of Current and Voltage:** 2.1 Construction and principle of PMMC, MI & Electro-dynamometer type Instrument. Merits and demerits. 2.2 Methods of production of torque. 2.3 Extension of Range of Ammeter and Voltmeter. (Simple Numerical) 2.4 Different methods of Extension of Range of Ammeter and Voltmeter. 2.5 Errors and their compensation. 2.6 Calibration of Ammeter and Voltmeter. 2.7 Clamp on meter construction and working. 2.8 Digital ammeters and voltmeters, application.

3	**Instrument Transformers:** 3.1 Construction, theory and errors in CT and PT. 3.2 Effect of secondary of CT open circuited. 3.3 Use of CT and PT for extension of ranges. 3.4 Specifying a CT and PT Polarity.
4	**Measurement of Power:** 4.1 Concept of power in A.C. Circuit. 4.2 Principle and Construction of dynamometer type wattmeter 4.3 Errors and their compensation. 4.4 Poly phase wattmeter. 4.5 Measurements of power in 3 phase circuit for balanced and unbalanced load 4.6 Effect of power factor variation on wattmeter readings in two wattmeter method. 4.7 Measurement of reactive power in three phase balanced load by one wattmeter method and two wattmeter method. 4.8 Digital Wattmeter – Principle, Block Diagram, advantages
5	**Measurement of Electrical Energy:** 5.1 Concept of electrical energy. 5.2 Constructional feature & principle of working of single phase and three-phase induction type energy meter. 5.3 Constructional feature & principle of working of single phase and three-phase bidirectional (Import-Export type) energy meter. 5.4 Different types of errors and their compensation. 5.5 Calibration of energy meter. 5.6 Electronic energy meter. 5.7 Tri vector meter- Construction, working and Applications.
6	**Measurement of Resistance, Inductance and Capacitance:** 6.1 Classification of Resistance- Low, Medium and High. 6.2 Methods of Measurements of Low, Medium and High Resistance (Potentiometer, Wheatstone's bridge and Megger) 6.3 Measurement of Earth resistance- Earth tester (Analog & Digital) 6.4 Measurement of Transmission tower footing resistance. 6.5 Digital Multimeter. 6.6 L.C.R. Meter – Block diagram and working 6.7 Testing of faults in cable.
7	**Oscilloscope** 7.1 Block diagram study of CRO 7.2 Lissajous pattern, use of these in phase & frequency measurements. 7.3 Concept of Dual trace, dual beam, Sampling, storage, Digital read-out oscilloscope.
8	**Other Meters:** 8.1 Single phase and three phase Power Factor Meter (only dynamometer type). 8.2 Frequency meter (Weston and Ferro dynamic type). 8.3 Digital Frequency Meter.

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Basic Concepts	04	04	02	00	06
2	Measurement of Current and Voltage:	08	02	06	04	12
3	Instrument Transformers	04	02	04	00	06
4	Single phase transformer.	10	04	04	04	12
5	Measurement of Electrical Energy:	06	06	04	00	10
6	Measurement of Resistance, Inductance and Capacitance	08	02	06	04	12
7	Oscilloscope	04	04	02	00	06
8	Other Meters	04	04	02	00	06
		48	**28**	**30**	**12**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Experiments

Sr. No.	Unit No.	Experiment/Assignment	Approx Hours
1	2	To study the constructional details of PMMC and MI instruments.	02
2	2	To measure high value of DC current by low range ammeter with shunt.	02
3	2	To measure high value of DC voltage by low range voltmeter with multiplier.	02
4	3	i) To measure high value of AC current by low range ammeter with CT. ii) To measure high value of AC voltage by low range voltmeter with PT.	02
5	4	To measure active and reactive power in three phase balanced load by one wattmeter method.	02
6	4	To measure active power in three phase balanced and unbalanced load by two wattmeter method and observe the effect of power factor variation on wattmeter reading.	02
7	5	To calibrate and use single phase energy meter.	02
8	6	To measure medium resistance by Wheatstone's bridge.	02
9	4	i) To measure insulation resistance by Megger. ii) To measure Earth resistance by earth tester. (Substation / Earth pit.)	02
10	6	To measure electrical quantities by digital multimeter and clamp on meter.	02

11	8	i) To measure frequency of AC supply. ii) To measure power factor of single phase and three phase load.	02
12	6	To measure circuit parameters by LCR meter.	02
13	7	To measure voltage and frequency of single phase a.c. voltage.	02

Reference Books:

Sr. No.	Name of Book	Author	Publisher
1	Electrical and Electronics Measurements and Instrumentation	A. K. Sawhney	Dhanapat Rai and Co., New Delhi
2	Electrical Measurements and Measuring Instruments	Golding and Viddis	A. H. Wheeler & Co. Ltd, New Delhi
3	Methods of Electrical Measurements	C.T. Baldwin	Blakie Publications, London

Course Curriculum Development Committee:

a. **Internal Faculty**

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   ii. Dr. M.S. Narkhede

b. **External Faculty**

   i. Dr. M.A. Ali (LEE, Govt. Polytechnic, Aurangabad)

Academic Coordinator   **Head of Department**   **Principal**

                        (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 209.1	3	2	1	2	2	2	2	-	-	2
EE 16 209.2	3	3	3	3	3	2	2	-	-	3
EE 16 209.3	3	3	3	3	3	3	2	-	-	3
EE 16 209.4	3	3	3	3	2	2	2	-	-	3
EE 16 209.5	3	3	3	3	2	2	2	-	-	3
Avg. of POs	3	3	3	3	3	2	2	-	-	3

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE 16 209.1	2	1	1
EE 16 209.2	3	3	3
EE 16 209.3	3	3	3
EE 16 209.4	3	2	2
EE 16 209.5	3	2	2
Avg. of PSOs	3	2	2

Programme Code: **EE**									
Course Code: **EE 16 210**			Course Title: **Electrical Power Generation**#						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
04		**--**	**04**	**70**#	**30**#	**--**	**--**	**--**	**100**

(#) - indicates on line exam

Rationale:

This is the subject where the principles of electrical power generation systems are studied. Knowledge of different methods of generation of electricity and recent trends in the field is necessary for an electrical engineer. In this course, student will learn various method of generating power with function, location of equipment involved in power system operation. It also deals with economics of generation.

Course Outcomes:

The students will be able to

EE 16 210.1	Recall the principle of generation of electrical power and importance of grid system.
EE 16 210.2	Illustrate working , location of main equipment in different power plants
EE 16 210.3	Construct block diagram of different power plants.
EE 16 210.4	Compare different types of power plants.
EE 16 210.5	Interpret energy bills for different customers using various tariffs.

Contents:

1 : Introduction:
    1.1 Need of energy.
    1.2 Electrical energy system.
    1.3 Voltage level in AC Network.
    1.4 Primary Conventional and non-conventional energy resources and energy conversion processes.
    1.5 Types of generating stations.
    1.6 Terms related to power generation: Energy resources, fuel, Pollution,   Thermal efficiency, Thermodynamics, combined cycle plant, Installed capacity, Fossil fuels.
    1.7 Interconnected power system.
    1.8 National Grid of India.

2 : Thermal Power Stations:
    2.1 Introduction
          − Installed capacity in Maharashtra state, India
    2.2 Selection of site for thermal power stations.
    2.3 General layout of thermal power station.
    2.4 Thermodynamic cycle
          − Definition, diagram.
          − Typical values of steam at turbine inlet

− Efficiency of Rankine cycle.
2.5 Main equipment in thermal power plant:
   2.5.1 Coal storage and Handling plant
      − Function
      − Types of coal in order of heat value.
      − Equipment used in coal handling plant.
      − Location of coal storage and handling plant
   2.5.2 Ash storage and handling plant:
      − Function
      − Problems in Ash handling plant in India
      − Classification of modern ash handling system
      − Location of Ash storage and handling plant
   2.5.3 Steam Boilers:
      − Function
      − Requirement of Boiler
      − Types of Boiler: fire tube boiler, water tube boiler, Fluidized Bed Combustion boiler (FBCB).
      − Location of steam boiler
   2.5.4 Function, Types, Location of following equipment: superheater, Economiser, Air Preheater, Steam turbines, Condensers.
   2.5.5 Feed Water circuit
   2.5.6 Cooling water systems.
   2.5.7 Turbine Governing
2.6 Pollution control: problems of Dust collection from flue gases, types of pollution control, Electrostatic Precipitator
2.7 Advantages and disadvantages of thermal power plant.
2.8 List of Thermal power plant in India, Maharashtra.

3 : Hydro-electric Power Plants:
   3.1 Introduction
      − Installed capacity in Maharashtra state, India
   3.2 Classification of hydroelectric power plants.
   3.3 Selection of site for hydroelectric power plants.
   3.4 General layout of hydroelectric power plants.
   3.5 Function and location of following component: Reservoir, Dam, Spill ways, Intake, Forebay, Penstock, Surge tank, Turbine, Power house, Draft tube.
   3.6 Classification of turbine based on i) Head ii) Discharge iii) Direction of flow iv) Pressure v) Specific Speed
   3.7 Governing of Turbine.
   3.8 Advantages and limitations of Hydro-electric power plant
   3.9 List of Hydro-electric Power Plants in India, Maharashtra

4 : Nuclear Power Plants:
   4.1 Introduction
   4.2 Basic definitions: Nuclear Fission, Fusion, Fissionable Materials, Fissile Material, Chain reaction, Moderators.
   4.3 Fuels for nuclear fission reactor
   4.4 Nuclear Energy Released by Fission
   4.5 Site selection of nuclear power plant
   4.6 Nuclear Reactor: basic component of nuclear reactor with function.
   4.7 Types of nuclear reactor power plants.
   4.8 General Layout of Nuclear power station.

4.9 Working of Nuclear Reactor: BWR-PP, PHWR-PP, and LM-FBR.
4.10 Nuclear reactor waste management.
4.11 Advantages and disadvantages of Nuclear power plant.
4.12 list of nuclear power plant in Maharashtra.
4.13 Comparison with thermal and Hydro-electric power

5 : Diesel Power Stations:
5.1 Introduction
5.2 General layout of Diesel Power Station.
5.3 Main component of Diesel power plant.
5.4 Major parts and working of Diesel Engine.
5.5 Applications of diesel power stations

6:Combined Cycle Power Plants
6.1 Introduction
6.2 General layout of combined cycle power plant.
6.3 major component of combined cycle power plant.
6.4 Advantages and disadvantages of combined cycle power plant
6.5 Applications of combined cycle power plant.
6.6 Example of combined cycle power plants in India

7: Economics Of Power Generation:
7.1 Connected load, Actual load, Load-curve, Load duration curve, Integrated
    load duration curve. (Simple numerical)
7.2 Definition of following:
     Plant Factor and reserves, Maximum demand factor, Load Factor, Diversity Factor, plant factor,
    capacity factor, connected load factor (Simple numerical)
7.3 Concept of Load forecasting: short term and long term.
7.4 Cost of Generation: Power Project cost – Fixed, Running, Annual, Break
    even
7.5 Tariffs: definition, types, factors deciding tariffs structure. (Simple
     Numerical)
7.6 Interpretation of electric bills. (Domestic and Industrial)

Note: Visit to minimum two types of power plants with report writing.

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction	04	2	2		4
2	Thermal Power Station	18	4	8	6	18
3	Hydro-Electric Power plant	12	4	4	4	12
4	Nuclear Power Plant	12	4	4	4	12
5	Diesel Power Station	04	2	4		6
6	Combined Cycle Power Plant	04	2	4		6
7	Economics Of Power Generation	10	4	4	4	12
		64	22	30	18	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks

may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

Reference Books:

1. Electrical Power Systems by Dr. S. L. Uppal and Prof. S. Rao, Publisher: Khanna Publishers, New Delhi.
2. Principals of Power Systems by V. K. Mehta and Rohit Mehta, Publisher: S. Chand and Co. Ltd., New Delhi.
3. Non-Conventional Energy Sources by G. D. Rai, Publisher: Khanna Publishers, New Delhi.

Course Curriculum Development Committee:

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       i. Miss. Ashwini V Patil
      ii. Dr.P.N.Padghan

   b. **External Faculty**

       i. Mrs B. S. Motling

Academic Coordinator	**Head of Department** **(Electrical Engineering)**	**Principal** **Govt. Polytechnic, Mumbai**

CO Vs PO Matrix (EE 16302)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 210.1	3	3	2	3	1	2	-	-	-	3
EE 16 210.2	3	3	2	3	2	2	1	-	-	3
EE 16 210.3	3	3	2	2	2	2	1	-	-	3
EE 16 210.4	3	3	2	2	2	3	1	-	-	3
EE 16 210.5	3	3	3	3	3	2	1	-	-	3
Avg. of POs	3	3	2	3	2	2	1	--	--	3

CO Vs PSO Matrix (EE 16302)

CO	PSO1	PSO2	PSO3
EE 16 210.1	2	2	2
EE 16 210.2	3	2	3
EE 16 210.3	3	2	2
EE 16 210.4	3	2	3
EE 16 210.5	3	3	2
Avg. of PSOs	3	2	2

Programme Code: **EE**									
Course Code:**ME16203**			Course Title: **Elements Of Mechanical Engineering**						
Compulsory/Optional			**Compulsory**						
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
02		**02**	**04**	**--**	**--**	**--**		**50 (PA)**	**50**

Rational: Student belonging to electrical engineering is made to learn some fundamentals of mechanical engineering so that they will have basic understanding of mechanical systems, equipments and processes. Finally, it develops the basic knowledge that is so essential to the creation of successful technician.

Course Outcomes: Student should be able to,

CO1	Describe construction, working and principles of turbines, pumps &I.C.Engines.
	Acquire knowledge of mechanical engineering
CO2	Describe the scope of mechanical engineering with multidisciplinary industries.
CO3	Describe and identify common machine element with their functions and power transmitting devices.
CO4	Describe construction and working of boilers and turbines
CO5	Describe construction and working of hydraulic pumps and air compressors.
CO6	Describe construction and working refrigeration and air conditioning equipments.

Topic	Hours	Marks
1.Prime Movers: 1.1Introduction. 1.2Typesof prime movers. 1.3Workingprincipleofexternal combustion engines. 1.4WorkingprincipleofInternal Combustionengines-Constructionandworking of two strokeandfourstrokepetrol and diesel engines. 1.5Selectionof prime movers for applications-Hydraulic pump, air compressor, electric generator, automobile.	**06**	**10**

2. Boilers and Turbines:	**06**	**10**
2.1 Introduction. 2.2 Concept of temperature, heat, and thermal resistance. 2.3 Modes of heat transfer- Conduction, convection, and radiation. 2.4 Steam generation – Types of boilers, boiler mountings and accessories, Types of steam condensers, steam turbines and feed water pumps		
3. Hydraulic Pumps and Air Compressors: 3.1 Introduction. 3.2 Types of hydraulic pumps. 3.3 Construction and working of centrifugal pump and reciprocating pump. 3.4 Selection of pump for different combinations of head and discharge. 3.5 Uses of compressed air. 3.6 Construction and working of single stage reciprocating compressor. 3.7 Construction and working of screw compressor.	**04**	**08**
4. Introduction to Refrigeration and Airconditioning: 4.1 Introduction. 4.2 Vapour compression cycle – Block diagram and components used in VCC. 4.3 Properties of moist air. 4.4 Psychometric processes. 4.5 Construction and working of window airconditioner and split airconditioner.	**04**	**06**
5. Mechanical Drives and mechanisms: **5.1 Mechanisms:** 5.1.1 Definition 5.1.2 machine and structure difference 5.1.3 four bar mechanism and slider crank mechanism 5.1.4 introduction to inversion of mechanism **5.2 Mechanical Drives:** 5.2.1 Types of power transmission drives- Belt, rope, chain and gear drives. 5.2.2 Advantages and disadvantages of Belt, rope, chain and gear drives. 5.2.3 Machine elements used in motion and power transmission- shaft, bearings, coupling, pulleys, and gears. 5.2.4 Types of shaft, bearings, couplings, pulleys, and gears.	**08**	**10**

5.2.5Briefdiscussionof brakes, clutches and their types.		
6.Industrial hydraulics and pneumatics: 6.1 Introduction 6.2 Industrial hydraulics and pneumatics. 6.3Components of hydraulic and pneumatic circuits. 6.4Hydrauliccircuit for shaper. 6.5Pneumaticcircuit for speed control of air motor.	**04**	**06**

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Practical Marks			
			R Level	U Level	A Level	**Total Marks**
1	Prime Movers	06	02	04	04	10
2	Boilers and Turbines	06	02	04	04	10
3	Hydraulic Pumps and Air Compressors	04	02	04	02	08
4	Introduction to Refrigeration and Air-conditioning	04	02	04	-	06
5	Mechanical Drives and mechanisms	08	02	04	04	10
6	Industrial hydraulics and pneumatics	04	-	02	04	06
	Total	**32**	**10**	**22**	**18**	**50**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Practical /Tutorials/Assignments/Visits:

Sr.	**Unit**	**Practical /Tutorials/Assignments/Visits:**	**Approx.**

No.				Hours
1	III	Study of hydraulic power plant.		02
2	I	Study of thermal power plant.		04
3	I	Study of four stroke diesel engine–construction working of four stroke diesel engine.		04
5	I	Study of different types of boilers		04
6	II	Study of boiler mountings and accessories.		02
7	III	Pumps- Selection of appropriate pump		02
8	III	Study of centrifugal pump		02
9	IV	Study vapours compression refrigeration cycle		04
10		Study of window air conditioner		02
11		Study of power transmitting elements: couplings, gears, and bearings.		02
Total				**32**

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Basic mechanical engineering	G.Shanmugam, S. Ravindram	TataMcGrawHill
2	Elements of mechanical engineering	C.S. Chetankumar	S.Chand&Co. Ltd.
3	Engineering Thermodynamics	S.Domkundwar	S.Chand&Co. Ltd.
4	Engineering Thermodynamics	P. K.Nag	TataMcGrawHill
5	Theory of Machines	R. S. Khurmi andJKGupta	S.Chand&Co.Ltd.

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Academic Coordinator　　　**Head of Department**　　　　**Principal**
　　　　　　　　　　　　　　(Mechanical Engineering)　**Govt. Polytechnic Mumbai**

CO VsPO matrix

CO1	Describe construction, working and principles of turbines, pumps &I.C.Engines.
	Acquire knowledge of mechanical engineering
CO2	Describe the scope of mechanical engineering with multidisciplinary industries.
CO3	Describe and identify common machine element with their functions and power transmitting devices.
CO4	Describe construction and working of boilers and turbines
CO5	Describe construction and working of hydraulic pumps and air compressors.
CO6	Describe construction and working refrigeration and air conditioning equipments.

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	3	3	2	2				2	3
CO2	2	2	3	2	2				2	2
CO3	2	2	3	2	2				2	3
CO4	2	3	3	2	2				2	3
CO5	2	3	3	2	2				2	3
CO6	2	3	3	2	2				2	3

CO Vs PSO matrix

	CO/POs	PSO1	PSO2
CO1	Describe construction, working and principles of turbines, pumps &I.C.Engines.	1	2
CO2	Acquire knowledge of mechanical engineering	1	1
CO3	Describe the scope of mechanical engineering with multidisciplinary industries.	1	1
CO4	Describe and identify common machine element with their	2	2

	functions and power transmitting devices.		
CO5	Describe construction and working of boilers and turbines	1	1
CO6	Describe construction and working of hydraulic pumps and air compressors.	1	1

Programme : **Diploma in CE/CO/EC/EE/IT/IS/LG/LT/ME/RT**									
Course Code: **HU16104**				Course Title: **Environmental Studies**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
	2		2			-	25*	25@	50

* Oral exam shall be based on the Term Work

@ TW shall be based on tutorial

Rationale:

Environmental studies is the interdisciplinary academic field which systematically studies human interaction with the environment in the interests of solving complex problems. It is a broad field of study that includes also the natural environment, built environment, and the sets of relationships between them. The turn of the twentieth century saw the gradual onset of its degradation through depletion of resources such as air, water and soil; the destruction of ecosystems and the extinction of wildlife by our callous deeds without any concern for the well-being of our surrounding. We are today facing a grave environmental crisis. It is therefore necessary to study environmental issues to realize how human activities affect the environment and what could possibly be the remedies or precautions which need to be taken to protect the environment.

Course Outcomes:

Student should be able to

CO1	State importance of environment
CO2	Identify key issues about environment
CO3	Analyze the reasons for environment degradation
CO4	Distinguish the various improvement methods
CO5	Identify measures taken by the world bodies to restrict and reduce degradation

Course Content Details:

Unit No	Topics / Sub-topics
1	**Nature of Environmental Studies:** **1.1** Definition, Scope and Importance of the environmental studies **1.2** Importance/significance of the environmental studies irrespective of course **1.3** Need for creating public awareness about environmental issues **1.4** Ways/means/methods of creating public awareness **1.5** Some important terms related with Environmental Studies

2	**Natural Resources and Associated Problems:**
	2.1 Introduction
	2.2 Renewable Resources
	2.3 Forest Resources:
	○ General description of forest resources
	○ Functions and benefits of forest resources
	○ Effects on environment due to over exploitation of forest resources:
	■ Due to deforestation
	■ Due to timber extraction
	■ Due to dams
	■ Due to building of waterways
	2.4 Water Resources:
	○ Hydrosphere: Different sources of water: Surface Water, Ground Water & Frozen Water
	○ Use and overexploitation of surface and ground water
	○ Effect of floods, draught, dams etc. on water resources and community
	2.5 Mineral Resources:
	○ Categories of mineral resources
	○ Basics of mining activities
	○ Mine safety
	○ Effect of mining on environment
	2.6 Food Resources:
	○ Food for all (Food Security)
	○ Effects of modern agriculture
	○ World food problem
	• Case Study: Adverse environmental effect of Bhakra Nangal Dam
3	**Ecosystems:**
	3.1 Concept of Ecosystem
	3.2 Classification
	3.3 Structure and functions of ecosystem: Structure (Components), Functions &Food Chain
	3.4 Energy flow in ecosystem: Gross primary product and Net primary product, Autotrophic levels and Bioaccumulation
	3.5 Major ecosystems in the world
	3.6 Case Study: Silent Spring
4	**Biodiversity and Its Conservation:**
	4.1 Definition of Biodiversity
	4.2 Levels of biodiversity:

	Genetic, Species, Community & Ecosystem 4.3 Value of biodiversity 4.4 Threats to biodiversity: Habitat destruction, Invasive species, Genetic pollution, Overexploitation, Hybridization, Climate change & Overpopulation 4.5 Conservation of biodiversity: In-situ & Ex-situ 4.6 Case Study of any two endangered species

5	**Environmental Pollution:**
	
	5.1 Definition of environmental pollution
	5.2 Air pollution:
	   a. Definition
	   b. Classification: Types of air pollution, Types of air pollutants
	   c. Sources: Anthropogenic & Natural
	   d. Effects: Health effects, Climate change, Global warming, Acid rain, Ozone layer depletion & Photochemical smog
	   e. Prevention: Particulate control, Scrubbers, NOx control, VOC abatement, Acid gas control & Mercury control
	
	5.3 Water Pollution:
	   a. Definition
	   b. Water trivia facts
	   c. Water pollution trivia facts
	   d. Classification: Surface, Groundwater, Oxygen depletion in waters, Nutrient pollution, Microbiological pollution, Suspended matter & Chemical pollution
	   e. Sources/Causes of pollution: Sewage & waste water, Marine dumping, Industrial waste water, Nuclear waste, Oil pollution, Underground storage leakages, Atmospheric deposition and Eutrophication
	   f. Effects of water pollution
	   g. Prevention (What you can do)
	   h. Treating water pollution, Water pollution at home
	
	5.4 Soil Pollution: Definition, sources, effects, prevention
	5.5 Noise Pollution: Definition, sources, effects, prevention
	5.6 Case Study: Bhopal Gas Tragedy and Minamata Disease

6	**Social Issues and Environment:** 6.1 Concept of development 6.2 Sustainable development: Environmental, Economic, Social & Cultural

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		as river / forest / grassland / hill / mountain 2. Visit to a local polluted site: Urban/Rural/Industrial/Agricultural 3. Study of common plants, insects, birds 4. Study of simple ecosystems of ponds, river, hill slopes etc Weightage in Term Work marks-- 05	
		Total	**32**

References/ Books:

Sr. No.	Author	Title	Publisher
01	Anindita Basak	Environmental Studies	Pearson Education
02	R. Rajgopalan	Environmental Studies from Crises to Cure	Oxford University Press
03	Dr. R. J. Ranjit Daniels, Dr. Jagdish Krishnaswamy	Environmental Studies	Wiley India
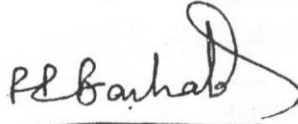
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Head of Department
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Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 211**				Course Title: **Electrical Circuits and Network**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**02**	**02**	**07**	**70 (3 Hrs)**	**30**	**50***	**--**	**50**	**200**

(*) - indicates assessment by External examiner

Rationale:

Students of electrical engineering must know different types of circuits networks and related concepts. It is also necessary that, they should be able to apply appropriate laws or theorems to analyse the various circuits. This is one of the foundation courses which is required to understand the concepts of advanced courses and develop skills that are needed in Electrical field.

Course Outcomes:

EE 16 211.1	Define different terminologies related AC circuits and Poly-phase circuits.
EE 16 211.2	Analyse simple linear DC networks and AC circuit using basic methods and theorem.
EE 16 211.3	Compare the behaviour of resistive inductive and capacitive circuit when AC voltage is applied.
EE 16 211.4	Draw phasor diagram for resistive inductive and capacitive circuit.
EE 16 211.5	Distinguish between active, reactive and apparent power.
EE 16 211.6	Compare star and delta connected system.

Unit No.	Topics/Subtopics

1	**DC Network theorem:**
	1.1 Network Analysis : Direct method, Network reduction method.
	1.2 **Statement, Explanation, and simple Numerical on following theorem**.
	    a) Mesh/Loop analysis
	    b) Nodal analysis
	    c) Superposition theorem
	    d) Thevenin's theorem.
	    e) Nortons's theorem.
	    f) Maximum Power Transfer Theorem.
	    g) Star Delta transformation

2	**AC Fundamentals :**
	2.1:Difference between a.c. and d.c. quantity, Advantages of a.c. over d.c. ,Generation of alternating voltages and currents, Mathematical expression of alternating quantity.
	2.2 Definition of : Waveform, Instantaneous Value, cycle, Alternation, Time period, frequency, amplitude.
	2.3 :Relationship between
	a) Time period and frequency
	b) Angular velocity and frequency
	c) Frequency and speed
	2.4 : Different forms of equation of alternating voltage.
	2.5 Definition of : Peak value, Average value, RMS value, form factor, peak factor for sinusoidal voltage and current.
	2.6 : Concept of phase, phase difference, lagging and leading phasor, Phasor representation of sinusoidal quantity.
	Numericals based on above
3	**Phasor Algebra :**
	3.1Mathematical representation of phasor
	a) Symbolic Notation, significance of operator j.
	b) Trigonometric form
	c) Exponential form
	d) Polar form
	3.2 Conversion from polar to rectangular form and vice versa.
	3.3 Addition, Subtraction, Multiplication and division vector
	Numerical based on above
4	**AC series circuit :**
	4.1 AC through pure resistance: Circuit, Equation, waveform,
	Phasor diagram ,Average power.
	4.2 AC through pure Inductance : Circuit, Equation, waveform, Phasor diagram , Inductive reactance ,Average power.
	4.3 AC through pure capacitance : Circuit, Equation, waveform, Phasor diagram , Capacitive reactance ,Average power.
	4.4 Series RL, RC and RLC circuit: Circuit, phase angle, Impedance, Admittance, Average power, Power curve.
	4.5 Voltage triangle, Impedance triangle, Power triangle, Apparent power, True Power, Reactive power.
	4.6 Resonance in RLC series circuit: Derivation of resonance frequency, Effect of frequency on R,XL,XC, Z and current, quality factor, resonance curve .
	Numerical based on above
5	**AC Parallel Circuit :**
	5.1 Concept of parallel circuit.
	5.2 Admittance, susceptance and conductance.
	5.3 Solving parallel circuits by impedance/admittance method, phasor method.
	5.4 Calculation of current, power, power factor in A.C. parallel RL RC and RLC circuits .
	(Numerical based on above.)
	5.5 Condition and characteristics of parallel resonant circuit, Resonance curve, Comparison with series resonance, Quality factor of parallel resonant circuit .
6	**Polyphase Circuits:**
	6.1Difference between single phase and polyphase system, Generation of three-phase a.c. supply, Advantages of three-phase supply over single-phase supply.
	6.2 Concept of phase sequence and balanced/unbalanced load.
	6.3 Star connected system, Relation between phase and line values of current and voltage in balanced Star system.
	6.4 delta connected system ,Relation between phase and line values of current and voltage

	in balanced Delta system. 6.5 Active, Reactive and Apparent power in three phase Star/Delta system. 6.6 Advantages of star and delta connected system (Numerical based on above.)

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	DC Network Theorem	14	08	10	4	22
2	AC Fundamentals	06	04	04	00	08
3	Phasor Algebra	04	02	03	00	05
4	AC Series Circuit	10	06	06	04	16
5	AC Parallel Circuit	08	03	03	04	10
6	Polyphase Circuit	06	05	04	00	09
		48	28	30	12	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Practical (Any Ten)

Sr. No.	Unit	Experiment/Assignment	Approx Hours
1	1	Verify Superposition theorem applicable to D.C. circuit.	04
2	1	Verify Thevenin's theorem applicable to D.C. circuit.	02
3	1	Verify Norton's theorem applicable to D.C. circuit.	02
4	2	Verify the maximum power transfer Theorem applicable to D.C. & A.C. circuit.	02
5	2	Observe AC and DC waveform on CRO and find magnitude of DC voltage, peak average, R.M.S. values and frequency of AC voltage,	02
6	4	Observe response of " Inductor" and " Capacitor" to A.C. voltage	04
7	4	Determine impedance, phase angle of R-L series circuit, plot phasor diagram and also calculate active, reactive and apparent power consumed in R-L series circuit.	04
8	4	Determine impedance, phase angle of R-C series circuit, plot phasor diagram and also calculate active, reactive and apparent power consumed in R-C series circuit	04

9	4	Determine impedance, phase angle of RLC series circuit, plot phasor diagram and also calculate active, reactive and apparent power consumed in RLC series circuit	04
10	4	Obtain resonance in R-L-C series circuit .	04
11	5	Find the current and power factor in R-L parallel Circuit.	04
12	5	Find the current and power factor in R-C parallel Circuit.	04
13	5	Find the current and power factor in R-L-C parallel Circuit.	04
14	5	Obtain resonance in R-L-C parallel circuit.	04
15	6	Verify relationship between line and phase values of voltage and current in star connected balanced load	02
16	6	Verify relationship between line and phase values of voltage and current in delta connected balanced load	02

Reference Books:

Sr. No.	Book Title	Author	Publication
1	Electrical Technology Volume-I	B. L. Theraja	S. Chand and Co. Ltd., New Delhi.
2	Basic Electrical Engineering	V.K. Mehta, Rohit Mehta	S. Chand and Co. Ltd., New Delhi.
3	Circuit and Network	V.N. Mittle,	Tata McGraw Hill
4	Schaum online series Theory and problems of Electric circuits	Edminister,	T. M. G. H., New York
5	Engineering Circuit Analysis	W. H.Hyat and J. E. Kemmerly	T.M.G.H., New York

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    iii. Dr. P.N .Padghan
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    i. Mrs Jyoti Naik G.P. Thane

Academic Coordinator   **Head of Department**   **Principal**
                                            (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO Vs PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 211.1	3	3	2	0	0	0	0	1	0	3
EE 16 211.2	3	3	3	3	3	0	0	1	0	3
EE 16 211.3	3	3	3	3	3	0	0	1	0	3
EE 16 211.4	3	3	3	3	3	0	0	1	0	3
EE 16 211.5	3	3	3	3	2	0	0	1	0	3
EE 16 211.6	3	3	3	3	3	0	0	1	0	3

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE 16 211.1	3	3	0
EE 16 211.2	3	3	0
EE 16 211.3	3	3	3
EE 16 211.4	3	3	0
EE 16 211.5	3	3	3
EE 16 211.6	3	3	3

Programme : **Diploma in Electrical Engineering**	
Course Code: **EE 16 212**	Course Title: **D.C. Machine & Transformer**
Compulsory / Optional: **Compulsory**	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	2	2	7	70 (3 Hrs.)	30	50*	--	50	200

1. RATIONALE :

The knowledge of DC machines including their characteristics is necessary for students of Electrical Engineering. The subject deals with the concepts, characteristics & applications of DC Generators & Motors. A diploma holder has to work in various fields such as manufacturing industries, State Electricity boards, Power Generation Stations, etc. His work involves operation control and maintenance of electrical machines. He should therefore know the working principle, constructional features, and performance of AC machines. Transformer is one of the most important devices of electrical power system. It has imparted more flexibility to AC system than DC system, due to which the AC system is widely preferred over DC system in most of the applications. Since technicians are expected to work with various electrical / electronic systems involving transformer, it is highly essential to provide them necessary knowledge about construction, operation & testing of transformer with mathematical background. This course aims at strategic development of students so that they can understand, operate, use & test the transformer as per the requirement.

Course Outcomes:

EE 16 212.1	State the principle of electromechanical energy conversion
EE 16 212.2	State working principle and identify the different parts of DC generator, DC motor and Transformer
EE 16 212.3	Clarify material used for different parts of DC generator, DC motor and Transformer,
EE 16 212.4	Compare different types of DC Generators, DC Motor and transformers
EE 16 212.5	Compare the characteristics of various DC generator and DC motors
EE 16 212.6	Solve Equivalent circuit and find losses, voltage regulation and efficiency of transformer
EE 16 212.7	Select proper DC machine and transformer for particular application

Unit No.	Topics/Subtopics
1	**Introduction to D. C. Machine** 1.1 Principles of Electromechanical Energy Conversion 1.2 Necessity of DC machines 1.3 Constructional parts of D. C. machine and their functions. 1.4 Winding Terms: i. e. terms related to windings, types of armature windings, difference between Lap & Wave winding. (No Numerical)
	D. C. Generator.

2	2.1 Working principles of DC generators
	2.2 Types of DC generators.
	2.3 E. M. F. equation & voltage equation of DC generator
	2.4 Losses in DC generator
	2.5 Power stages of DC generator
	2.6 Characteristics of DC generators
	2.7 Armature reaction
	2.8 Commutation, methods to improve commutation.
	2.9 Applications of shunt, series and compound generator.
	(Simple numerals on above)
3	**D. C. Motor.**
	3.1 Working principle of DC motor
	3.2 Concept and significance of back emf.
	3.3 Torque expression, voltage equation, speed regulation
	3.4 Characteristics & applications of DC motor, (shunt, series compound)
	3.5 Power Stages in D. C. Motor (Numerical)
	3.6 Speed control of D. C. Motor (Numerical)
	3.7 Starters of DC motor- Necessity, Three & Four point starter, simple numerals on above.
4	**Single phase transformer.**
	4.1 Introduction, Working principle of transformer,
	4.2 Constructional parts and their functions.
	4.3 Materials used for construction.
	4.4 Classification of transformer.
	4.5 EMF equation of transformer (derivation), Transformation ratio,
	4.6 Concept of ideal transformer.
	4.7 Transformer on no load- Vector diagram & numerical.
	4.8 Transformer on load – phasor diagram of loaded transformer
	4.9 Magnetic leakage and kVA capacity of transformer.
	4.10 Equivalent circuit diagram of transformer.
	4.11 Efficiency & Losses in Transformer and regulation of transformer
	4.12 Method to find losses and efficiency and regulation of transformer (OC & SC test).
	4.13 All day efficiency of 1-phase transformer.
	4.14 Single phase Autotransformer, principles, advantages and disadvantages
	4.15 Polarity of transformer.
	4.16 Isolation Transformer
	4.17 Simple numerals on above
5	**Three Phase transformer.**
	5.1 Construction with function of each part.
	5.2 Connections & their importance
	5.3 Vector groups
	5.4 Three Phase auto transformer
	5.5 Applications of all types (Numerical on calculations of V, I & kVA capacity)
	5.6 Concept and fundamentals of instrument transformer

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to D. C. Machine	04	04	02	00	06
2	D. C. Generator.	10	04	06	04	14
3	D. C. Motor.	10	06	06	04	16
4	Single phase transformer.	16	08	12	04	24
5	Three Phase transformer	08	06	04	00	10
		48	**28**	**30**	**12**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

A. List of Experiments

Sr. No.	Unit No.	Experiment/Assignment	Approx Hours
1	1	Write a Report on the machine Laboratory in terms of practicing of reading name plates of various machines and their supply system.	02
2	1	To study the constructional parts of D. C. Machine.	02
3	2	To plot Load characteristic of D. C. shunt generator.	02
4	3	Speed control of DC shunt motor using Flux Control & Armature Voltage Control method.	02
5	3	To reverse directions of rotation of D. C. shunt motor.	02
6	3	Load test on D. C. shunt motor & calculation of efficiency, output, torque etc.	04
7	4	To find transformation ratio of single phase transformer.	02
8	4	Determine the efficiency & regulation of single phase transformer by Direct loading.	04
9	4	To perform O. C. & S. C. test on single phase transformer for finding efficiency & regulation of transformer.	04
10	5	Study the constructional details of distribution & power transformers. (based on visit to transformer manufacturing industry)	08

Books:

Sr. No.	Name of Book	Author	Publisher
1	Performance & Design of A.C. Machine	M.G. Say	C.B.S. Publications, New Delhi
2	A Text Book Of Electrical Technology vol-II	B.L. Theraja A.K. Theraja	S. Chand & Co.
3	Electrical Machines.	Nagrath & Kothari	Tata McGraw-Hill Co. New Delhi
4	Electrical Technology	Edward Hughes	Pearson Education, New Delhi
5	Electrical Machines	S.K. Bhattacharya	Tata McGraw-Hill Co. New Delhi

Websites:

1. www.nptel.com

2. www.electrical4u.com/

3. electrical-engineering-portal.com

4. www.learnerstv.com

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                                  (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 212.1	3	3	--	--	2	--	---	---	1	3
EE 16 212.2	3	3	--	--	2	--	---	---	1	3
EE 16 212.3	3	3	2	1	2	1	--	2	1	2
EE 16 212.4	3	3	3	3	1	1	--	2	1	2
EE 16 212.5	3	3	2	2	2	1	--	2	1	2
EE 16 212.6	3	3	3	2	3	2	--	2	1	2
EE 16 212.7	3	3	2	2	1	1	--	2	1	2
Avg. of POs	3	3	2	2	2	1	--	2	1	2

CO Vs PSO matrix

CO	PSO1	PSO2	PSO3
EE 16 212.1	3	1	2
EE 16 212.2	3	1	2
EE 16 212.3	3	2	2
EE 16 212.4	3	1	2
EE 16 212.5	3	2	2
EE 16 212.6	3	1	2
EE 16 212.7	2	2	2
Avg. Of PSOs	3	1	2

Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum
[Out Come Based (OBE)]

Semester-IV
(Course Contents)

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

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Programme: Electrical Engineering **Fourth Semester** **With effect from June 2017**

Teaching & Examination Scheme for the Students admitted in Second Year in 2017-18

Semester : IV

Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 501	Professional Practices	--	C	0	0	2	2	0	0	0	25	25	50
2	EE 16 301	Maintenance of Domestic Appliances	--	C	0	0	4	4	0	0	0	50*	50	100
3	EE 16 302	Industrial Measurement	--	C	3	0	4	7	70	30	50*	0	0	150
4	EE 16 303	Electrical Transmission & Distribution#	--	C	3	0	2	5	70#	30#	0	50*	0	150#
5	EE 16 304	Utilization of Electrical Energy	--	C	3	0	2	5	70	30	0	50*	0	150
6	EE 16 307	AC Machines	--	C	3	1	2	6	70	30	50*	0	0	150
7	EE 16 402	Renewable energy Sources	--	C	4	0	2	6	70	30	0	50*	0	150
					16	01	18		350	150	100	225	75	
		Total Credits						35		**Total Marks**				900

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
*Indicates assessment by External Examiner. # Indicates on line theory exam.

Academic Coordinator **HOD (EE)** **Principal**

Programme Code: **EE**								
Course Code: **EE 16 501**			Course Title: **Professional Practice**					
Compulsory / Optional: **Compulsory**								
Teaching Scheme and Credits				Examination Scheme				
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
--	--	02	02	--	--	--	25	25	50

Rationale:

In the present scenario acquiring the technical knowledge is not sufficient, but every technocrat should be aware about his own professional progress to become a successful engineer in his carrier. He should know how to prepare his own CV, how to take part in group discussions, interview facing techniques, how to prepare a more interactive presentation, these all will help to improve his personality for the better success in his growing age. Industry visits, expert lectures from professionals and industry expert should really add for the job working progress.

Course Outcomes: (CO's)

EE16 501.1	Know his professional and social aim.
EE16 501.2	Prepare own bio-data and various interview techniques.
EE16 501.3	Know the importance of group discussion, presentation and latest job profiles.
EE16 501.4	Plan industry visits, expert lectures for better practical experience.

Contents:

1. **Know Yourself**
    1.1 My Aim
        1.1.1   Professional Aim
        1.1.2   Social Aim and Awareness
    1.2 C.V. (Curriculum Vitae)
        1.2.1   Personality
        1.2.2   Behavior
        1.2.3   Personal Bio-data
    1.3 Group Discussion
        1.3.1   Importance of Group Discussion
        1.3.2   Making Groups as per the strength in the class and allocating the latest topics for discussion and write the report.
            1.3.2.1 Technical education and society
            1.3.2.2 Electrical energy sources
            1.3.2.3 All types of pollution
            1.3.2.4 Government industrial policies
            1.3.2.5 Any other related topic

2. **Seminar Presentation**
    2.1 Collection of information related to our course on any topic
    2.2 Use books, websites, journals, magazine, field knowledge from experts etc.
    2.3 Present this information through PPT. (Min 5 and max 7)

3.	**Presentation of Professionals / Industry Experts**

3.1 Why these presentations are necessary

3.2 How this will Help you to know more than your curriculum

3.3 Arrange minimum two expert lecturers for two hour session on various topics by these experts.

    3.3.1   Role of electrical engineer in Industry

    3.3.2   Scope and Industry culture

    3.3.3   Electrical Safety

    3.3.4   Industrial Drives and Control

    3.3.5   Any latest topic related to electrical engineering

3.4 Students should prepare a report as a part of term work.

4.	**Industry Visits**

4.1 Types of Industries and their purposes

    4.1.1   Manufacturing and Processing

    4.1.2   Trading and Marketing

    4.1.3   Services to the People and Maintenance

    4.1.4   Importing and Exporting

4.2 How small, medium and large-scale industries are different.

4.3 At least one visit should be organized to any of the following mentioned industries and write a report.

    4.3.1   Generating Station, Substation, Load Dispatch center, Switch gear manufactures, Motor

                Generator manufactures Electrical sections of various industries etc.

5.	**Today's Job Profiles and Interview Techniques**

5.1 Current Market Survey to find the Job

5.2 Your area of Interest to Apply and Preparation

5.3 Make a report on various techniques as a part of term work.

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Know Yourself	6				
2	Seminar Presentation	6				
3	Presentation of Professionals / Industry Experts	4				
4	Industry Visits	12				
5	Today's Job Profiles and Interview Techniques	4				
	Total	32				

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

Suggested Implementation Strategies:

1. Lecture method
2. Improved lecture method.
3. Expert Lecturers
4. Q & A technique with Group Discussion.

5. Demonstration
6. Seminars
7. Field visit

Suggested Learning Resources:

1. Print: Text Books/Reference Books/Manuals/Journals.
2. Non Print: CDs / PPT / Transparencies / Charts / Models/ Webs

Reference Books:

Sr. No.	Name of Book	Name of Author	Publications
1	A professional practice course of EE's [electrical engineering]	Nagurney L.S. and Frochlich J.P.	IEEE
2	Teaching Professional and Ethical Aspects of Electrical Engineering to a Large Class	Kevin M. Passino	IEEE

CO's Vs PO's Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16 501.1	-	1	-	-	3	2	1	1	2	1
EE16 501.2	-	1	-	-	-	1	1	3	3	3
EE16 501.3	-	1	-	1	1	1	2	3	3	3
EE16 501.4	-	-	-	-	2	2	2	3	3	3

CO's Vs PSO's Matrix:

CO	PSO1	PSO2	PSO3
EE16 501.1	-	-	3
EE16 501.2	-	-	3
EE16 501.3	-	-	3
EE16 501.4	-	-	3

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low)   2: Moderate (Medium)   3: Substantial (High) *If there is no correlation, put "-"*

Academic Coordinator   **Head of Department**   **Principal**
                                  Electrical Engineering Dept.   **Govt. Polytechnic Mumbai**

Programme : **Diploma in Electrical Engineering**	
Course Code: **EE 16 301**	Course Title: **Maintenance of Domestic Appliances**
Compulsory / Optional: **Compulsory**	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
--	--	04	04	--	--	--	50[*]	50	100

Rationale:

Working knowledge domestic appliances should be learnt by every electrical engineer. Engineers should be well versed with installation and maintenance procedure of the domestic appliances, rating of cable/wire/fuse/mcb, power supply specification, earthing, and specific safety requirement for the particular appliance. Standard and basic electrical tools need to be practiced. This subject is intended to develop skills of maintenance, testing and fault finding of domestic appliances with following course outcomes. These outcomes will be satisfied, when students actually performs the laboratory work.

Course Outcomes:

EE16301.1	Apply safe working practices
EE16301.2	Comply environment regulation and housekeeping
EE16301.3	Interpret & use company terminology, product catalogue and technical communication
EE16301.4	Make basic electrical / electronic circuits / connections and measure Electrical parameters
EE16301.5	Carryout & test simple domestic wiring system with Earth continuity
EE16301.6	Test & Repair Domestic appliances

Unit No.	Topics/Subtopics
1	**Safety Practices** 1.1 ☐Fires in electrical Circuits & Precautions 1.2 Fire Extinguishers & its Types 1.3 ☐General Safety of Tools & equipment which are used while testing, repairing and maintenance of electrical gadgets 1.4 Environment requirement of electrical installation of domestic appliances and house keeping 1.5 Rescue of person who is in contact with live wire 1.6 Treat a person for electric shock/ injury

2	**Revision of basic electricity and electronics**
	2.1 Single phase & three phase circuits
	2.2 Electrical terms like Voltage, Currents, Resistance, Impedance & power factor
	2.3 Familiarization with electronic components like Capacitor, Choke coil, Diode, Transistor, Thyristor, IGBT
	2.4 Concept of open circuit and short circuit in the circuit diagram and installations
	2.5 Series & Parallel Circuits
	2.6 Direct current & Polarity testing
	2.7 Alternating Current & identifying phase, neutral and earth terminals
	2.8 Interpret the components as per circuits and laying components on PCB Testing of assembled PCB
	2.9 Concept of earthing, purpose & types. □Introduction to Pipe earthing & Plate earthing, Earthing of domestic installation, earth continuity conductors
3	**Wiring & its concepts**
	3.1 Conductors, Insulators & its types
	3.2 Crimping & Crimping Tools, Soldering
	3.3 Joints in electrical conductor, end termination : Using glands, lugs, pin terminal and terminal connectors
	3.3 Concept of gauge of wire, conductor material & its current carrying capacity
	3.5 Determination of Fuse size according to the load of circuit and its location On single line diagram of domestic installation upto switch socket
	3.6 Rating and specification of electrical cord, flexible cables, wires, single phase 6A/16A plug & socket. Terminal connection of switch, switch socket and Plug top, MCBs, ELCB, Fuses, resistors, inductors, capacitor
	3.7 Concept of different types of switchgears used in general Electrical installations.
	3.8 Use of Megger & Test lamps in fault location
4	**Domestic Appliances**
	4.1 Voltage and Power requirement of all kinds of home appliances
	4.2 Symbols, Diagram & Rules, Study of product catalogues Does and Don'ts related to gadget, Service log book , test certificate, Report of service
	4.3 Basic construction and assembly of electric iron, heater and fan
	4.4 Basic construction and assembly of mixer, grinder, blender and OTG
	4.5 Basic construction and electrical parts of washing machine, microwave oven, refrigerator and dish washer
	4.6 Repair and service technique of home appliances and battery Maintenance
	4.7 Types/rating of batteries and their application in inverter and UPS
	4.8 Construction and parts of lead acid/ maintenance free battery. Specific gravity of battery
	4.9 Process of discharging and recharging of battery
	4.10 Battery chargers and precautions are to be taken while charging

List of Practical : (All experiments from 1 to 10. And any six from 11.1 to 11.9)

Sr.No	Unit	Experiment/Assignment	Approx Hours
1	1	To understand signs and notices which are observed in factory and domestic electrical installation regarding electrical safety.	04
2	1	To demonstrate dousing of fire caused electrical short circuit	04
3	1	To identify proper electrical tool/equipment for general or specific purpose and practice its safe handling.	04
4	1	To demonstrate rescue of person who is in contact with live wire	04
5	1	To demonstrate first aid treatment to a person who receives electric shock/ injury	04
6	2	To set up simple electrical connections using resistance, voltmeter, ammeter & multimeter for single phase and three phase circuit.	04
7	3	To set up one board with fuse , switch and switch socket to practice of electrical joints, crimping, end termination along with test of continuity , polarity and insulation	04
8	2	To construct, solder, and test a simple circuit by using electronic components.	04
9	2	To prepare and test electronic choke & CFL assembly,led	04
10	3	To demonstrate good earthing of domestic installation and earth continuity conductors by measuring voltages between P-N, P-E and N-E	04
11	4	To understand different electrical appliances, their circuit diagrams, faults finding and repairing. Equipment are listed from 11.1 to 11.9	04
11.1	4	Electric Iron	04
11.2	4	Electric Hot Plate	04
11.3	4	Single phase invertor	04
11.4	4	Electric Room Heater	04
11.5	4	Electric Fan	04
11.6	4	Electric water Heaters	04
11.7	4	Electric Bell	04
11.8	4	Electric Mixer Grinder	04
11.9	4	Fluorescent lamp (FTL) with magnetic and electronic choke	04

Reference Books:

Sr. No.	Book Title	Author	Publication
1	Electrical Technology Volume-I	B. L. Theraja	S. Chand and Co. Ltd., New Delhi.
2	Basic Electrical Engineering	V.K. Mehta, Rohit Mehta	S. Chand and Co. Ltd., New Delhi.
3	Basic Electrical Engineering	M. L. Anwani	Dhanapat Rai and Co., New Delhi
4	How to repair small appliances Vol I & II	Jack Darr	H. W. Sams, Photofacts publications.1966
5	Electrical Safety, Fire Safety Engineering and Safety Management	S. Rao, R.K. Jain, H. L. Saluja	Khanna Publishers 1997
5	http://home.howstuffworks.com/how-to-repair-small-appliances.htm		
6	http://www.fixitclub.com/small-appliances-repairs/		

Course Curriculum Development Committee:

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Academic Coordinator   **Head of Department**   **Principal**

                                                    (Electrical Engineering)   **Govt. Polytechnic,**

Mumbai

CO Vs PO Matrix

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16301.1	2	3	3	3	3	2	3	3	3	3
EE16301.2	2	3	3	3	3	3	3	3	3	3
EE16301.3	2	3	3	3	3	3	3	3	3	3
EE16301.4	3	3	3	3	2	3	3	3	3	3
EE16301.5	3	3	3	3	3	3	3	2	2	3
EE16301.6	2	3	3	3	3	3	3	2		3
Avg. Of COs	2.34	3	3	3	2.84	2.84	3	2.67	2.84	3

CO Vs PSO Matrix

COs	PSO1	PSO2	PSO3
EE16301.1	3	2	2
EE16301.2	3	2	2
EE16301.3	3	2	2
EE16301.4	2	2	2
EE16301.5	3	3	3
EE16301.6	3	2	3
Avg. Of PSOs	2.84	2.16	2.34

Programme : **Diploma in Electrical (EE) Engineering**	
Course Code: **EE 16 302**	Course Title: **Industrial Measurement**
Compulsory / Optional: **Compulsory**	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	-	4	7	70	30	50*	-	-	150

*Indicates assessment by Internal & External examiners.

RATIONALE:

This course is introduced with a view that the students will be exposed to various types of Transducers, signal conditioning and recording system to measure the process parameters. After completion of this course student will gain sufficient knowledge of process measurement.

Course Outcomes:

Upon completion of this course, students should be able to,

EE16302.1	Identify, list and classify different transducers.
EE16302.2	Draw the Input/output characteristics of transducers.
EE16302.3	Demonstrate and verify the transduction principles of transducers.
EE16302.4	Measure the process parameters such as Temperature, pressure, level, flow etc.
EE16302.5	Select the relevant transducers and recorders for the given application.

Course Content Details:

Unit No.	Topics / Sub-topics

1	**Introduction to Transducers:**
	1.1 concept of Instrumentation
	1.2 Basic block diagram of Instrumentation system & functions of each elements.
	1.3 Definitions of Static and dynamic characteristics
	1.4 Primary & secondary standards
	1.5 Concept of Transducers
	1.6 Classification of Transducers
	– Primary and Secondary Transducers
	– Analog and Digital Transducers
	– Active and Passive Transducers
	1.7 Resistive Transducer:-
	  Potentiometer ,Strain gauge (No derivation only formula),
	  Types of strain gauges :- unbounded, bounded, Semiconductor, Light dependent resistor.
	1.8 Inductive transducer:- Inductance principle, LVDT,RVDT
	1.9 capacitive transducers:-capacitance principle, variable capacitance due to change in dielectric media, change in overlapping area, change in distance between two plates .

2	**Process Measurement Transducer**
	   2.1 pressure transducer:-
	      − Manometer, Bourdon tube, bellows, diaphragm, Dead weight tester
	   2.2 Temperature transducer:-
	      − Bimetallic thermometer, Thermocouple and its effect, Thermistor , RTD,
	        pyrometer.
	   2.3 Flow Transducer:-
	      − Orifice, Venturimeter, Rotameter, Coriolis flow meter.
	   2.4 Level Transducer:-
	      − Capacitive type , Ultrasonic type ,Bubbler type.
	Working principle, application of above transducer

3.	**Signal conditioning:**
	   3.1 Concept of signal conditioning
	   3.2 Block diagram of AC and DC signal conditioning and working.
	   3.3 Operational Amplifiers, OP AMP – 741,Block diagram and its
	      Electrical characteristics
	      − Integrator, Differentiator, adder, subtractor, Inverter etc.
	      − V to I converter, I to V converter, V to F converter A/D and D/A
	        converters only working principle
	      − Instrumentation Amplifier, Differential amplifier
	   3.4 Filters :- Types and frequency response (Only passive, active first
	      order filters) (No derivations)
	   3.5 Multiplexing

4.	**Data Processors & Data transmission:**
	   4.1 Necessity of data processing in Instrumentation.
	   4.2 Generalized Data acquisition system : Block diagram & explanation
	   4.3 Concept of Data transmission
	   4.4 Block diagram of data transmission system & explanation
	   4.5 Advantages and disadvantages of digital data transmission over
	      analog transmission

5	**Display Devices and Recorders:**
	   5.1 Digital display devices (LED, seven segment only)
	   5.2 Necessity of Recorder in Instrumentation
	   5.3 Classification of Recorders.
	   5.4 Block diagram and working principles of strip-chart, X-Y recorder.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Introduction to Transducers**	08	8	6	2	16
2	**Process Measurement Transducer**	08	2	8	6	16
3	**Signal conditioning**	08	4	4	10	18
4	**Data Processors & Data transmission**	04	2	8	2	12
5	**Display Devices and Recorders**	04	2	6	---	08
	Total	32	18	32	20	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes:This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Experiments:

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	2	To plot characteristics of Thermistor	2
2	2	To measure temperature using thermocouple	2
3	2	To plot characteristics of RTD	2
4	2	To measure pressure using pressure transducer	6
5	2	To measure liner displacement by LVDT	2
6	3	To construct signal conditioning circuit using OP – Amp 741 and Observe output, plot the adder, subtracter , Differentiator & Integrator.	6
7	3	To assemble Instrumentation amplifier circuit and find the gain of it	4
8	2	To measure and control the Liquid level using capacitive transducer	2
9	3	To study V to I converter and I to V converter using Op – Amp 741 and Observe output	4
10	3	To observe the response of first order low pass filter using OP-AMP	4
11	2	To measure of flow by orifice / venturi tube / rotameter	4
12	2	To measure angular displacement using capacitive transducer**.**	2

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Electrical and Electronics Measurements and Instrumentation	A.K.Sawhney	Dhanpat Rai and Sons
2	Instrumentation Devices and Systems	Rangan, Mani Sharma	Tata McGraw Hill
3	Instrumentation and Control	S.K.Singh,	Tata McGraw Hill
4	Principle of Industrial Instrumentation	D.Patranabis	Tata McGraw Hill

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        ii Mr.S.G.Thube
        iii Ms. V.K.Pawar

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     i. Mrs.S.S.Kulkarni

    Academic Coordinator   **Head of Department**   **Principal**
                                Electrical Engineering.   **Govt. Polytechnic Mumbai**

Course Name:- Industrial Measurement   Course Code:-EE16302

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16302.1	3	3	2					1	1	1
EE16302.2	3	3	3					2	1	1
EE16302.3	3	3	2					2	1	1
EE16302.4	3	3	3					3	1	1
EE16302.5	3	3	3					2	1	1

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE16302.1	**3**	**1**	
EE16302.2	**3**	**1**	
EE16302.3	**3**	**2**	
EE16302.4	**3**	**2**	
EE16302.5	**3**	**2**	

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Introduction to Transducers	**EE16302.1**, **EE16302.3**
2	2	Process Measurement Transducer	**EE16302.1**, **EE16302.2**
3	3	Signal conditioning	**EE16302.4**, **EE16302.3**
4	4	Data Processors & Data transmission	**EE16302.4**
5	5	Display Devices and Recorders	**EE16302.5**

Programme : **Diploma in Electrical Engineering (EE)**									
Course Code: **EE 16 303**				Course Title: **Electrical Transmission and Distribution**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**02**	**05**	**70 #**	**30#**	**-**	**50***	**-**	**150**

* Indicates assessment by External Examiner

#Indicates assessment by On Line examination

Rationale:

This is the subject where the principles of electrical transmission and distribution systems are studied. Knowledge of components of electrical transmission and distribution system and their functions is necessary for understanding power system performance. Study of load dispatch and HVDC transmission is also important for working in power sector or industry.

Course Outcomes:

Upon completion of this course, students should be able to,

EE16 303.1	Know various types of transmission & distribution systems.
EE16 303.2	Understand importance of load dispatch centre.
EE16 303.3	Identify various components & their functions of transmission and distribution systems.
EE16 303.4	Calculate string efficiency of insulator and transmission efficiency
EE16 303.5	Calculate the performance of transmission and distribution system.
EE16 303.6	Draw and explain the phasor diagram of short & medium transmission line.
EE16 303.7	Know about HVDC Substation and its types.

Course Content Details:

Unit No	Topics / Sub-topics
1	**Introduction to Transmission:** 1.1 A.C. and D.C. transmission. 1.2 Advantages and disadvantages. 1.3 National, Regional and State Load Dispatch Centers. 1.4 Introduction to grid and different voltage levels for HVAC and HVDC. 1.5 Compare between HVAC & HVDC
2	**Transmission line components:** 2.1 Introduction to line component. 2.2 Types of conductor- Al, ACSR, Cu and solid stranded bundle conductors. 2.3 Line supports – requirement, type. Construction of supporting structures, Towers, monopoles 2.4 Spacing between conductors. 2.6 Concept of length of span. 2.7 Sag in overhead line. 2.8 Calculations of sag: effect of wind and ice loading (Simple Numerical) 2.9 Types of insulator – Pin, Suspension, Strain, Stay, Shackle. 2.10 Safety factor, puncture and ultimate strength.

	2.11 Potential distribution over a string of suspension insulator. 2.12 Simple numerical on string efficiency.

3	**Transmission line parameters:**
	 3.1 Constants of transmission lines
	 3.2 Skin effect
	 3.3 Transposition of conductor and necessity.
	 3.4 Corona
	        3.4.1 Factors affecting corona.
	        3.4.2 Important terms
	        3.4.3 Advantages and disadvantages of corona.
	        3.4.4 Methods of reducing corona effect

4	**Performance of transmission line:**
	 4.1 Classification of transmission line, Important terms, regulation & efficiency of T/L
	 4.2 Short transmission line, eq. circuit representation & phasor diagram &
	    analysis. (Simple Numerical)
	 4.3 Medium transmission line, End condenser method, Nominal T and π
	    circuit representation & analysis, phasor diagram.
	 4.4 Ferranti effect.
	 4.5 Introduction of Long transmission line.

5	**High Voltage DC Transmission**
	  5.1 Principle of HVDC system
	  5.2 Types of DC link (Block diagram, components & description)

6	**Introduction to Distribution system:**
	 6.1 Components of Distribution system - distributor, feeder and service
	    mains.
	 6.2 Classification of distribution system.
	 6.3 A.C. distribution.
	 6.4 Connection scheme of distribution system -radial and ring mains
	    system.
	 6.5 Factors to be considered for design considerations.
	 6.6 Voltage drop calculation for feeder fed at one end for single phase and
	    three phase four wire A.C. balanced system.

7	**Underground Cables:** 7.1 Introduction and requirement. 7.2 Classification of Cable. 7.3 Cable conductor. 7.4 Cable construction. 7.5 Cable insulation, metallic sheathing and mechanical protection. 7.6 Comparison with overhead lines. 7.7 Methods of cable laying. 7.8 Proximity effect. 7.9 Aerial bunch cable
8	**Tariff & Power factor improvement :** 8.1 Different types of tariffs. 8.2 Causes and disadvantages of low power factor 8.3 P.F. improvement using static capacitor. 8.4 Advantage of P.F. improvement.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to Transmission	04	2	4	0	06
2	Transmission line components	10	4	4	6	14
3	Transmission line parameters	04	2	4	0	06
4	Performance of transmission line	08	2	4	6	12
5	High Voltage DC Transmission	04	2	4	0	06
6	Introduction to Distribution system	08	2	4	6	12
7	Underground Cables	06	2	0	6	08
8	Tariff & Power factor improvement	04	2	4	0	06
	Total	**48**	**18**	**28**	**24**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments:

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	**1**	Introduction to MATLAB	**04**
2	**1,2**	Study of basic tools required for Electrical Engg.	**04**
3	**3**	Simulation of simple R,L,C of single phase circuit.	**04**
4	**3,4**	Simulation of short Transmission Line	**04**
5	**3,4**	Simulation of Numerical 'T' circuit representation of medium transmission line	**04**
6	**3,4**	Simulation of Numerical 'π' circuit representation of medium transmission line	**04**
7	**6**	Simulation of distribution system – radial/ ring mains.	**04**
8	**8**	Simulation of Power factor improvement using FACTS devices	**04**
		Total	**32**

References/ Books:

Sr. No.	Name of Book	Author	Publisher

1	Elements of Power System	V. K. Mehta and Rohit Mehta	S. Chand and Co. Ltd.
2	Electrical Power System	Dr. S. L. Uppal ,Prof. S. Rao	Khanna Publisher, New Delhi.
3	A course in Power plant Engineering	Dr. V. M. Domkundwar	Dhanpat Rai & Sons
4	A course in Electrical Power	Soni, Gupta, Bhatnagar	Dhanpat Rai & Sons
5	Transmission & Distribution	J. B. Gupta	S. K. Khanna
6	Electrical Power system Design	M.V.Deshpande	Tata Mcgraw-Hill

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          (Electrical Engineering)   **Govt. polytechnic Mumbai**

Unit and CO mapping:

S.N.	Unit	CO
1	Introduction to Transmission	**EE16 303.1, EE16 303.2**
2	Transmission line components	**EE16 303.1, EE16 303.3, EE16 303.4**
3	Transmission line parameters	**EE16 303.3**
4	Performance of transmission line	**EE16 303.1, EE16 303.5, EE16 303.6**
5	High Voltage DC Transmission	**EE16 303.7**
6	Introduction to Distribution system	**EE16 303.1, EE16 303.3, EE16 303.5**
7	Underground Cables	**EE16 303.3**
8	Tariff & Power factor improvement	**EE16 303.1, EE16 303.3**

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16 303.1	2	3	2	3	-	1	-	-	-	-
EE16 303.2	2	3	3	3	2	1	-	3	1	2
EE16 303.3	2	3	3	2	1	1	-	-	-	-
EE16 303.4	3	3	3	3	-	-	-	-	-	-
EE16 303.5	3	3	3	3	-	-	-	-	-	-
EE16 303.6	3	3	2	2	-	-	-	-	-	-
EE16 303.7	1	1	2	1	2	1	-	3	1	2
Avg	2.29	2.71	2.57	2.43	0.71	0.57	0	0.86	0.29	0.57

CO Vs PSO matrix

	CO/POs	PSO1	PSO2	PSO3
EE16 303.1	Know various types of transmission & distribution systems.	2	1	2
EE16 303.2	Understand importance of load dispatch centre.	3	3	2
EE16 303.3	Identify various components & their functions of transmission and distribution systems.	3	2	3
EE16 303.4	Calculate string efficiency of insulator and transmission efficiency	3	1	1
EE16 303.5	Calculate the performance of transmission and distribution system.	3	1	1
EE16 303.6	Draw and explain the phasor diagram of short & medium transmission line.	3	3	3
EE16 303.7	Know about HVDC Substation and its types.	2	2	3
	Avg	2.71	1.86	2.14

Programme Code: **EE**									
Course Code: **EE 16 304**				Course Title: **Utilization of Electrical Energy**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**--**	**02**	**05**	**70**	**30**	**--**	**50***	**--**	**150**

Rationale:

The electrical supervisor / technician are expected to possess knowledge of utilization of electrical energy especially in the industry. Their main job functions are to supervise the operation & control of various electrical drives, electrical furnaces. Railway is one of the major employers of Electrical Diploma holders; therefore, Diploma holder should also study the electrical traction and Electric Traction system. This course deals with utilization of electrical energy in various industries.

Course Outcomes:

The students will be able to

EE16304.1	**Define terminologies used in illumination.**
EE16304.2	**Select suitable lighting, lighting schemes and sources of light for specific applications.**
EE16304.3	**Identify suitable methods of electric heating for specific applications.**
EE16304.4	**Choose Electric Drive for specific applications.**
EE16304.5	**Preliminaries of track Electrification systems with equipment.**

Contents:

1 : Illumination:

- Definitions of Terms used in Illumination-Light, Luminous flux, Luminous Intensity, Lumen, Illuminance or Illumination or Degree of illumination, Mean Horizontal Candle Power (M.H.C.P.), Mean Spherical Candle Power (M.S.C.P.), Mean Hemispherical Candle Power (M.H.S.C.P.), Reduction Factor, Foot candle, Lux, Nit, Stilb, Brightness.
- Laws of Illumination
  (simple numerical)
- Diffusing and Reflecting Surfaces: Globes and Reflectors
- Types of Lighting Schemes-Direct, Semi-Direct, Semi-Indirect, Indirect, General Lighting.
- Factory Lighting - General Requirement, Types of installations: General Lighting, local lighting, Emergency Lighting.
- Flood Lighting - Flood Lighting purposes, Classification of projectors, Location and mounting of projectors.
- Introduction of Street Lighting.

2 : Sources of Light:
  Construction, Working and Applications of following Lamps:
- Incandescent Lamps.
- Halogen Lamps.
- Low Pressure Mercury Vapour Lamps (Fluorescent Tube).
- High Pressure Mercury Vapour Lamps.
- Sodium Vapour Lamps.

- Compact Fluorescent Lamps (C.F.L.)
- Metal Halide Lamps
- LED Lamps
- Neon Signs.
- Introduction to LASERS

3 : Electric Heating :
- Advantages of Electric Heating.
- Modes of Transfer of Heat:
- Classification of Electric Heating Methods:
- Resistance Heating: Construction & Operation, Direct Resistance Heating - Salt Bath Furnace, Indirect Resistance Heating: Resistance Ovens, Requirements of Heating Element Material, Causes of Failure of Heating Elements, Methods of Temperature Control, Applications of Resistance Heating, Design of Heating Element. (Simple Numerical problems on heating elements)
- Arc Heating - Construction & Operation, Direct Arc Furnace, Indirect Arc Furnace, Applications of Arc Heating.
- Induction Heating - Construction & Operation Core Type Induction Furnaces: Ajax Wyatt Furnace, Coreless Induction Furnace, Applications of Induction Heating, High frequency eddy current heating. Radiant & infrared heating, Estimation of Heat data. (Simple Numerical problems on rating of furnace.)
- Dielectric Heating: Principle of Dielectric Heating, Advantages of Dielectric Heating
- Limitations of Dielectric Heating, Applications of Dielectric Heating.

4 : Electric Drives:
- Introduction: What is drive?
- Drives – Mechanical Drive and Electric Drive, Advantages and Disadvantages of Electric Drive.
- Factors Governing Selection of Electric Motors, Nature of Electric Supply - 3 phase& 1 phase AC and DC, Type of Drive: Group Drive & Individual Drive.
- Nature of Load: Nature of the Mechanical Load, Matching of the Speed Torque Characteristics of the Motor with that of the Load, and Starting Conditions of the Load.
- Braking Characteristics - Plugging, Rheostatic Braking and Regenerative Braking, as Applied to DC Series and Three Phase Induction Motor.
- Mechanical Features - Type of Enclosure as per IS. Type of Bearings, Type of Transmission for Drive, Noise Level.
- Size of Motor - Load Conditions - Continuous Loads, Short Time Loads, Intermittent Loads, Continuous Operation with Short Time Loads and Continuous Operation with Intermittent Loads.
- Duty Cycles
- Standard Ratings for Motors as per ISS.
- Load Equalisation (No Calculations).

5 : Electric Traction:
- Introduction to Traction System, Requirements of an Ideal Traction System, Non-electric Traction Systems, Electric Traction Systems, Advantages and Disadvantages of Electric Traction Systems.
- Systems of Track Electrification
- Block diagram of AC locomotives with description of various equipment and accessories
- Working principal, advantages and disadvantages of Mono Rail and Metro Railways.
- Introduction of Diesel Multiple Unit (DMU), Electrical Multiple Unit (EMU) and Main Line Electrical Multiple Unit (MEMU)

List of Practical's (Any 8)

Sr. No	Unit No.	Experiment/Assignment	Approx. Hours
1	1	Measure Illumination at various places within the college premises by lux-meter.	4
2	1	Prepare a report by observing different lighting schemes at various sites / locations.	4
3	2	Prepare a survey report after collecting technical information of various lamps available in the local market.	4
4	2	Prepare an industrial visit report after visiting nearby lamp manufacturing industry.	4
5	3	Prepare a report on electrical heating furnace after visiting the industry.	4
6	4	Select the appropriate motors and justify the selection for given different load situations. (at least two)	4
7	4	Make a report by comparing various electrical drives for traction.	4
8	5	Prepare a report visiting nearby electric traction sub-station.	4
9	5	Prepare a report by comparing Metro and Mono Rail for public transport.	4
10	5	Prepare a report on various equipment's and accessories used in AC Locomotives.	4

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Illumination**	8	4	4	4	12
2	**Sources of Light**	10	4	6	4	14
3	**Electric Heating**	12	6	4	8	18
4	**Electric Drives**	12	8	4	4	16
5	**Electric Traction**	6	6	4	---	10
		48	28	22	20	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified

Reference Books:

1. Electrical Power System by Dr. S. L. Uppal and Prof. S. Rao, Publisher: Khanna Publisher, New Delhi.
2. Utilization of Electric Power & Electric Traction by J. B. Gupta Publisher: S. K. Kataria & Sons.
3. Art & Science of Utilization of Electrical Energy by H. Partab Publisher: Dhanpat Rai & Sons.
4. Electric Traction by J. Upadhyay and S. N. Mahendra Publisher: Allied Publisher House Ltd.

Course Curriculum Development Committee:

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   ii. Dr. P.N.Padghan

b. **External Faculty**
   i. Mrs S. S. Kulkarni (VPM Polytechnic, Thane)

Academic Coordinator	Head of Department (Electrical Engineering)	Principal Govt. Polytechnic, Mumbai

CO VS PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16304.1	3	3	2	2	2	2	2	-	-	2
EE16304.2	3	3	2	3	2	2	2	-	-	2
EE16304.3	3	3	3	3	2	2	2	-	-	2
EE16304.4	3	3	3	3	2	2	2	-	-	2
EE16304.5	3	3	2	3	2	2	2	-	-	2
Avg. of POs	3	3	2	3	2	2	2	--	--	2

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE16304.1	3	3	1
EE16304.2	3	3	2
EE16304.3	3	1	3
EE16304.4	3	2	2
EE16304.5	3	-	1
Avg. of PSOs	3	2	2

Unit Vs CO Matrix

Unit	EE16304.1	EE16304.2	EE16304.3	EE16304.4	EE16304.5
1	3	3	-	-	-
2	3	3	-	-	-
3	-	-	3	-	-
4	-	-	-	3	-
5	-	-	-	-	3
Avg. of COs	1.2	1.2	0.6	0.6	0.6

Programme Code: **Electrical Engineering**									
Course Code: **EE 16 307**				Course Title: **AC Machines**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**01**	**02**	**06**	**70**	**30**	**50***	**--**	**--**	**150**

Rationale:

This subject is applied technology subject. It teaches students facts, concepts, principles & procedure for operations of electrical machines such as induction motor, alternator and synchronous motor. Student will be able to analyze the characteristics and qualitative parameters of these machines. The knowledge and skills obtained will be helpful in discharging technical functions such as maintenance, supervision, and controlling in the industry.

Course Outcomes:

EE16307.1	Demonstrate the constructional details & explain working principal of various types of ac machines.
EE16307.2	Solve Equivalent circuit parameters and construct the circle diagram of induction motor.
EE16307.3	Explain armature reaction, parallel operation and find voltage regulation of alternator.
EE16307.4	Examine effect of excitation and plot curves of synchronous motor.
EE16307.5	Compare Induction motor and synchronous motor.
EE16307.6	Select proper rating of motors for particular application.

Contents:
1: Introduction to AC Rotating Machines:
1.1   Introduction to AC rotating machines.
1.2   General information of three phase machines.
1.3   Difference between AC and DC Machines.
2: Three Phase Induction Motor:
2.1   Working principle of 3-phase I.M.
2.2   Construction and types of 3- phase induction motor.
2.3   Comparison between squirrel-cage and slip-ring induction motor.
2.4   Production of rotating magnetic field.
2.5   Three phase induction motor speed, slip, frequency, rotor frequency and their relations. (Simple Numerical)
2.6   Equation of rotor induced emf, current, frequency, reactance, and impedance under steady and running condition. (Simple Numerical)
2.7   Torque equation of three phase induction motor. (Simple Numerical)
2.8   Starting and running torque of squirrel cage and slip ring induction motor.
2.9   Condition for maximum and starting torque.
2.10 Torque slip characteristics of three phase induction motor.
2.11 Effect of change in rotor circuit resistance on torque-slip characteristics.
2.12 Effect of change in supply voltage on torque-slip characteristics.
2.13 Torque Ratios (Numerical)
2.13.1 Starting torque to Maximum torque
2.13.2 Full load torque to Maximum torque

3: Three Phase Induction Motor – Starters, Speed Control & Circle diagram.

3.1 Need of starters
3.2 Various starters used to start 3-phase IM
      Starting of squirrel cage and slip ring induction motor.
      Compare starters with DOL starter (simple numerical)
3.3   Speed control of three phase induction motor by
      -    Pole changing method
      -    Frequency control method
      -    By stator voltage control
      -    Rotor resistance control (Simple Numerical)
3.4   Applications of three phase induction motor.
3.5   Power stages of three phase induction motor.
3.6   I.M. as a generalized transformer.
3.7   Equivalent Circuit of 3-phase IM.
3.8   Construction of Circle Diagram
         - Importance of circle diagram
         - No load test and Blocked rotor test on 3-phase IM
         - Construction of the circle diagram. (Numerical)

4: Three Phase Alternator:

4.1   Construction of three phase Alternator
      -    Rotor- smooth cylindrical & projected type
4.2   Advantages of stationary armature construction
4.3   Derivation of e.m.f. equation of Alternator which includes
      -    Chording factor
      -    Distribution factor
           (Simple Numerical)
4.4   Factors affecting the terminal voltage of Alternator
      -    Armature resistive drop
      -    Leakage reactance drop
      -    Armature reaction at various power factors & concept of Synchronous impedance
4.5   Regulation of three phase Alternator by
      -    Synchronous impedance method
      -    mmf method. (Simple Numerical)
4.6   Parallel operation of three phase alternator.
      -    Synchronizing by 1) One dark two bright lamp method, 2) Synchroscope.

5   : Synchronous Motor:
5.1   Construction.
5.2   Characteristics of synchronous motor.
5.3   Principle of operation.
5.4   Starting of Synchronous Motor.
5.5   Synchronous Motor on load with constant excitation. (Simple Numerical)
5.6   Effect of excitation at constant load. (Simple Numerical)
5.7 Starting Methods.
         Power flow within a synchronous motor.
         V curve & inverted V curve. (Simple Numerical)
5.8   Applications.
5.9   Comparison between IM & Synchronous Motor.

6: Single Phase Motors:
6.1   Double field revolving theory.
6.2   Types of Single-phase IM.
6.3   Split phasing principle of starting.

6.4	Principle of working, schematic diagram and applications of following motors
	- Resistance start induction run
	- Capacitor start induction run
	- Capacitor start Capacitor run
	- Shaded pole

List of Practical:

Sr. No	Unit No.	Experiment/Assignment	Approx. Hours
1	2	To measure the slip of 3-phase induction motor by: i) Tachometer ii) Comparing rotor & stator frequency.	2
2	3	To use different types of starters to start and run 3-phase induction motor. i) D.O.L. starter, ii) Stator resistance starter, iii) Star-Delta starter, iv)Auto transformer starter, v)Rotor resistance starter.	2
3	3	To measure the performance of 3-phase induction motor by direct loading.	4
4	3	Perform no load test and block rotor test on 3-phase induction motor, to construct the circle diagram.	4
5	3	To study the Double cage IM.	2
6	4	To perform O.C.C. of the alternator	2
7	4	To determine the percentage regulation of 3-phase alternator by synchronous impedance method at Various power factors.	4
8	4	To perform parallel operation of three phase alternator.	4
9	4	To find the percentage regulation of 3-phase alternator by direct loading method at various power factors.	4
10	5	To start the synchronous motor by applying any one starting method. Plot V & inverted V curve of the same.	4

Survey Project:
1. To list the various types of 1-phase induction motor. Collect the literature for them from dealers / manufacturers of local places & compare on the following points
   i) Method of starting ii) Cost iii) Performance iv) Starting torque etc.
   and prepare a report.

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Introduction to AC Rotating Machines.**	2	2	2	-	04
2	**Three Phase Induction Motor.**	12	4	6	6	16
3	**Three Phase Induction Motor – Starters, Speed Control & Circle diagram**	10	4	6	6	16
4	**Three Phase Alternator**	12	4	6	4	14
5	**Synchronous Motor**	08	2	6	4	12
6	**Single Phase Motors.**	04	4	4	-	08
	Total	48	20	30	20	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified

Reference Books:

Sr.No.	Name of Book	Author	Publisher
1	Electrical Machines.	P.S. Bhimbhra.	Khanna Publisher.
2	A Text Book Of Electrical Technology vol-II	B.L. Theraja A.K. Theraja	S. Chand & Co.
3	Electrical Machines.	Nagrath & Kothari	Tata McGraw-Hill Co. New Delhi
4	Electrical Technology	J.B. Gupta	S.K. Kataria & Sons.
5	Electrical Machines	S.K. Bhattacharya	Tata McGraw-Hill Co. New Delhi

Websites:
1. www.nptel.com
2. www.electrical4u.com/
3. electrical-engineering-portal.com
4. www.learnerstv.com

Course Curriculum Development Committee:

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     ii. Dr. P.N. Padghan.

  b. **External Faculty**

      i. Mr. L.S. Patil, Govt. Polytechnic, Nasik.

Academic Coordinator   **Head of Department**   **Principal**

                         (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO VS PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16307.1	3	-	-	-	-	-	-	-	-	2
EE16307.2	3	-	3	-	2	2	-	-	-	2
EE16307.3	3	3	3	3	2	3	2	-	-	2
EE16307.4	3	3	3	3	2	3	2	-	-	2
EE16307.5	3	3	3	3	2	3	2	-	-	2
EE16307.6	3	3	3	3	2	3	2	-	-	2
Avg. of POs	3	2	2.5	2	1.6	2.3	1.3	--	--	2

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE16307.1	1	-	1
EE16307.2	3	2	2
EE16307.3	3	2	2
EE16307.4	3	2	2
EE16307.5	3	2	2
EE16307.6	3	2	2
Avg. of PSOs	2.6	1.6	1.8

Unit Vs CO Matrix

Unit	**EE16304.1**	**EE16304.2**	**EE16304.3**	**EE16304.4**	**EE16304.5**	**EE16307.6**
1	2	-	-	-	-	-
2	3	3	-	-	3	-
3	-	3	-	-	3	3
4	3	-	3	-	-	3
5	3	-	-	3-	3	3
6	3	-	-	-	-	3
Avg. of COs	2.3	1.0	0.5	0.5	1.5	2

Programme : **Diploma in Electrical Engineering**							
Course Code: **EE 16 406**		Course Title: **Renewable Energy Sources**					
Compulsory / Optional: **Compulsory**							
Teaching Scheme and Credits			Examination Scheme				
TH	PR	Total	TH	TS	PR	OR	TW	Total
4	2	6	70 (3 Hrs.)	30	-	50*	--	150

1. RATIONALE :

Due to the extensive use of energy the conventional energy sources like fossil fuel are depleting very fast & the thrust is to be given on renewable energy sources for power generation. An Electrical Engineer should be aware of methods of extracting energy from Non Conventional energy sources like Solar, Wind, Geothermal etc.

Energy is an important aspect in all sectors of country's economy. The energy crisis is mainly caused due to increased population and enhanced standard of living and life style of people. The conventional sources of energy are insufficient to meet these demands. Hence, alternative energy sources are utilized for power production. The use of alternate energy sources is increasing day by day. Diploma engineers are expected to develop, operate and maintain these systems. It is therefore essential to know basics of energy conversion, conservation, and energy audit and waste heat recovery techniques.

Course Outcomes:

EE16406.1	State the various methods of energy conversion from solar energy & its applications.
EE16406.2	State the various methods of energy conversion from wind energy & its applications.
EE16406.3	State the various methods of energy conversion from ocean energy, geothermal energy, biomass & other sources of renewable energy

Unit No.	Topics / Sub-topics
1	**Energy scenario and development:** 1.1 Overview of world energy scenario 1.2 Overview of India's energy scenario 1.3 Energy Sources: classification of energy sources 1.5 Need and Prospectus of Alternate Energy Sources
2	**Solar energy** 2.1 Principle of conversion of solar radiation into Heat and Electricity. 2.2 Solar radiation Geometry: Declination, hour Angle, Altitude angle, incident angle, Zenith angle, solar Azimuth angle 2.3 Instruments for measuring solar radiation (explanation of only Pyranometer) 2.4 Construction and working of typical flat plate collector, solar concentrating collector and their applications, Advantages and Limitations 2.5 Space Heating and Cooling (only vapour absorption system) 2.6 Construction and working of solar cell, performance characteristic of solar cell 2.7 Solar Photo voltaic Electric Conversion (Stand alone and Grid connected

	system)
	2.8 Introduction to MPPT (no details)
	2.9 Solar pond, solar electric power generation (explanation of only high temperature system), Solar Distillation, Solar cooking
	2.10 Solar pumping and Green House (No numerical on above content)
3	**Wind energy** 3.1 Principle of Wind energy conversion, Nature of the wind energy. 3.2 Power in wind, Power coefficient, Maximum power, Forces on the blades, Wind Energy Conversion 3.3 Selection of site for wind mill. 3.4 Classification of WEC systems. 3.5 Advantages and limitations of WECS 3.6 Basic components of WECS. 3.7 Wind energy collectors- Horizontal and Vertical axis machines, 3.8 Safety systems and Environmental aspects. (No numerical on above content)
4	**Bio-mass energy** 4.1 Biomass conversion technologies - 1) combustion 2) Thermo chemical 3) Biochemical. Wet processes, Dry processes. 4.2 Biogas generation – anaerobic digestion, 4.3 Types of Bio-gas plants, KVIC Digester, fixed dome digester, Deenbhandu, Pragati Biogas plant. 4.4 Materials used for biogas generation. Selection of site for biogas plant. Applications. Energy plantation.
5	**Energy from the oceans** 5.1 Ocean Thermal Electric Conversion-Methods of Power Generation, Open and closed cycle OTEC system 5.2 Tidal power –Basic Principle, Components of Tidal Power Plants, 5.3 Operation Methods-single basin and double basin 5.4 Advantages and limitations for tidal power Generation 5.5 Sites Requirements, Prospects of tidal energy in India.
6	**Other alternate sources of energy** 6.1 Geothermal Energy –Sources, Principle, Hydrothermal Resources ,Geothermal energy power plant, Advantages ,Limitation and application of Geothermal Energy, Geothermal occurrence in India 6.2 Small Hydroelectric Plant(Mini and Micro hydel) Nature, Classification of SHP station, Components of SHP, Design Consideration for Mini and Micro Hydel Projects, Advantages and Limitation of SHP 6.3 Fuel Cell- Principle of Operation, Classification, Advantages, Limitation and Application of Fuel cell 6.4 Magneto-Hydro Dynamic(MHD) Power Generation- Principles, MHD system, Advantages, Future Prospects

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Energy scenario and development:**	06	06	02	00	08
2	**Solar energy**	16	04	06	04	14
3	**Wind energy**	12	04	06	04	14
4	**Bio-mass energy**	08	04	06	00	10
5	**Energy from the oceans**	08	06	04	00	10
6	**Other alternate sources of energy**	14	04	06	04	14
		64	**28**	**30**	**12**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Experiments

Sr. No.	Unit No.	Experiment/Assignment	Approx Hours
1	2	Study of solar energy & solar photovoltaic systems through books, literature and internet.	4
2	3	Study of wind energy systems through books, literature and internet.	2
3	4	Study of biomass energy through books, literature and internet.	2
4	5	Study of ocean energy through books, literature and internet.	2
5	6	Study of Geo thermal energy systems through books, literature and internet.	2
6	6	Study of Fuel cells through books, literature and internet.	2
7	2	Visit to solar power plant and visit report on it.	6
8	3	Visit to wind power plant and visit report on it.	6
9	4	Visit to biogas plant and visit report on it.	6

Reference Books:

Sr.No.	Name of Book	Author	Publisher
1	Solar Energy - Principles of thermal collection and storage	S.P. Sukhatme	Tata McGraw-Hill Co. New Delhi
2	Non-Conventional Sources of Energy	Rai, G.D	Khanna Publishers, Delhi
3	Renewable Energy Sources &	Bansal N. K.,	Tata McGraw-Hill Co.

	Conversion technology	Kleemann M. & Michael, Meliss	New Delhi	
4	Biogas systems: Priciples and Applications	Mital K.M	New Age International	
5	Biogas Technology - A Practical Hand Book	K.Khendelwal & S.S. Mahdi	Tata McGraw-Hill Co. New Delhi	

Websites:

i) www.mahaurja.com
ii) www.indiasolar.com
iii)www.beeindia.in

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   b. **External Faculty**

        i. Mr. L. S. Patil, Govt. Polytechnic, Nashik

Academic Coordinator   **Head of Department**   **Principal**

                  (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16406.1	3	3	2	3	3	3	---	2	1	3
EE16406.2	3	3	2	3	3	3	---	2	1	3
EE16406.3	3	3	2	3	3	3	--	2	1	3
Avg. of POs	3	3	2	3	3	3	--	2	1	3

CO Vs PSO matrix

CO	PSO1	PSO2	PSO3
EE16406.1	3	1	3
EE16406.2	3	1	3
EE16406.3	3	1	3
Avg. Of PSOs	3	1	3

Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum
[Out Come Based (OBE)]

Semester-V
(Course Contents)

Government Polytechnic Mumbai

(Academically Autonomous Institute of Maharashtra Government)

49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)

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Programme: Electrical Engineering   **Fifth Semester**   **With effect from June 2018**

Teaching & Examination Scheme for the Students admitted in Third Year in 2018-19														
Semester : V														
Sr. No.	Course Code	Course Title	Awards of Class	Compulsory /Optional	Teaching Scheme(Hrs./Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 213	Computer Aided Electrical Drawing	--	C	1	0	2	3	0	0	0	50	0	50
2	EE 16 305	Electrical Energy Conservation & Audit#	1	C	4	0	2	6	70#	30#	0	50*	0	150
3	EE 16 306	Switch gear & Protection	1	C	3	0	2	5	70	30	50*	0	0	150
4	EE 16 308	Project & Seminar-I	1	C	0	0	4	4	0	0	0	50*	0	50
5	EE 16 401	Power Electronics &Drives	1	C	4	0	2	6	70	30	50*	0	0	150
6	EE 16 403	Principles of Control System	1	C	3	0	2	5	70	30	0	50*	0	150
7	(Elective) EE 16 404 EE 16 405	a. Illumination Engineering b. Power System Analysis	1	O	3	0	0	3	70	30	0	0	0	100
8	EE 16 406	Industrial Training - I	--	C			4	4	0	0	0	50*	50	100
					18	0	18		350	150	100	250	50	
		Total Credits						36	Total Marks					900

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
*Indicates assessment by External Examiner. # Indicates on line theory exam.

Academic Coordinator   **HOD (EE)**   **Principal**

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 213**				Course Title: **Computer Aided Electrical Drawing**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
1	0	2	3	0	0	50*	0	0	50

*Indicates External Examiner

RATIONALE:

All the equipments, installations, circuits and other electrical and electronic systems in commercial, power and industrial sector need drawings for their manufacturing, installation, operation and maintenance. A technician working in design and shop floor must possess the skill of reading, interpreting different drawings and simulating electrical and electronics circuit for most of the activities. With the evolution of various computer software's the role of earlier draftsman is now taken over by Computer software. The Computer Aided Drawing (CAD) and simulation (MATLAB / SIMULINK, etc) software will be used to perform various practical exercises in this course. This will enable the students to become competent for working in the fast growing information technology environment by enhancing their computer aided drawing, designing and simulating skills in the field of electrical and electronics engineering.

Course Outcomes:

EE16 213.1	Identify various symbols and notations in electrical and electronics engineering drawings.
EE16 213.2	Interpret drawings, draw interferences and workout other technical details.
EE16 213.3	Draw various electrical and electronics circuits according to standard practices using CAD software.
EE16 213.4	Simulate and test simple electrical and electronics circuits using Simulation software

Course Content Details:

Unit No.	Topics/Subtopics
1	**Introduction to AutoCAD:** 1.1 Concept and terminology. 1.2 Its advantages. 1.3 Loading AutoCAD. 1.4 Creating Opening, Saving and Closing Drawing. 1.5 User Co-ordinate System (UCS) icon. 1.6 Drawing with Precision. 1.7 Drawing Units. 1.8 Linear and angular measurements. 1.9 Accessing help.
2	**Drawing Commands:** 2.1 POINT, LINES, CIRCLE, ARC, ECLIPSE, RECTANGLE, POLYGON, PLINE, HATCH, TEXT, GRADIENT, BOUNDARY, RAY, CONSTRUCTION LINE.

3	**Editing Commands:** 3.1 ERASE, OOPS, MOVE, COPY, MIRROR, CHANGE BREAK, FILLET, ROTATE, SCALE, ARRAY.

4	**Display Commands:**
	    4.1 Control commands like ZOOM, PAN, VIEW, REDRAW, REGEN, REGENAUTO, etc .
	    4.2 Drawing with geometrical commands like SNAP & GRID.

5	**Dimensioning:**
	    5.1 Elements of dimension.
	    5.2 Drawing linear dimensioning using dimension option.
	    5.3 MTEXT, TEXT, ANGLE, HORIZONTAL, VERTICAL, ROTATED.
	    5.4 Drawing aligned dimension.
	    5.5 Dimensioning arcs and circle.
	    5.6 Dimensioning angles using quick dimensions.
	    5.7 Editing dimensions.

6	**Layers:**
	    6.1 Understanding layers, Creating ,Naming, Assigning colour, LT, LW, Transparency value.
	    6.2 Using layers, Switching, Changing Layers state, Saving layers state, Changing an exisiting object layer, Making object layer current, Modifying layers.

7	**Plotting and Printing:**
	    7.1 Preparing a drawing for plotting and printing.
	    7.2 Doing a draft plot.
	    7.3 Plotting a drawing.
	    7.4 Creating a layout in paper space.
	    7.5 Specifying plot setting preview.
	    7.6 Plotting and printing.

8	**Draw various electrical circuits using CAD software**
	    8.1 Draw the cross sectional view of various electrical machines using.
	    8.2 Draw lighting and power wiring diagram for a given installation

9	**Introduction of Simulation Software:**
	    9.1 List the steps of using Simulation software .
	    9.2 Getting started, ending, commonly used blocks, Creating a model, Assigning Variables, Observing Variables during Simulation, Storing/Saving Data, Creating and Masking Sub-systems.
	    9.3 State the steps to generate graphics and plot Waveform/ response for Analysis.
	    9.4 Graphics, Plot, sub plot, label, legend etc.

10	**Electrical Circuit Simulation:**
	    10.1 List the steps of using Simulation software in Electrical engineering
	    10.2 State the procedure to build simple circuits
	    10.3 Build, Simulate and test simple electric circuits.

11	**Electronics Circuit Simulation:** 11.1 List the steps of using Simulation software

	11.2 State the procedure to build simple circuits 11.3 Build, Simulate and test simple electronics circuits.

List of Experiments: *(Any 08 Experiments)*

Sr. No.	Experiment/Assignment	Approx Hours
1	To draw Electrical symbol.	02
2	Draw different types of rectifier circuit using CAD and take print out of : (a)Single phase half wave (b)Single phase full wave (c)Bridge rectifier	02
3	Simulate three resistances in series circuit and find out voltage and current in each resistance.	02
4	Simulate the following circuits and find out voltage and current in each resistance. (a)Two resistances in parallel (b)Resistance and inductor in parallel	02
5	Simulate R-L series circuit and observe voltage wave forms across each component.	02
6	Simulate R-C series circuit and observe voltage wave forms across each component.	02
7	Simulate R-L-C series circuit and observe voltage wave forms across each component.	02
8	Simulate one switch one bulb house wiring diagram circuit.	02
9	Simulate stair case wiring circuit.	02
10	Simulate star connection using resistors and observe voltage current relation of line and phase.	02
11	Simulate delta connection using resistors and observe voltage current relation of line and phase.	02
12	Simulate single phase half-wave rectifier circuit.	02
13	Simulate single phase full-wave rectifier circuit.	02
14	Simulate single phase bridge rectifier circuit.	02
15	Draw the circuit diagram of any electrical engg. practical set up.	02
16	Draw Layout of Substation 11KV/415V	02

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Books:

Sr.No.	Name of Book	Author	Publisher
1	Performance & Design of A.C. Machine	M.G.Say	C.B.S. Publications, New Delhi
2	A Text Book Of Electrical Technology vol-II	B.L.Theraja A.K.Theraja	S. Chand & Co.

3	Electrical Machines	S.K. Bhattacharya	Tata McGraw-Hill Co. New Delhi
4	AutoCAD 2013 for Engineers and Designers.	Sham Tickoo	Dream tech press, New Delhi, Latest edition
5	Mastering AutoCAD 2013 and AutoCAD LT 2013	George Omura	Sybex, New Delhi, Latest edition
6	AutoCAD 2011 & AutoCAD LT 2011	Ellen Finkelstein	Wiley India publication
7	AutoCAD 2010 by Publisher	Paul Whelan	Dreamtech Press
8	AutoCAD for windows express	Tim McCarthy	Narosa.
9	Electrical Wiring estimating and costing	S.L.Uppal	Dhanpat Rai and Sons

List of Software/Learning Websites
1) Open Source Softwares preferred.
2) AutoCAD
3) Circuit maker
4) http://coolcadelectronics.com/coolspice/
5) http://students.autodesk.com/ (register and get free student version of LATEST AutoCAD software for approximately 3 years)
6) http://www.circuitstoday.com/circuit-design-and-simulation-softwares
7) http://en.wikipedia.org/wiki/List_of_free_electronics_circuit_simulators
8) Android applications available on Google Play store like AutoCAD 360, Circuit Builder, Electric Circuit, Circuit Simulator, WeSpice Demo, Electric Circuit Calculator, Electrical Engineering

Course Curriculum Development Committee:

a. **Internal Faculty**

      i. Mrs. J. D. Waghmare

      ii. Mr.M.S.Narkhede

b. **External Faculty**

      i. Mrs.Meenakshi Shirsat

Academic Coordinator   **Head of Department**   **Principal**

      (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO Vs PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16 213.1	3	3	3	3	0	1	1	1	1	1
EE16 213.2	3	3	3	3	0	1	1	1	1	1
EE16 213.3	3	3	3	3	0	1	1	1	1	1
EE16 213.4	3	3	3	3	0	1	1	1	1	1
Avg. of POs	3	3	3	3	0	1	1	1	1	1

CO Vs PSO matrix

CO	PSO1	PSO2	PSO3
EE16 213.1	2	3	1
EE16 213.2	2	3	1
EE16 213.3	2	3	1
EE16 213.4	2	3	1
Avg. Of PSOs	2	3	1

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE16305**				Course Title: **Electrical Energy Conservation & Audit** [#]					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
04		**02**	**06**	**70**	**30**	**--**	**50**		**150**

(*) indicates assessment by internal examiner

Rationale:

For implementing and monitoring effectiveness of the energy conservation methods and proper use of electrical energy, its audit is must. To maintain the growth of development, electricity generation will be required to be increased by proper mix of conventional and non-conventional sources of energy. But at the same time its conservation and audit should be done to increase the efficiency of electrical power system. Hence electrical engineers must have knowledge of various methods of energy conservation and concept of energy audit and its implementation.

Course Outcomes: Students will be able to-

EE 16 305.01	Identify the relationship between energy consumption and its impact on environment
EE 16 305.02	Describe energy conservation principle, its management concept and objectives
EE 16 305.03	Assess the energy saving & conservation in different electric sector
EE 16 305.04	Perform energy audits and decides simple payback period
EE 16 305.05	Employ devices and equipment used for energy auditing and its conservation

Course Content Details:

Unit No.	Topics/Subtopics
1	**Energy and Environment:** 1.1 Environment and social concerns related to energy utilization. 1.2 The green house effect. 1.3 Global Warming and its effect. 1.4 Pollution, Acid Rains. 1.5 Global Energy and environment Management.

2	**Elements of Energy Conservation and Management**
	2.1 Present energy scenario, State and national level Sector wise Energy consumption, demand supply gap
	2.2 Scope for energy conservation and its benefits
	2.3 Energy conservation Principle: Maximum energy efficiency, Maximum cost effectiveness
	2.4 Energy Conservation Act-Main features, Standards and labelling, designated consumers
	2.5 Energy Conservation Building Codes (ECBC): Brief introduction of the salient features of the act
	2.6 Energy management concept and objectives: Initializing Planning, Leading, Controlling, Promoting, Monitoring and Reporting
	2.7 Energy management programmes
	2.8 Demand side Management, Aggregate Technical and Commercial loss
3	**Energy Conservation In Industries**
	3.1 Energy saving opportunities in electric motors : selection, overrating/ oversizing, efficiency vs output power curve, starting method
	3.2 Benefits of Power factor improvement and its techniques-Shunt capacitor, Synchronous Condenser etc., Block diagram of APFC panels (manual and automatic)Simple numerical on improvement of power factor by using shunt capacitor
	3.3 Effects of harmonics on – Motors, and remedies leading to energy conservation
	3.4 Energy conservation by VSD, Energy efficient motors, retrofitting of old motors
	3.5 Energy conservation in electric furnaces, ovens and boilers.,
	3.6 lighting techniques – Use of Daylight , concept of output lumen per watt consumption of light source, use of modern lamp and luminaries (Ex. LED) over conventional lighting, dimming, voltage regulators
	3.7 Methods and techniques of energy conservation: Ventilation and air conditioners, Area Sealing, Insulating the Heating / cooling fluid pipes , automatic door closing- Air curtain, Thermostat / Control
	3.8 Identification of losses and its minimisation in the power distribution system: From point of supply to utilisation point- transformers, cables , wires, Hotspot at electric contacts
4	**Energy Conservation In Commercial and residential premises**
	4.1 Requirement of electrical energy for a specific purpose in a school, college, shops, malls, banks, offices, house /flat,
	4.2 Use of alternative energy source in place of electrical energy
	4.3 Utility services in residential complex, building, civic bodies
	4.4 Use of standard and labelling or Energy star marked electrical consumer goods or products
	4.5 Adoption of energy conservation methods listed in 3.6, 3.7,3.8

5	**Energy Audit:** 5.1 Energy audit and its benefits 5.2 Energy flow diagram 5.3 Types of energy audits : Preliminary audit , Detailed audit 5.4 Methodology of Preliminary audit : ABC or Pareto Analysis, questionnaire form, data collection form, submission of preliminary audit report 5.5 Methodology of Detailed audit: i] Phase- I:pre audit,ii] phase-II: Audit process at site-Walk through audit and Device performance audit, iii]Phase- III post audit analysis and decision making 5.6 Energy audit report 5.7 Numerical on calculation of simple payback period for installing energy conservation equipment/devices
6	**Measurement and energy conservation Devices :** 6.1. Measurements of parameters in energy audit process 6.2List and brief description of various electrical non electrical measuring instruments are during audit process, such as –smart meters(V,I,W,KVA, KVAR, PF) data loggers , remote sensing and measurements devices, Power Analyser, thermometer-contact, infrared, leak detector, tachometer and lux meter etc 6.3. List and brief description of Equipment/devices used for energy conservation Example, such as – photo sensors, day light controller, occupancy sensors, temperature controllers, thermostats, humidity controllers, pressure controllers, timers, harmonic filters, voltage stabilizers, motor starters, PLC 6.4 Introduction to: Energy Management System, Internet of things and Mobile Application used for energy conservation

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Energy and Environment	02	02	04	-	**06**
2	Elements of Energy Conservation and Management	08	02	06	04	**12**
3	Energy Conservation In Industries	22	04	08	06	**18**
4	Energy Conservation In Commercial and residential premises	10	02	06	04	**12**
5	Energy Audit:	12	02	06	04	**12**
6	Measurement and energy conservation Devices :	10	02	04	04	**10**
	Total	**64**	**14**	**34**	**22**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of

marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Practical:

Sr.No	Unit	Experiment/Assignment	Approx Hours
1	1,2	Prepare a report on Internet survey of State , National and International Agencies related to environment, energy conservation	**06**
2	2	Prepare report on Internet survey of energy conservation programmes of States , India and other countries	**04**
3	3,4,5	Case study : Preliminary Audit of Any one of the following a]School/college b]Commercial premises c] Small scale industry/Heavy engineering workshop d] Utility services of civic body/large residential	**12**
4	6	Study of devices/equipment used for measurement and energy conservation during audit process	**06**
5	6	Literature survey of Energy Management System, IOT and Mobile Apps.	**04**

Reference Books:

Sr. No.	Book Title	Author	Publication
1	General aspects of Energy Management and Audit, 3rd edition	Bureau of Energy Efficiency	Bureau of Energy Efficiency
2	Energy Conservation and Audit	S.C.Tripathi	Tata Mcgraw Hill, New Delhi.
3	Power Factor Correction	Siemens	New Age Publishers
4	Energy Conservation	D. Yogi Goswami and Frank Kreith	CRC Press
5	Energy Audit and Management, Volume-I& II		IECC Press
7	Energy Conservation Act 2001 https://powermin.nic.in/sites/default/files/uploads/ec	Ministry of Law and Justice	GOI

	[act2001.pdf](act2001.pdf)		
8	Industrial Instrumentation, Volume 1	K Krishnaswamy	New age Intl.
9	Electrical measurements and measuring Instruments	R. K. Rajput	S. Chand

Course Curriculum Development Committee:

  a. **Internal Faculty**

       i. I. N Khuspe

      ii. Mr. M. S. Narkhede

  b. **External Faculty**

       i. Dr.. Dilip Lulekar

Academic Coordinator   **Head of Department**   **Principal**

                            (Electrical Engineering)   **Govt. Polytechnic,**

Mumbai

Unit and CO mapping:

Unit No.	Topic Title	Course Outcomes
1	Energy and the Environment	CO1,CO2
2	Elements of Energy Conservation and Management	CO1,CO2
3	Energy Conservation In Industries	CO2,CO3
4	Energy Conservation In Commercial and residential premises	CO2,CO3
5	Energy Audit	CO4,CO5
6	Measurement and energy conservation Devices	CO4,CO5

CO VsPO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 305.01	3	3	-	2	3	3	3	3	3	3
EE 16 305.02	3	3	3	2	3	3	3	3	3	3
EE 16 305.03	3	3	3	3	3	3	3	3	3	3
EE 16 305.04	3	3	3	3	2	3	3	3	3	3
EE 16 305.05	3	3	3	3	3	3	3	3	3	3
Av. Of POs	3	3	2.4	2.6	2.8	3	3	3	3	3

CO VsPO matrix:

CO	PSO1	PSO2	PSO3
EE 16 305.01	2	3	3
EE 16 305.02	3	3	3
EE 16 305.03	3	3	3
EE 16 305.04	3	3	3
EE 16 305.05	2	3	3
Av. Of PSOs	2.6	3	3

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 306**				Course Title: **Switchgear and Protection**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**02**	**06**	**70 (3 Hrs.)**	**30**	**50*(Ext)**	**-**	**-**	**150**

Rationale:

In generation, transmission and utilization of electrical energy switchgear and protection plays an important role for delivering uninterrupted power supply to the consumers. It is also necessary at various levels to protect the power system from damage. The electrical engineer must know switchgear and protection systems. It will help while working as a supervisor in substations, manufacturing industries & public service utilities.

Course Outcomes:

Student should be able to

EE 16 306.1	Identify the effects of abnormalities in the operation of power system
EE 16 306.2	Analyze the working principle and operation of current interrupting devices.
EE 16 306.3	Analyze the working principle and operation of protective relays .
EE 16 306.4	Identify the various components of switchgear and protection systems.
EE 16 306.5	Recognize the faults in the power system and remedies.
EE 16 306.6	Name the specifications and select the suitable switchgears in the protection of power system.

Unit No	Topics / Sub-topics
1	**Basic Concepts:** 　　1.1 Necessity and functions of protective system. 　　1.2 Substation equipment, functions and layout. 　　1.3 Faults and abnormal conditions. 　　1.4 Types of faults and their causes. 　　1.5 Short circuit calculations- Symmetrical faults only (Numerical problems). 　　1.6 Use of current limiting reactors & their arrangements.
2	**Circuit Interrupting Devices:** 　　2.1 Fuses –Terms and definitions, types, construction and 　　　　Working characteristics, selection and applications 　　　　(Rewirable, D-type, Cartridge, HRC and Drop-out Fuses) 　　2.2 Isolators- vertical break, horizontal break &pantograph type. 　　2.3 Arc formation process, methods of arc extinction, related terms. 　　2.4 Circuit breakers- Concept, Classification, Working principle, 　　　　Construction, Specification and Applications of – 　　　　Miniature circuit breakers (M C B) , Moulded case circuit breakers 　　　　(M C C B) , Earth leakage circuit breaker (E L C B or R L C B),

	Sulphur Hexa Fluoride circuit breaker (SF6), Vacuum circuit breaker. Air Break& Air blast circuit breakers (ACB), Comparison of fuse & MCCB. 2.5 Selection of MCCB for motor. 2.6 Selection and rating of fuses & circuit breakers
3	**Protective Relaying:** 3.1 Functions, requirements and related terms. 3.2 Basic relay circuit. 3.3 Protective zones. 3.4 Primary and backup protection. 3.5 Desirable qualities of protective relaying. 3.6 Relay time and Fault clearing time. 3.7 PSM ,TSM ,Relay setting (Simple Numerical Problems) 3.8 Thermal Relay 3.9 Over current relay-Time current characteristics. 3.10 Introduction to Static relay 3.11 Static over current relays. 3.12 Static Distance relays 3.13 Microprocessor based over current relays. 3.14 Microprocessor based Distance relays 3.15 Microprocessor based Differential relays 3.16 Microprocessor based Directional relays 3.17 Microprocessor based Impedance relays **3.18** Introduction to Numerical relay
4	**Earthing:** 4.1 Introduction & importance. 4.2 Difference between neutral earthing and machine earthing 4.2 Types of earthing 4.3 Substation earthing
5	**Protection of Alternator:** 5.1 Abnormalities & Faults. 5.2 Differential protection (Simple Numerical Problems). 5.3 Over current, earth fault, inter turn fault, negative phase sequence, over heating protection. 5.4 Reverse power protection.
6	**Protection of Transformer:** 6.1 Abnormalities & faults. 6.2 Differential protection (Simple Numerical Problems). 6.3 Over current, earth fault, inter turn, restricted earth fault, over heating protection. 6.4 Buchholtz relay.
7	**Protection of Induction motor:** 7.1 Abnormal operating conditions and causes of failures. 7.2 Phase fault , Ground fault , Negative phase sequence protection , Single Phase preventer

8	**Protection of Bus bar and Transmission line:**
	  7.1 Abnormalities & faults.
	  7.2 Bus bar protection.
	  7.3 Transmission line protection- over current, distance protection.
	  7.4 Three Stepped distance protection.
	  7.5 Carrier Current protection.

9	**Over Voltage Protection:**
	  8.1 Causes of over voltages.
	  8.2 Lighting phenomenon & over voltage due to lightning.
	  8.3 Protection of transmission line & substation from direct stroke.
	  8.4 Types, Construction & principle of operation of lightning arresters & surge absorbers.
	  8.5 Protection against traveling waves.
	  8.6 Insulation co-ordination.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Basic Concepts	04	2	4	0	**06**
2	Circuit Interrupting Devices	08	2	6	6	**14**
3	Protective Relaying	08	2	6	6	**14**
4	Neutral Earthing	04	2	2	0	**04**
5	Protection of Alternator	06	2	3	3	**08**
6	Protection of Transformer	06	2	3	3	**08**
7	Protection of Induction Motor	04	2	2	0	**04**
8	Protection of Bus bar and Transmission line	04	2	0	4	**06**
9	Over Voltage Protection	04	2	4	0	**06**
	Total	**48**	**18**	**30**	**22**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments:
Any ten (10) of the following

Sr. No.	Unit	Experiment/Assignment	Approx. Hours

1	2	To identify the components of different types of low voltage and medium voltage circuit breakers with their specifications.(through visits , video or model).
		  I) Miniature circuit breaker (M C B)
		  II) Moulded case circuit breaker (M C C B)
			04

		III) Earth Leakage circuit breaker (E L C B)	
2	2	To identify the components of different types of high voltage circuit breakers with their specifications.(through visits , video or model). I) Sulpher - Hexa fluoride circuit breaker (S F 6) II) Vacuum circuit breaker.	04
3	**2**	To Plot the characteristics of rewirable fuse.	**02**
4	**3**	To plot performance characteristics of over current relay.	**02**
5	**3**	To plot performance characteristics of IDMT relay.	**02**
6	**3**	To plot performance characteristics of Differential relay.	**02**
7	**3**	To plot performance characteristics of Impedance relay.	**02**
8	**5**	Simulation of alternator protection.	**04**
9	**6**	Simulation of transformer protection.	**04**
10	**7**	Simulation of Induction Motor protection.	**04**
11	**8**	Simulation of transmission line protection.	**04**
12	**9**	To identify the components of different types of lightning arresters with their specifications. (through visits , video or model).	**04**
13	**4**	To identify the components of different types of earthing with their specifications. (through visits , video or model).	**04**
14	**2**	To identify the components of different types of isolators with their specifications. (through visits , video or model).	**04**

Visit :   Visit to a nearby substation and study all the circuit breakers, relays, isolators, lightening arrestors,   etc and its protection scheme.

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Switchgear and Protection	Sunil S. Rao	Khanna Publishers, New Delhi.
2	Fundamentals of Power System Protection	Y. G. Paithankar and S. R. Bhide	Prentice-Hall India, New Delhi
3	Power System protection and Switch gear	Badri Ram	Tata McGraw Hill Education Private Ltd., New Delhi.
4	Switchgear and Protection	J. B. Gupta	S. K. Kataria and Sons, New Delhi.

Programme: **EE**									
Course Code: **EE16308**				Course Title: **Project & Seminar I**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
-	-	4	4	-	-		50*	-	50

Rationale:

A Diploma holder in Electrical Engineering needs to supervise, operate and maintain electrical systems, in industries and fields. Project introduces the students to professional engineering practice by providing them with an opportunity to work on an engineering problem. It is also important to convey the ideas and to have effective communication with the people. In "Project & seminar I" student will present the seminar preferably on the selected project topic.

Course Outcomes: Student should be able to:

EE16308.1	Identify and use verity of academic resources.
EE16308.2	Carry out literature survey from various sources available.
EE16308.3	Organize the information for presentation.
EE16308.4	Develop audience-centered presentation.
EE16308.5	Ask meaningful questions.
EE16308.6	Prepare appropriately to participate effectively in class discussion.

Course Content Details:

Unit No	Topics / Sub-topics

1	**Methodology:**
	• This course will be spread over two semesters i.e. fifth and sixth semester.
	• Course registration will be at the beginning of the fifth semester.
	• Students will form a batch of four to five students.
	• Students will
	  o Identify the project and get it approved from the guide.
	  o Carry out Literature survey
	  o Plan and design the project
	  o Identify the of required components

2	**Seminar:** • Student should present the seminar in fifth semester preferably on the selected project topic. • Every student will prepare and deliver the seminar. • Use of audio visual and / or power point presentation is desirable. • Presentation will be for @ 15 minutes including 5 minutes of question and answer.

3	**Submission of Seminar Document:**
	• The student shall get the seminar draft approved from Guide and complete final document before presenting seminar
	• Each student shall prepare two hard copies of final seminar document and retain one copy with student and submit one hard copy along with soft copy for department.
	• The structure of the seminar document shall be as per the following format: Certificate / Acknowledgement / Index / Introduction / Detailed content / Conclusion / References.
	• The seminar report shall be of minimum 10 pages and Max. 20 pages with 1.5 line spacing. Font: New Times Roman, left margin 3 cm, right margin 1.5 cm, top margin 2 cm, bottom margin 2 cm, header & footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified. It should be certified by seminar Guide and Head of department.
4	**Suggestive list of topics for selection of project .**
	• Industry supported project
	• Energy Conservation and Audit.
	• Renewable energy.
	• Maintenance based project.
	• Smart Metering, Electricity Theft Reduction
	• Power Quality
	• Automation
	• Illumination Engineering
	• Green building Codes
	• Hybrid Vehicles
	• Variable Voltage Variable frequency drives
	• Traction new trends
	• BLDC motors
	• Smart Grid Applications
	• Simulation
	• Traffic light control system
	• Any other topics related to Electrical Engineering

Course Curriculum Development Committee:
a. **Internal Faculty**

       i.   Ms. V.U. Bhosale LEE

b. **External Faculty**
       i.   Mrs. Barnali S Motling (HOD, KJ Somaiya, Mumbai)

Academic Coordinator   **Head of Department**   **Principal**
                             Electrical Engg.   **Govt. polytechnic Mumbai**

CO Vs PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16308.1	--	2	--	--	2	--	--	3	3	2
EE16308.2	--	2	--	--	2	--	3	3	3	2
EE16308.3	--	2	--	--	--	--	2	3	3	2
EE16308.4	--	3	2	2	2	2	--	3	3	2
EE16308.5	1	3	--	--	--	--	--	--	3	2
EE16308.6	1	3	--	--	--	--	--	--	3	2

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16308.1	--	--	3
EE16308.2	--	--	3
EE16308.3	--	--	3
EE16308.4	--	--	3
EE16308.5	--	--	2
EE16308.6	--	--	2

Programme Code : **EE**	
Course Code: **EE16 401**	Course Title: **Power Electronics and Drives**
Compulsory / Optional: **Compulsory**	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
4	**-**	**2**	**6**	**70**	**30**	**50***		**-**	**150**

Rationale:

Power Electronics is ushering in a new kind of industrial resolution because of its important role in energy conservation, renewable energy systems, bulk utility energy storage, electric and hybrid vehicles in addition to its traditional roles in industrial automation and high energy efficiency systems. Electrical engineer should be competent enough to adjust with the new technology which has come due to advancements in Power Electronics. The intention of this course is to introduce important power electronic semiconductor switches and their applications as for the power conversion and control.

Course Outcomes: Student should be able to:

EE16401.1	Select appropriate power semiconductor device for a particular applications.
EE16401.2	Compare various power converters and their applications
EE16401.3	Select appropriate type of drive for a particular application
EE16401.4	Assemble and test simple power electronic circuit
EE16401.5	Trace the fault in the simple circuit

Course Content Details:

No derivation and No numerical for all Topics

Unit No	Topics / Sub-topics

1	**Power Semiconductor devices:**
	 1.1 Introduction to Thyristor family and other power devices.
	 1.2 SCR: Construction, symbol, working & V-I characteristics
	 1.3 Definitions: Holding current, latching current, break over voltage.
	 1.4 Construction, symbol, V-I characteristics and application of Triac, Diac, MOSFET and IGBT
	 1.5 Phase control using TRIAC
	     Light dimmer
	     Fan regulator
	     Temperature Control using SCR or triac

2	**SCR turn on, turn off methods and protection circuits:**
	 2.1 SCR turn on methods : Voltage Triggering, Gate Triggering, dv/dt Triggering and Light Triggering, Temperature triggering.
	 2.2 Gate triggering circuits for SCR - Circuit diagram, working principle, waveforms of
	     • Resistor triggering
	     • R-C triggering
	     • UJT triggering.

	2.3 Thyristor Turn off methods.
	  a) Natural Commutation
	  b) Forced Commutation :
	    • Class A- Self commutation by resonating load
	    • Class B- Self commutation by LC circuit
	    • Class C- Complementary commutation
	    • Class D – Auxiliary commutation
	    • Class E – external pulse commutation
	di /dt protection, dv/dt protection

3	**Controlled Rectifier** 3.1 Difference between uncontrolled rectification and controlled rectification. 3.2 Single Phase Fully Controlled Half Wave Converter - With Resistive Load ,With RL Load and Freewheeling Diode. 3.3 Single Phase Fully Controlled Full Wave Converter - With Resistive Load & With RL Load. 3.4 Single Phase Fully Controlled Bridge Converter - With Resistive Load & With RL Load 3.5 Three Phase Fully Controlled Bridge Converter- With RL Load. 3.6 Comparison of 3 phase and 1 Phase Converters.

4	**Inverters**
	4.1 Introduction. Classification of inverters according to nature of input source, method of commutation, connection of thyristor & commutating component.
	4.2 Working principle & operation of
	  • Basic and modified Series inverter ,
	  • Basic Parallel inverter
	4.3 Circuit diagram , working ,waveforms of
	  • Single phase half bridge inverter
	  • Single phase full bridge inverter
	4.4 Voltage control in single phase inverters (PWM Inverters):Different Techniques

5	**Chopper**
	5.1 Chopper Principle
	5.2 Control Techniques:
	  • Constant Frequency System
	  • Variable Frequency System
	5.3 Step Up Chopper And Step down chopper
	5.4 Circuit diagram and working of Class A, Class B, Class C, Class D and Class E choppers
	5.5 SCR Vs MOSFET as the switching device used in chopper

6	**Drives and other application of power electronics :** 6.1 Concept of electric drives. 6.2 Adjustable speed drive VS servo drives 6.3 DC drives: Speed control of DC series motor with single phase half and full controlled converter. 6.4 Chopper based DC drive for separately excited DC motor. 6.5 Introduction to brushless DC motor. 6.6 Three phase half wave brushless DC motor. 6.7 Block diagram of DC brushless drive. 6.8 AC Drives - Speed control of three phase Induction Motor with Variable frequency • Voltage source inverter fed induction motor drive .

	• Pulse width modulated inverter fed induction motor drive **6.9 Other applications** Circuit diagram, operation of : • Static circuit breaker(DC and AC) • Induction heating control • Dielectric heating control

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Power Semiconductor devices	10	04	04	02	10
2	SCR turn on and turn off methods and protection circuits	10	04	04	02	10
3	Controlled Rectifier	10	04	06	02	12
4	Inverters	10	04	06	02	12
5	Chopper	10	04	06	02	12
6	Drives and other applications of power electronics	14	04	06	04	14
	Total	**64**	**24**	**32**	**14**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).
Notes:This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments / Assignments :

Sr. No.	Unit	Experiment / Assignment (Any 08)	Approx. Hours
1	1	Construct circuit & verify the V-I characteristic of SCR.	4
2	1	Construct circuit & verify the V-I characteristic of TRIAC.	4
3	1	Construct circuit & verify the V-I characteristics of power MOSFET.	4
4	1	Construct circuit & verify the V-I characteristics of power IGBT	4
5	1	Construct the circuit of light dimmer/ fan regulator	
6	1	Observe temperature control using thyristor	4
7	2	Construct circuit & observe firing angle (α) control of R , RC or UJT triggering	4
8	3	Observe the output of single phase fully controlled bridge rectifier using R load and RL load	4
9	4	Observe the output of single phase series or parallel inverter	4
10	4	Observe the output of half Bridge Inverter	4
11	6	Observe the output of step down chopper	4
12	6	Observe the output of step up chopper	4
13	7	Control of speed of Induction motor using v/f method	4
		Total	**32**

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Power Electronics	M. D. Singh & K.B. Khanchandani	McGraw-Hill Publishing
2	Power Electronics	Muhammad H. Rashid	Prentice Hall Of India Private Ltd.
3	Power Electronics	P S Bimbhra	Khanna Publishers.
4	Power electronics devices circuits and industrial applications	V.R. Moorthi	OXFORD
5	Electrical drives concepts and applications	Vedam Subramanian	McGraw-Hill Publishing

Course Curriculum Development Committee:
a.   Internal Faculty
      i.   Ms. V.U. Bhosale LEE
      ii.   Ms A.A. Sangale
b.   External Faculty
      i.   Mr Rohan homkar K.J. Somaiya polytechnic Mumbai.

Academic Coordinator   **Head of Department**   **Principal**
                           Electrical Engg.   **Govt. polytechnic Mumbai**

Unit and CO mapping:

S.N.	Unit	CO
1	Power Semiconductor devices	CO1,C04,CO5
2	SCR turn on and turn off methods and protection circuits	CO1,C04,CO5
3	Controlled Rectifier	CO2,C04,C05
4	Inverters	CO2,C04,C05
5	Chopper	CO2,C04,C05
6	Drives and other applications of power electronics	CO3,C04,C05

CO Vs PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16401.1	2	3	3	2	2	-	1	2	1	3
EE16401.2	2	3	3	3	3	1	1	3	1	3
EE16401.3	2	3	3	3	3	2	1	2	1	3
EE16401.4	2	3	3	3	2	-	-	1	1	3
EE16401.5	2	3	3	3	2	-	-	1	1	3
Avg. of POs	2	3	3	3	2.4	0.6	0.6	1.8	1	3

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16401.1	3	2	3
EE16401.2	3	2	3
EE16401.3	3	2	3
EE16401.4	3	2	3
EE16401.5	3	2	3
Avg. of PSOs	3	2	3

Unit Vs CO Matrix

Unit	EE16401.1	EE16401.2	EE16401.3	EE16401.4	EE16401.5
1. Power Semiconductor devices	3	1	1	3	3
2. SCR turn on and turn off methods and protection circuits	3	1	1	3	3
3. Controlled Rectifier	3	3	1	3	3
4. Inverters	3	3	1	2	2
5. Chopper	3	3	1	2	2
6. Drives and other applications of power electronics	3	2	3	2	2
Avg. of COs	3	2.1	1.3	2.5	2.5

Programme : **Diploma in Electrical Engineering**		
Course Code: **EE 16 403**	Course Title: **Principles of Control System**	
Compulsory / Optional: **Compulsory**		

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**02**	**05**	**70 (3 Hrs.)**	**30**	**-**	**50*(Ext)**	**-**	**150**

Rationale:

In changing economy now, a day more and more stress is being given up in increasing the throughput in industries. The basic tool for achieving this is automation. Control system being a backbone of the automation plays a vital role in engineering education. To understand and discharge the duties of an electrical engineer he/she should have knowledge of Principles of control system.

Course Outcomes:

Student should be able to

EE16403.1	Know the difference between different types of control systems.
EE16403.2	Understand the working principle and operation of closed loop system.
EE16403.3	Analyze different types of control actions and choose a particular action .
EE16403.4	Understand the concept of stability of system.
EE16403.5	Understand the time response of control system.
EE16403.6	Understand the frequency response of control system.

Unit No	Topics / Sub-topics
1	**Basics of Control System:** 1.1 Definition of Control System 1.2 Classification – open loop and closed loop system 1.3 Manually controlled and automatically controlled closed loop system 1.4 Examples of closed loop system – Automatic tank level control system, A position control system, Rudder control of ship. 1.5 Feedback and Its effect on: overall gain, Stability, Sensitivity, External disturbance/ noise. 1.6 Types of Feedback Control Systems – (Only introduction) a) Linear and Non Linear b) Time invariant and Time variant c) Continuous data and Sampled data (Discrete) 1.7 Transfer function and it's properties 1.8 Derivation of Transfer function for linear RLC series circuit. 1.9 Block Diagrams: a) use b) elements c) Six Rules for reduction technique d) block diagram for feedback control system (closed loop system) and derivation of it's transfer function.

	1.10 Signal Flow Graph, step by step construction of signal flow graph for given set of algebraic equations. 1.11 Basic properties of Signal flow graphs. 1.12 Definitions for Signal flow graphs: Input mode (source), output mode (sink), path, Forward path, Loop, Path gain, Forward-path gain, Loop gain, non-touching loops. 1.13 Manipulation and algebra of Signal flow graph 1.14 Example of construction of Signal flow graph. 1.15 Explanation of Mason's gain formula **1.16** Force (Torque) – Voltage and Force (Torque) – Current analogy between Mechanical Translational, Rotational and Electrical systems	
2	**Time response of Control system:** 2.1 Transient and Steady state response of first order control system 2.2 Typical test signals for Time response of Control system: step, ramp and parabolic. **2.3** Unit step response of control system (rise time, delay time, settling time , maximum overshoot, steady state error)	
3	**Concept of Stability:** 3.1 Stability: Definition, types (absolute, relative) 3.2 Impulse responses corresponding to different locations of roots of characteristic equation. 3.3 Relation between the transient response and the characteristic equation roots. 3.4 Root location in S plane for determining stability. 3.5 Hurwitz criterion 3.6 Routh Hurwitz criterion (Simple Numericals) 3.7 Root Locus: Definition of Root Loci, Complementary Root Loci, Root Counters, Complete Rot Loci. **3.8** Root Loci concept	
4	**Frequency Response Analysis:** 4.1 Introduction 4.2 Correlation between time and frequency response **4.3** Frequency response analysis of system using Bode plot for standard function.	
5	**Control actions :** 5.1.On-Off, P, I, P+I, P+D,P+I+D, actions **5.2.**Comparative advantages and disadvantages of PI, PD and PID actions	

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Basics of Control System	18	16	4	4	24
2	Time response of Control system	07	06	2	2	10
3	Concept of Stability	12	18	2	0	20
4	Frequency Response Analysis	07	08	2	0	10
5	Control actions	04	02	04	0	06
	Total	48	50	14	06	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments:

Any ten (10) of the following preferably in Matlab /Scilab software

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	**1**	Obtain Pole, zero, gain values from a given transfer function	**02**
2	**1**	Obtain Transfer function model from pole, zero, gain values	**02**
3	**1**	Obtain Pole, zero plot of a transfer function	**02**
4	**2**	Determine Step response of 1st order system	**02**
5	**2**	Determine Impulse response of 1st order system	**02**
6	**2**	Determine Step response of 2nd order system	**02**
7	**2**	Determine Impulse response of 2nd order system	**02**
8	**2**	Determine a) Step response of Type '0' system **b)** Impulse response of Type '0' system	**02**
9	**2**	Determine a) Step response of Type '1' system b) Impulse response of Type '1' system	**02**
10	**2**	Determine a) Step response of Type '2' system b) Impulse response of Type '2' system	**02**
11	**3**	To determine a) Effect of PI controller on system performance b) Effect of PD controller on system performance	**02**
12	**3**	Determine Root Locus plot of a 2nd order system	**02**
13	**3**	Observe the a) Effect of addition of zeros to forward path of an open loop system. b) Effect of addition of zeros to forward path of a closed loop system.	**02**
14	**3**	Observe the a) Effect of addition of poles to forward path of an open loop system. b) Effect of addition of poles to forward path of a closed loop system	**02**

15	4	Determine Bode plot of a 2nd order system	04

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Automatic Control Systems	Benjamin C Kuo	Prentice-Hall Inc, New Jercy
2	Control Systems Engineering	I.J.Nagrath , M.Gopal	New Age International , New Delhi

Course Curriculum Development Committee:
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   b. **External Faculty**
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Academic Coordinator   Head of Department   Principal
                          (Electrical Engineering)   Govt. polytechnic Mumbai

EE16403.1	Know the difference between different types of control systems.
EE16403.2	Understand the working principle and operation of closed loop system.
EE16403.3	Analyze different types of control actions and choose a particular action .
EE16403.4	Understand the concept of stability of system.
EE16403.5	Understand the time response of control system.
EE16403.6	Understand the frequency response of control system.

Unit and CO mapping:

S.N.	Unit	CO
1	Basics of Control System	EE16403.1
2	Time response of Control system	EE16403.2
3	Concept of Stability	EE16403.6
4	Frequency Response Analysis	EE16403.4
5	Control actions	EE16403.3

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16403.1	3	3	2	1	1	1	1	1	1	1
EE16403.2	3	3	2	1	1	1	3	1	1	1
EE16403.3	3	3	3	1	3	1	1	1	1	1
EE16403.4	3	3	3	1	3	1	1	1	1	1
EE16403.5	3	3	3	1	1	1	1	1	1	1
EE16403.6	3	3	1	1	1	1	1	1	1	1

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16403.1	3	1	1
EE16403.2	3	3	1
EE16403.3	3	2	1
EE16403.4	3	1	1
EE16403.5	3	1	1
EE16403.6	3	1	1

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 404**				Course Title: **Illumination Engineering**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**00**	**03**	**70 (3 Hrs.)**	**30**	**-**	**-**	**-**	**100**

Rationale:

This course is designed to teach students various concepts of Illumination Engineering. Students shall apply the basic illuminations laws. He/She should be able to apply the acquired knowledge in designing the schemes. With changing needs of the society students shall be able to fulfil the optimized solution considering the need of energy conservation. He/She should be able to take care the needs of various sectors of the society in illumination area.

Course Outcomes:

Student should be able to

EE16 404.1	Understand the meaning of terms used in illumination engineering
EE16 404.2	Realize the requirements of various types of consumers
EE16 404.3	Study requirements of illumination levels for various applications
EE16 404.4	Understand illumination schemes fundamentals.
EE16 404.5	Differentiate between various types of lamps

Unit No	Topics / Sub-topics
1	**Fundamentals of Illumination:** 1.1.Fundamentals of Illumination 1.2.Illumination terminology: Illumination, Light intensity, Lumen, Lux 1.3.Laws of Illumination (Simple numerical) 1.4.Concept of Photometry 1.5.Measurement of Illumination 1.6.Features of good Illumination scheme 1.7.Biological effect of artificial illumination , Light pollution

2	**Lamps & Lighting Accessories:**
	 2.1 Types of Lights
	     a. Visible light
	     b. Ultraviolet light
	     c. Infrared light
	 2.2 Types of Lamps
	
	     a. Incandescent lamp
	     b. ARC lamps – ac &dc arc lamp
	     c. Fluorescent lamp
	     d. Mercury vapour lamp, HPMV lamp, Mercury iodide lamp
	     e. Sodium vapour lamp
	     f. Neon lamp, Neon Sign Tubes

	g. Halogen lamp
	h. CFL Lamps
	i. Metal halides lamp
	j. LED lamps
	k. Lasers
	k. Selection criterion for lamps
	
	2.3 Construction, working principle advantages and disadvantages of all lamps
	2.4 Comparison between incandescent & Florescent lamps
	2.5 Lighting schemes: selection of lamp, illumination efficiency, glare & power consumption
	   a. Direct & Indirect
	   b. Semi direct & semi indirect
	   c. General lighting scheme
	2.6 Lighting calculation methods
	   a. Watt/m2 method
	   b. Lumens or light flux method
	   c. Point to point method (simple numerical)

3	**Illumination Control & Control Circuits:**
	3.1 Purpose of lighting control
	3.2 Working principle and operation of:
	  a) Dimmer
	      i) Resistance type dimmer
	      ii) Salt water dimmer
	  b) Dimmer Transformer
	      i) Autotransformer dimmer
	      ii) Two winding transformer dimmer
	  c) Electronic Dimmer
	      i) Thyristor operated dimmer
	      ii) Triac operated dimmer
	3.3 Control of enhance lightning
	3.4 Methods used for light control
	3.5 Control circuits for lamps: single lamp controlled by single switch, two switches
	3.6 Single lamp controlled by two-point method, three-point method & four-point method.
	3.1 Polar curve: its meaning and applications for designing the lamps

4	**Illumination for Interior Applications:** 4.1 Standards for various situations in Interior Illumination 4.2 Methods for Designing illumination schemes 4.3 Design considerations for Interior location of Residential Commercial, Industrial premises 4.4 Design Illumination scheme for different Interior locations of Residential, Commercial, Industrial unit 4.5 Numericals on above sub topics

5	**Illumination for Outdoor Applications:**
	5.1. General and specific requirements for lighting schemes of
	   a) Factory Lighting
	   b) Street Lighting
	   c) Flood Lighting
	   d) Railway Platform Lighting
	   e) Lighting for Advertisement / Hoardings
	   f) Sports Lighting
	   g) Simple numericals based on design of simple scheme

6	**Lighting for Special Applications**
	6.1. Lighting schemes and general requirements for:
	   a) Agricultural & Horticultural applications
	   b) Health Care Centers and Hospitals
	   c) Decorative lighting
	   d) Stage lighting
	   e) Aquariums and Shipyards

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	R Level	U Level	A Level	Total Marks
			Distribution of Theory Marks			
1	Fundamentals of Illumination	06	06	00	00	06
2	Lamps & Lighting Accessories	08	04	06	04	14
3	Illumination Control & Control Circuits	10	0	02	08	10
4	Illumination for Interior Applications	10	04	02	10	16
5	Illumination for Outdoor Applications	10	04	02	10	16
6	Lighting for Special Applications	04	00	02	06	08
	Total	48	18	14	38	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Applied Illumination Engineering	Jaclk L Lindsey	The Fairmont Pres Inc.
2	Lighting Engineering and applied calculations	R.H.Simons & Robert Bean	New Age International , New Delhi
3	Handbook of Industrial Lighting	Butterworths, Styanley , Lyons	Butterworths
4	Lighting Control Technology and Applications	Robert S Simpson	Focal Press
5	Energy Management in illuminating systems	Kao Chen	CRC Press

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    ii. Dr.M.S.Narkhede

b. **External Faculty**
    i. Dr.A.V.Bhangale (Government Polytechnic, Avasari)

Academic Coordinator   **Head of Department**   **Principal**
                              (Electrical Engineering)   **Govt. polytechnic Mumbai**

Unit & CO Mapping:

Sr. No.	Unit	CO
1	Fundamentals of Illumination	EE16 404.1, EE16 404.4
2	Lamps & Lighting Accessories	EE16 404.2, EE16 404.3
3	Illumination Control & Control Circuits	EE16 404.3
4	Illumination for Interior Applications	EE16 404.2, EE16 404.5
5	Illumination for Outdoor Applications	EE16 404.2, EE16 404.5
6	Lighting for Special Applications	EE16 404.3, EE16 404.5

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16 404.1	2	3	2	3	1	1	1	1	1	1
EE16 404.2	2	3	1	3	3	1	3	1	1	1
EE16 404.3	2	3	3	2	2	2	1	1	1	1
EE16 404.4	1	2	1	3	2	2	2	1	1	1
EE16 404.5	1	3	3	2	2	2	2	1	1	1

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16 404.1	2	1	3
EE16 404.2	3	2	3
EE16 404.3	3	2	3
EE16 404.4	2	1	3
EE16 404.5	2	1	3

Programme Code: **EE**									
Course Code: **EE 16 405**			Course Title: **Power System Analysis**						
Compulsory / Optional: **Optional (Elective-I)**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**--**	**--**	**03**	**70**	**30**	**--**	**--**	**--**	**100**

Rationale:

This subject deals with the representation of the power system, analysis of its components and determines performance by analytical as well as graphical methods which will be useful in analysis of electrical power system. This subject provides the basic knowledge required to study power system operation & control, Power Quality & Deregulation System.

Representation of power system will be useful to know the actual components of power system, Circuit model of system along with their per unit values. Transmission line parameter is useful to study the effects of parameter on performance of power system. Generalized circuit constants method is very useful & simple tool for predicting the performance of power system wrt. its parameters. Power flow serves as guidance for analysis of power system analytically & Circle diagram is a graphical tool for putting across the concept of load flow & line compensation,

Course Outcomes:

EE16405.1	Develop per unit reactance diagram for given system using power system components
EE16405.2	Compute Transmission line parameters
EE16405.3	Determine performance of line by using Generalized circuit constant equations
EE16405.4	Compute real power & reactive power for sending end & receiving end by using complex power equations.
EE16405.5	Construct the circle diagram to know the performance of transmission line

Contents:
1 : Representation of Power System

- Basic Structure of Power System.
- Equivalent Circuit representation of the System components-Alternator, Transformer,
- Transmission line: Short, Medium & long
- Single line diagram.
- Impedance diagram.
- Reactance diagram.
- Per unit Calculations. (Numerical)
- Aspects of Power System analysis.
- Role of power system Engineer

2 : Transmission Line Parameter

2-1 Resistance

- Concept of transmission line resistance.
- Difference between A.C. resistance & D.C. resistance.
- Influence of skin effect and proximity effect on Line conductors.

- Effect of temperature on Transmission line resistance.(No derivation)
- Effect of resistance on line performance.

2.2 Inductance

- Concept of Transmission Line Inductance.
- Significance of inductance.
- Flux linkage of isolated current carrying conductor due to internal and external flux.
  (Derivation only)

- Inductance of single-phase line composed of solid conductors & bundled conductors. (No Numerical)
- Concept of self G.M.D. and mutual G.M.D. (Numerical)
- Inductance of single phase line composed of composite conductors. (No derivation) Numerical
- Inductance of three phase line (single circuit) composed of solid conductors with symmetrical and asymmetrical spacing.

2.3 Capacitance

- Concept of Line capacitance.
- Significance of capacitance.
- Potential difference between two points due to charged conductors (Gauss's Law.)
- Potential difference between two conductors in a group of charged conductors.
- Capacitance of single phase line composed of solid Conductors and duplex bundled
- conductors. (Numerical)
- Capacitance of three phase line (single circuit) with symmetrical spacing. (Numerical)
- Effect of earth field on transmission line capacitance.
- Capacitance of single phase line with solid conductors considering earth.

3 : Generalized Circuit

3.1
- Concept of generalized circuit constants.
- Generalized circuit constants of short, medium & long transmission line.(No derivation) Numerical
- Measurement of Generalized circuit constant

3.2
- Generalized circuit constants of two networks connected in series & connected in parallel. (Only derivation)
- Advantages of Generalized circuit representation.

4 : Power Flow

- Concept of Complex Power ($S=V I^*$), Real Power and reactive Power.
- Derivation of complex power, real power, reactive power for sending end as well as receiving end of the transmission line using GCE(Numerical)
- Condition for maximum power (Numerical)

5 : Circle Diagram

- Concept of circle diagram.
- Receiving end circle diagram. (procedure and numerical)
- Determination of ratings of reactive power compensating equipments. (procedure and numerical)
- Sending end circle diagram. (procedure and numerical)
- Advantages of circle diagram.

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Representation of Power System	06	02	02	04	08
2	Transmission Line Parameter (R+L+C)	16	04	10	12	26 (6 +12+8)
3	Generalized Circuit	12	02	08	08	18 (12+6)
4	Power Flow	06	02	02	04	08
5	Circle Diagram	08	00	04	06	10
	Total	**48**	**10**	**26**	**34**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified

Reference Books:

1. Electrical Power System by Dr. S. L. Uppal and Prof. S. Rao, Publisher: Khanna Publisher, New Delhi.
2. Power system Analysis and Design by B.R. Gupta Publisher: Wheeler.
3. Modern Power system Analysis (Fourth Edition 2011) by I. J. Nagrath & D. P. Kothari Publisher: Tata McGraw Hill.
4. Power system Analysis by J. John J. Graninger & Wiliam D. Stevenson J. R Publisher: Tata McGraw Hill.
5. Electrical power systems by C. L. Wadhwa, Publisher: New Age International
6. Power System Analysis by T. K. Nagsarkar & M. S. Sukhija, Publisher: OXFORD University Press

Websites:
www.mahatransco.com
www.mhdcl.com

Course Curriculum Development Committee:

a. **Internal Faculty**
   i. Dr. P.N. Padghan
   ii. Dr. M.S. Narkhede

b. **External Faculty**

        i. Mrs S. S. Kulkarni (VPM Polytechnic, Thane)

Academic Coordinator   **Head of Department**   **Principal**
                          (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO VS PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16405.1	3	3	2	2	1	1	1	--	1	3
EE16405.2	--	2	3	3	--	1	1	1	1	2
EE16405.3	--	2	3	3	1	2	2	2	1	3
EE16405.4	2	3	3	3	3	3	2	3	1	3
EE16405.5	2	3	3	3	3	3	2	3	1	3
Avg. of POs	1.4	2.6	2.8	2.8	1.6	2.0	1.6	1.8	1	2.8

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE16405.1	1	3	2
EE16405.2	2	3	2
EE16405.3	2	3	3
EE16405.4	2	3	3
EE16405.5	2	3	3
Avg. of PSOs	1.8	3	2.6

Unit Vs CO Matrix

Unit	EE16405.1	EE16405.2	EE16405.3	EE16405.4	EE16405.5
1	3	2	2	2	1
2	2	3	2	2	2
3	1	2	3	2	2
4	2	2	2	3	2
5	2	2	2	2	3
Avg. of COs	2.0	2.2	2.2	2.2	2.0

Programme : **Diploma in Electrical Engineering**	
Course Code: **EE 16 312**	Course Title: **Industrial Training - I**
Compulsory / Optional: **Compulsory**	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
00	**00**	**04**	**04**	-	-	-	**50***	**50**	**100**

Rationale:

The diploma engineers are required to work in industry to manufacture and test Semi finished/Finished Products, and in substations etc for diagnose problems and technical resolutions. The students need to have industry and workshop exposure, where they can experience real life equipment, materials, instruments and various kinds of Process & related Equipments. This course has been designed for the students to have real life experiences to help them prepare for their career. The Electrical sector needs skilled and managerial personnel who have technical expertise as well as entrepreneurial qualities to manage the industry and substation.

Course Outcomes:

EE 16 312.1	Assign the opportunity to apply the knowledge and skills they have acquired on campus in a real-life work situation.
EE 16 312.2	Furnish the opportunities for practical, hands-on learning from practitioners in the students' areas of specialization.
EE 16 312.3	Expose students to a work environment, common practices, employment opportunities and work ethics in their relevant field.
EE 16 312.4	Enhance the employability skills of the students.
EE 16 312.5	Provide opportunities for students to be offered jobs in the organizations in which they undergo their Industrial Training.

DURATION OF INDUSTRIAL TRAINING:

Total no. of weeks: 4 weeks before the beginning of 5th semester after finishing of final exam of 4th semester (during summer vacation of 5th Semester).

Training Area: Students can be trained in

1. electrical machines production units,
2. Generating stations,
3. electrical substations ,
4. domestic rewiring
5. Electrical appliances maintenance shops/workshops,
6. Power system protection ,
7. Locomotives ,

8.   Industry Automation,
9.   Lifts / Elevators maintenance
10. Repairing of electrical measuring instruments
11. Renewable energy sources
12. Electrical contractor ,
13. Authorized Testing Laboratories workshop ,
14. Technical Consultant etc.

Role of Department:
1. Department have to send training request letter to various industries well in advance before commencement of training.
2. After getting sufficient number of seats from the industries, students will be placed in different industries for their 5th semester training (during summer vacation).
3. Students will have to fill up training form.
4. Department will issue an order letter to industry for the said training mentioning the name and registration number of students.
5. All above activities have to be carried out in advance of previous semester as plan out of placement in consultation with students. The students would normally be placed as per their choices, in case of more demand for a particular industry/service centre, students would be allocated place based on their relative merit (based on third semester results)
6. During the training period, the head of the department will maintain a schedule for follow up of industrial training and according to it he/she will send the faculty members to various industries.
7. The faculty member in touch with industry will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.
8. At the end of the training internal faculty member will assess the work done by student based on his presentation at the institute and training report.

Role of Industry:
1. Industry will give effective training to the students for improving their practical skills
2. Industry is expected to assign group of the students under training to some middle management level person for supervision and guidance (Training-in-charge).
3. Training in-charge has to sign weekly diary (To certify the work done by students) with appropriate remarks.
4. Industry may allot project to individual or group of students under training and students has to prepare report on the same project.
5. Training in-charge are requested to guide students for preparing their project report.
6. Industry is expected to maintain attendance for the student under training and report any irregularity of the students to their parent college.
7. Industry is also expected to issue a certificate of attending training on their letter head with comments if any for student's record and motivation.

Guidelines for the Students
1.   Students would interact with the identified faculty of the department to suggest his choices for suitable industry/service centre

2.   Students have to fill the forms duly sealed and signed by authorities along with training order letter and submit it to training officer in the industry on the first day of training.

3.   Student would carry with him/her the Identity card issued by institute during training period

4.   He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the industry. Student is expected to follow these rules, regulations, procedures etc obediently.

5.   During the training period students has to keep record of all the useful information in Log book and maintain the weekly diary (attached here with form-1).

6.   Prepare final report about the whole training for submitting to the department at the time of final presentation i.e. seminar.

Seminar

- Every student will prepare the Industrial training report and deliver the seminar.

- Seminar will be on the Industrial training completed by the student in the industry .

- Use of audio visual and / or power point presentation is desirable.

- Presentation will be for @ 15 minutes including 5 minutes of question and answer.

- Seminar should be presented during fifth semester.

FORM-1
GOVERNMENT POLYTECHNIC,MUMBAI
ELECTRICAL ENGINEERING DEPARTMENT

TRAINEES WEEKLY REPORT

Trainee Name:-

Name of Organization:-

Enrollment No:-

Dept. Sec:-

Week commencing from date _____ to date _____

Day & Date	Abstract of Work done (Details of work with details of Electrical)	Remarks from training supervisor: Excellent / very good / good/ average / below average /poor	Sign of Training Supervisor

Course Curriculum Development Committee:
   a. **Internal Faculty**
         i.   Mrs. J. D. Waghmare

         ii. Dr. P. N. Padghan

         iii. Dr. M.S.Narkhede

   b. **External Faculty**
         i.   Mr. H.B. Chaudhari VJTI, Matunga, Mumbai

Academic Coordinator   **Head of Department**   **Principal**
                                  (Electrical Engineering)   **Govt. polytechnic Mumbai**

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 312.1	3	3	3	3	3	3	3	3	3	3
EE 16 312.2	3	3	3	3	3	3	3	3	3	3
EE 16 312.3	3	3	3	3	3	3	3	3	3	3
EE 16 312.4	3	3	3	3	3	3	3	3	3	3
EE 16 312.5	3	3	3	3	3	3	3	3	3	3

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE 16 312.1	3	3	3
EE 16 312.2	3	3	3
EE 16 312.3	3	3	3
EE 16 312.4	3	3	3
EE 16 312.5	3	3	3

Undertaking Form

I hereby declare that during my Industrial Training at _____ ,

during the period from _____ to_____ , I will obey all the rules and regulations of the

Industry . It will be my sole responsibility for my acts , deeds , any injury or accidents during this

Industrial training.

<div align="right">

Signature of Candidate

Name:-_____

Enroll No:-_____

</div>

Date: _____

Undertaking from Parents /Guardians

I the undersigned father/guardian of_____ am well aware

that my ward studying in 3rd/2nd year Electrical Engg. is going for Industrial Training at

_____ , during the period from _____ to_____ , I will obey

all the rules and regulations of the Industry . It will be fully responsibility of my ward for his

acts , deeds , any injury or accidents during this Industrial training.

 Address with Mobile No

_____

_____

_____

Mobile No:-_____

Date:

<div align="right">

Signature of Parent

Name of Parent

</div>

Industrial Training Report Format

1. Cover Page
2. Inner Pages
   a) Certificate with signature and seal by Industry/ Company/Factory
   b) Declaration by student
   c) Acknowledgement
3. Introduction about Industry/ Company/Factory
4. Training schedule
5. Table of Contents
6. List of Tables
7. List of Figures
8. Abbreviations and Nomenclature (If any)
9. Chapters
   1. Introduction to Project
   2. Tools & Technology Used
   3. Snapshots
   4. Work Done / Observations
   5. Specific Assignment / Project Handled
   4. Results and Discussions
   5. Conclusions and Future Scope
10. References
11. Data Sheet(If any)
12. Appendices (If any)

INSTRUCTIONS FOR TRAINING REPORT

1. A chapter may be further divided into several divisions and sub-divisions depending on type & volume of work.
2. The length of the training report may be about 20 to 30 pages.
3. The training report shall be computer typed (English- British, Font -Times Roman, Size-12 point) and printed on A4 size paper.
4. The training report shall be Hard Copy of Training Report (Spiral Binding) The training report shall be typed with 1.5 line spacing with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom. Every page in the report must be numbered. The page numbering, starting from acknowledgements and till the beginning of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv...... The page number of the first page of each chapter should not be printed (but must be accounted for). All page numbers from the second page of each chapter should be printed using Arabic numerals, i.e. 2,3,4,5... All printed page numbers should be located at the bottom centre of the page.

5. **The table of contents** should list all headings and sub-headings.

6. **The list of tables** should use exactly the same captions as they appear above the tables in the text. One and a half spacing should be adopted for typing the matter under this head.

7. **The list of figures** should use exactly the same captions as they appear below the figures in the text. One and a half spacing should be adopted for typing the matter under this head.

8. The list of symbols, abbreviation & nomenclature should be typed with one and a half line spacing. Standard symbols, abbreviation etc should be used.

9. Subject matter must be typed on single side of the page.

   All the pages must be numbered properly

INDUSTRIAL TRAINING REPORT
(Times New Roman, 24 pt. Bold)

TITLE OF THE PROJECT
(Times New Roman, 16 pt. Bold)

Submitted in partial fulfillment of the

Requirements for the award of

Diploma in Electrical Engineering

College LOGO

Submitted By (14 size)

Name: _____

Enrollment No._____

(Times New Roman, 14 pt. Bold)

SUBMITTED TO:

Department of Electrical Engineering (16 size)
GOVERNMENT POLYTECHNIC, MUMBAI

DECLARATION (16 Times New Roman)

I hereby declare that the Industrial Training Report entitled ("Title of the project") is an authentic record of my own work as requirements of Industrial Training during the period from _____ to_____ for the award of Diploma in Electrical Engineering, Government Polytechnic, Mumbai under the guidance of (Name of Project Guide).

(12 size)

(Signature of student)
(Name of Student)
(Enrollment No.)

Date: _____

CERTIFICATE
(16 Times New Roman, bold)

This is to certify that Mr. / Ms._____ has partially completed / completed Industrial Training during the period from _____ to_____ in our Organization / Industry as a Partial Fulfillment of for the award of Diploma in Electrical Engineering, Government Polytechnic, Mumbai . He / She was trained in the field of _____   .

Signature & Seal of Training Manager

 Note: This certificate must be typed on the company letter head.

ACKNOWLEDGEMENT
(16 Times New Roman, bold)

Government Polytechnic, Mumbai

Department of Electrical Engineering

P-16 Curriculum
[Out Come Based (OBE)]

Semester-VI
(Course Contents)

Government Polytechnic Mumbai
(Academically Autonomous Institute of Maharashtra Government)
49, Ali Yawar Jung Marg, Kherwadi, Bandra (E)
gpmumbai@gpmumbai.ac.in

Programme: Electrical Engineering   **Sixth Semester**   **With effect from June 2018**

Teaching & Examination Scheme for the Students admitted in Third Year in 2018-19														
Semester VI														
Sr. No.	Course Code	Course Title	Awards of Class	Compulsory / Optional	Teaching Scheme (Hrs / Week)				Examination Scheme (Marks)					
					L	TU	P	Total Credits	TH	TS	PR	OR	TW	Total
1	EE 16 309	Electrical Estimation & Costing	1	C	3	2	0	5	70	30	0	50*	0	150
2	EE 16 310	Project & Seminar-II	1	C	0	0	4	4	0	0	0	50*	50	100
3	EE 16 311	Testing & Maintenance of Electrical Equipments	1	C	3	0	4	7	70	30	50*	0	0	150
4	(Elective-II) EE 16 408 EE 16 406	a. Microcontroller & Applications b. Special Machines	1	O	3	0	2	5	70	30	50*	0	0	150
5	EE 16 407	Industrial Automation	1	C	3	0	2	5	70	30	50*	0	0	150
6	EE 16 313	Industrial Training - II	1	C	0	0	2	2	0	0	0	25*	25	50
7	MG 16 502	Entrepreneurship Development	1	C	1	2	0	3	0	0	0	25*	25	50
8	MG 16 501	Industrial Organization & Management#	1	C	3	0	0	3	70#	30#	0	0	0	100
					16	4	14		350	150	150	150	100	
Total Credits								**34**	**Total Marks**					**900**

Abbreviations: C- Compulsory; O- Optional; L- Theory Lecture; P-Practical; TU-Tutorial; TH- Theory Paper; TS- Term Tests (02); PR-Practical Exam; OR-Oral Exam; TW- Term Work.
*Indicates assessment by External Examiner. # Indicates on line theory exam.

Academic Co-ordinator   **Head of Electrical Engg. Dept.**   **Principal**

Programme Code: **EE**									
Course Code: **EE 16 309**			Course Title: **Electrical Estimation & Costing**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**02**	**--**	**05**	**70**	**30**	**--**	**50***	**--**	**150**

* Indicates External Examiner

Rationale:

Role of Electrical diploma holder is to work as Technicians & Supervisors for Electrical Installations of residential, commercial and industrial electrification schemes and prepare estimates for these schemes. Has opportunity to work as independent electrical contractors and execute illumination and electrification schemes. Knowledge of electrical engineering drawing, IE rules, NEC (National Electric Code), professional ethics, different types of electrical installation their design considerations equips the students with the capability to prepare the schedule of materials with specifications and estimates for different types of electrical installations. The contents of this subject have been designed keeping in view developing requisite knowledge and skills of estimation and costing in students of diploma in electrical engineering.

Course Outcomes:

EE16309.1	Understand various types of electrical symbols, diagrams, IE rules and Important terms related to electrical installation.
EE16309.2	Recognize various types of materials required for wiring
EE16309.3	Prepare the schedule of materials with specifications and estimates for service mains.
EE16309.4	Draw the wiring plan; prepare the schedule of materials with specifications and estimates for residential and commercial buildings.
EE16309.5	Draw the layout of machines, wiring plan, prepare the schedule of materials with specifications for industries.
EE16309.6	Exercise of contractor ship and tendering

Contents:

1   : Electrical Symbols, Diagrams and IE Rules

1.1 Need of Symbols
  1.1.1   List of symbols for electrical equipment's and accessories used in electrical
             Works.
  1.1.2   Light, fan and power circuits, alarm and indicating circuit, contactor control
             circuits as per I.S.S.
1.2 Type of Diagrams
  1.2.1   Wiring diagrams (multiple and single line representation) and schematic
             diagrams as per I.S.S.
  1.2.2   Plans & Layouts
1.3 Wiring Materials and Accessories
  1.3.1   Brief description, general specifications (as per I.S.S.) and approximate cost of
             different types of wires, cables, switches, distribution board, switch board,
             boxes, batten and its accessories, conduit and its accessories, lamp holders,
             socket out lets, plug ceiling roses.
  1.3.2   Fuse and energy meter used in domestic and power wiring installations.
1.4   Important Terms & IE rules related to Electrical Installation

2   : Service Mains

2.1 Meaning of service mains and their types, I.S. specification and I.E. rules.
2.2 Over Head Service Mains –materials, main components and specifications.
2.3 UG Service Mains –materials, main components and specifications.
2.4 Estimation of overhead and underground service connection system. (Simple
       Numerical)

3   : Estimation and Costing of Residential and Commercial Buildings

3.1 General requirements of electrical installations for Residential flats and Commercial
       Buildings
  3.1.1   Relevant IE rules and IS standard practices
  3.1.2   Lighting and power sub circuits with their circuit designs
  3.1.3   Diversity factor for sub circuits
  3.1.4   Location of outlets and Control switches
  3.1.5   Main board and distribution boards with their selection of rating & numbers
  3.1.6   Load calculation, Cable selection and Conduit selection
  3.1.7   Permissible Voltage drops and size of wires and conductors
  3.1.8   Need of earthing and point to be earthed as per IE rules.
  3.1.9   Difference between Residential & Commercial installation.
3.2 Steps to be followed in preparing electrical estimate.
3.3 Detailed estimates and costing of Residential & Commercial Buildings. (Simple
       Numerical)

4   : Estimation and Costing of Industrial Installation

4.1 General requirements of electrical installations for industries.
4.2 Relevant IE rules and IS standard practices
4.3 Concept of industry load as per small, medium and large scale industries.
  4.3.1   Concept of single line diagram and motor wiring circuit & Electrical circuit
             diagram
4.4 Design considerations of electrical installation in industries.

      4.4.1   Motor current calculations
      4.4.2   Points considered for the location of motor, starter and cable route
      4.4.3   Selection and rating of wire, cable and size of conductor
      4.4.4   Selection of rating of fuse wire, starter, main board, distribution board
      4.4.5   Determination of length of Wire, Cable and Conduit
      4.4.6   Need of industry earthing and point to be earthed as per IE rules.
    4.5 Essential requirements for the design of foundation of static and rotating machines.
      4.5.1   Factors considered for the design of foundation
      4.5.2   Procedure of levelling and alignment of two shafts of directly and indirectly coupled drives
      4.5.3   Effects of Misalignment
      4.5.4   Installation of rotating machines as per Code of Practice 900:1992
      4.5.5   Installation of small Substations
      4.5.6   Introduction to installation of Solar roof panel
    4.6 Steps to be followed in preparing electrical estimate.
    4.7 Detailed estimates and costing of small scale industries/workshop (Simple Numerical)

5 : **Contracting and Tenders**

    5.1 Contacting
      5.1.1   Concept of Contracts, their types and Contractors
      5.1.2   Contract Documents - Valid Contracts
    5.2 Tenders
      5.2.1   Concept of Tenders and their types
      5.2.2   Tender notices and general conditions in Tender forms
      5.2.3   Procedure for submission and opening of Tenders
      5.2.4   Comparative Statements and Criterion for selecting Contractors
      5.2.5   Administrative approval and Technical sanctions
      5.2.6   Principles of Execution of work
      5.2.7   Billing of Executed work
         5.2.7.1 Compare various methods of Billing

Suggested specification table with Hours and Marks (Theory)

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Electrical Symbols, Diagrams and IE Rules	04	02	02	04	08
2	Service Mains	08	02	04	06	12
3	Estimation and Costing of Residential and Commercial Buildings	18	04	10	12	24
4	Estimation and Costing of Industrial Installation	12	02	04	08	16
5	Contracting and Tenders	06	02	04	04	10
	Total	**48**	**12**	**24**	**34**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified

List of Tutorials/Assignments:

Sr. No.	Unit No.	Title
1	1	Drawing sheet containing List of symbols for electrical equipment's.
2	1	Drawing sheet containing Light, fan and power circuits, alarm and indicating circuit, contactor control circuits as per I.S.S.
3	1	Drawing sheet containing wiring diagrams and single line diagrams.
4	2	Drawing sheet containing overhead service mains and underground service mains connection with required accessories.
5	3	Practice to draw layout (Single line diagram) of Residential & Commercial Buildings.
6	3	Wiring diagram (real time problem) of Residential & Commercial Buildings.
7	4	Practice to draw layout (Single line diagram) of Industrial installation
8	4	Wiring diagram (real time problem) of Industrial installation with minimum two machines.
9	4	Drawing sheet containing installation of small substation
10	4	Drawing sheet containing installation of Solar Roof Panel

Reference Books:

1. Electrical Installation, Estimating and Costing by JB Gupta, SK Kataria and Sons, New Delhi.
2. Estimating and Costing by SK Bhattacharya, Tata McGraw Hill, New Delhi.
3. Estimating and Costing by Surjeet Singh, Dhanpat Rai & Co., New Delhi.
4. Estimating and Costing by SL Uppal, Khanna Publishers, New Delhi.
5. Electrical Estimating and Costing by N Alagappan and B Ekambaram, TMH, New Delhi.
6. Estimating and Costing by Qurashi

Websites:
   www.mahatransco.com
   www.mhedcl.com

Course Curriculum Development Committee:

a. **Internal Faculty**
   i. Dr. P.N. Padghan

   ii. Mrs.V.U. Bhosale

b. **External Faculty**
   i. Mrs R.U. Patil (VPM Polytechnic, Thane)

Academic Coordinator   **Head of Department**   **Principal**
                                 (Electrical Engineering)   **Govt. Polytechnic, Mumbai**

CO VS PO Matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16309.1	3	1	3	3	1	1	1	1	1	3
EE16309.2	1	2	2	2	1	2	1	1	1	3
EE16309.3	3	3	3	2	2	3	2	2	2	3
EE16309.4	3	3	3	2	2	3	2	2	2	3
EE16309.5	3	3	3	2	2	3	2	2	2	3
EE16309.6	3	3	3	1	3	3	3	3	3	3
Avg. of POs	2.67	2.5	2.83	2	1.83	2.5	1.83	1.83	1.83	3

CO Vs PSO Matrix

CO	PSO1	PSO2	PSO3
EE16309.1	2	2	3
EE16309.2	2	2	2
EE16309.3	2	3	2
EE16309.4	2	3	3
EE16309.5	2	3	3
EE16309.6	1	3	3
Avg. of PSOs	1.833	2.667	2.667

Unit Vs CO Matrix

Unit	EE16309.1	EE16309.2	EE16309.3	EE16309.4	EE16309.5	EE16309.6
1	3	3	2	2	2	1
2	2	2	3	--	--	3
3	2	2	--	3	--	3
4	2	2	--	--	3	3
5	2	2	3	3	3	3
Avg. of COs	2.2	2.2	1.6	1.6	1.6	2.6

Programme: **Diploma in Electrical Engineering**	
Course Code: **EE16310**	Course Title: **Project & Seminar II**
Compulsory / Optional: Compulsory	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
-	-	4	4	-	-		50*	50	100

Rationale:

The aim of the project is to provide an opportunity to the students to work on an open-ended engineering problem. The students will be able to apply knowledge from different areas or courses, which they have studied in their curriculum to a real-world scenario. The scientific way of solving the problems and ability to apply it to find alternative solutions for the problems will help them in their professional life. This course will help to inculcate leadership skills, decision making, participative learning, resource management, cost considerations, documentation and report writing skills with effective communication.

Course Outcomes: Student should be able to:

EE16310.1	Propose projects with innovative ideas in a clear and concise manner
EE16310.2	Identify and summarize an appropriate list of literature review, analyze previous work done and relate them to current project
EE16310.3	Plan and coordinate work in a group.
EE16310.4	Implement the skills acquired in the previous semesters to solve complex engineering problems.
EE16310.5	Test the designed project model and evaluate its performance.
EE16310.6	Communicate effectively in oral or written format to present the working of their project/product.

Course Details:

- The Project groups of fifth semester will continue the project work in sixth semester and complete project in all respect

1. Activity plan

Sr. No.	Activity	Week No
1	Prepare activity plan	1
2	Allocation of work responsibility to individual/team	2
3	Visits to Industries / Institutions / Market/field work/sites	3
4	Collection of Data /Survey/Analysis	4
5	Design of Components, preparation of drawing, estimates wherever required, printed circuits design, its checking,	5,6
6	Fabrication, Assembling, Model/Prototype development, Testing as per project requirements	7,8,9,10
7	Consolidation of work allotted to individual or team	11
8	Presentation of initial draft: pre-submission draft	12
9	Final Project Report: Printed: Submission: soft & Hard copy	13
10	Group presentation of project work at the time of final evaluation	16

The project work along with project report should be submitted as part of term work in third year sixth semester on or before the term end date.

2. Project Execution:

1. Guide shall monitor the work and help the students from time to time.

2. A project diary is to be maintained by each student, giving details of planning, work executed, information collected etc., on weekly basis and the same should be shown to the guide concerned

4. The guide should maintain a record of progressive / continuous assessment of project work and observe the progress of each group member on weekly basis.

  5. The same shall be kept ready for submission to the external examiner before the final examination.

3. Project Report:

1. The student shall get the initial draft copy of the project approved from the Project Guide.

2. Structure: It shall be as follows

Project Report Structure

- **Title page**
- **Inner title page (white)**
- **Certificate**
- **Certificate from Industry**
- **Index/Content/Intent**
- **List of Abbreviations/Symbols**
- **List of Figures**
- **List of Graphs**
- **List of Tables**
- **List of if any other inclusion**
- **Introduction**
- **Literature Survey/Review**
- **System Development**
- **Performance Analysis**
- **Conclusion**
- **References**
- **Appendices**
- **Acknowledgement**

1.   **Introduction (2-3 pages)**

        1.1 Introduction

        1.2 Need/Necessity/Motivation

        1.3 Objectives

2.   **Literature Survey/Review (5-10 pages)**

Related information available in standard Books, Journals, Transactions, and Internet Websites.

3. System Development (20-25 pages)

- The reporting shall be presented in one or more chapters with appropriate chapter titles.
- Experimental setups, procedures adopted, techniques developed, methodologies adopted. Important derivations/formulae
- Figures and tables should be presented immediately following their first mention in the text.

4. Performance Analysis (5-15)

- **Test results**

5. Conclusions (1 page)

5.1. Conclusion

5.2. Future Scope

5.3. Applications/Utility

6. References (1-2 pages)

- Author, "Title", Name of Journal/Transactions/ Book, Edition/Volume, Publisher, Year of Publication, pp.__.
- In case of web pages complete web page address with assessing date has to be enlisted
- List of references should be as per use in the text of the report

7. Appendices (5-7 pages)

- Related data or specifications or referred charts, details computer
- Code/program, etc.

8. Acknowledgement (1 page)

- Expression of gratitude and thankfulness for helping in completion of the said task with names starting from Guide, HOD, Principal and related persons Signed by the candidate.

9. General Guidelines

- Text should be printed on front and correct side of the watermark on quality white bond paper
- Paper size-A4
- Font : Times New Roman
- Report heading   :- All capital-16 font
- Chapter heading :- All capital-14 font
- Subchapter   :– Title case-12 font
- Sub-subchapter   : – First alphabet capital case-12 font
- Content   : –Sentence case-12 font
- Title of the Report should not be more than two lines
- Spacing between lines-1.5
- Left Margin-1.5"

- Right Margin-1/2"
- Top Margin-1"

10 Flap

Suitable flap with name of the candidate, Department, Institute, symbol of can be used with nylon strip

Course Curriculum Development Committee:

   a. **Internal Faculty**

       i.   Ms. V.U. Bhosale   LEE
      ii.   Mr. I.N. Khuspe   LEE

   b. **External Faculty**

       i.   Mr N.D. Adate   SBM Polytechnic Mumbai.

Academic Coordinator   **Head of Department**   **Principal**
                                   Electrical Engg.   **Govt. polytechnic Mumbai**

CO Vs PO Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16310.1	2	2	--	2	--	--	--	2	3	2
EE16310.2	1	1	1	1	1	1	1	3	3	2
EE16310.3	--	--	--	--	--	--	--	3	3	2
EE16310.4	--	--	3	3	--	--	--	3	3	2
EE16310.5	1	1	3	3	--	--	--	3	3	2
EE16310.6	--	--	--	--	--	--	--	3	3	2

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16310.1	--	2	2
EE16310.2	--	2	2
EE16310.3	--	--	3
EE16310.4	3	3	3
EE16310.5	3	3	3
EE16310.6	--	--	3

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 311**				Course Title: **Testing and Maintenance of Electrical Equipment**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03		**04**	**07**	**70**	**30**	**50**[*]	**--**	**--**	**150**

(*) indicates assessment by External examiner

Rationale:

This is applied technology level subject with application in industry, commercial, public utility departments of government / municipal councils, residential buildings etc. After studying this subject student will be able to inspect / test / troubleshoot electrical machines. They will be conversant about Indian Electricity Act, safety rules, safety of machines & persons, prevention of accident. Also students will be able to carry out routine and preventive maintenance of electrical equipment.

Course Outcomes:

EE 16 311.01	**Know safety measures & state safety precautions.**
EE 16 311.02	**Test and troubleshoot Transformer, AC machine as per IS code of practise**
EE 16 311.03	**Identify / Locate common troubles in electrical machines & switch gear.**
EE 16 311.04	**Plan & carry out routine & preventive maintenance.**
EE 16 311.05	**Diagnosis and recondition of Insulating materials resistance as per IS code.**

Unit No.	Topics/Subtopics
1	**Safety & Prevention:** 1.1 Definition of terminology used in safety; safety, hazard, accident, major accident hazard, responsibility, authority, accountability, monitoring. 1.2 Indian Electricity Act 1956 - Chapter IV General Safety Requirements Section-29 Construction, installation, protection, operation & maintenance of electric supply lines and apparatus, Section 30- Service linesand apparatus on consumers premises, Section 36- Handling of electric supply line and apparatus, General Electricity Safety precautions (Do's & Don't's). 1.3 Meaning & causes of electrical accidents; factors on which severity of

	Shock depends, Procedure for rescuing the person who has received an electric shock, methods of providing artificial respiration. 1.4 Precautions to be taken to avoid fire due to electrical reasons, operation of fire extinguishers.

2	**General Introduction:**
	2.1 Objectives of testing significance of I.S. Concept of tolerance, routine tests, type
	   tests, special tests
	2.2 Concept of routine, preventive & breakdown maintenance, advantages of
	   preventive maintenance, procedure for developing preventive maintenance
	   schedule, Factors affecting preventive maintenance schedule. Computerised
	   Maintenance Management System (CMMS), Total Productive Maintenance
	2.3 Earth resistance and earth resistivity, factors affecting earth resistance, earth
	   resistivity of different soil composition, methods for reducing soil resistance
	2.4 Testing of earth resistance and earth pit electrode: Basic earth resistance test method,
	   four terminal method, fall of potential method, permissible resistance of the earthing
	   required for different electrical installations

3	**Transformers:**
	3.1 Enlisting type test, routine test & special test as per I.S. 2026-1981.
	3.2 Procedure for conducting following tests: Measurement of winding resistance, no
	   load losses, & no load current, Impedance voltage, load losses, Insulation
	   resistance, Induced over voltage withstand test, separate source voltage withstand
	   test, Impulse voltage withstand test, Temperature rise test of oil & winding,
	3.3 Preventive maintenance & routine maintenance of distribution transformer
	   as per I.S. 10028(part III): 1981.
	3.4 Periodic checks for replacement of oil, silica gel
	3.5 Causes of failure of transformer, Various types of faults (mechanical, electrical
	   & magnetic), reason of occurrences
	3.6 Trouble shooting charts for single phase and three phase transformer

4	**Induction Motors:**
	4.1 Enlist of type tests, routine tests & special tests of 1 & 3 phase Induction motors.
	4.2 Procedures of routine test on single phase and three phase induction motors as
	   per IS7572:1984 and IS code 4029:2010 respectively
	4.3 Routine, Preventive, & breakdown maintenance of 1 & 3 phase Induction motors
	   as per IS 9001:1992.
	4.4 Maintenance schedule of alternators & synchronous machines as per IS 4884-1968.
	4.5 Causes of failure of induction motor, Various types of faults (mechanical,
	   electrical & magnetic), reason of occurrences
	4.6 Trouble shooting charts for single phase and three phase induction motor

5	**Insulation:**
	5.1 Factors affecting life of insulating materials, classifications of insulating materials
	as per IS:1271-1958
	5.2 Measuring insulation resistance by different methods such as i) Polarization, ii)Dielectric absorption, Prediction of the of insulation condition from measurement data
	5.3 Reconditioning of insulation - cleaning and drying the insulation, re-varnishing, vacuum impregnation.
	5.4 Insulating oil - properties of insulating oil, causes of deterioration of oil, testing of transformer oil as per IS 1866- 1961, purification of insulating oil.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Safety & Prevention**	4	2	2	4	8
2	**General Introduction**	8	2	4	4	10
3	**Transformers**	16	4	8	10	22
4	**Induction Motors**	14	4	8	8	20
5	**Insulation**	6	2	4	4	10
	Total	**48**	**14**	**26**	**30**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of Practical :

Sr. No	Unit	Experiment/Assignment	Approx Hours
1	1	Demonstration and practise of artificial respiration technique after electrocution	**2**
2	1	Demonstration of use in fire extinguisher in case of fire due to electrical abnormal conditions	**2**
3	2	Measurement of resistance of earth pit electrode which available at institute	**6**
4	2	Measurement of earth resistivity and locate best spot for earthing pit	**6**

5	3	Perform routine test on transformer as per latest IS code 2026-1981 (min three test)	**6**
6	4	Perform routine test on 1- phase induction motor as per code IS7572:1984 (min three test, other than insulation resistance test)	**6**
7	4	Perform routine test on 3- phase induction motor as per cod IS4029:2010 (min three test, other than insulation resistance test)	**6**
8	4	Observe & carry out weekly, monthly & yearly maintenance of motor in your workshop & prepare its report	**4**
9	5	Prepare trouble-shooting chart for single and three phase transformers	**4**
10	5	Prepare trouble-shooting chart for single and three phase motors.	**4**
11	6	Determine breakdown strength of transformer oil.	**2**
12	6	Perform insulation resistance test on motor as per IS code	**4**
13	3	Perform temperature rise test on transformer as per IS code	**6**
14	3	Perform temperature rise test on motor as per IS code	**6**

Reference Books:

Sr. No.	Book Title	Author	Publication
1	Operation & Maintenance Of Electrical Machines (Volume I and II)	B.V.S.,Rao	Media Promoters & Publishers Ltd. Mumbai
2	Preventive Maintenance Hand Books & Journals	C.J.Hubert	
3	Introduction to industrial safety	K.T.Kulkarni.	
4	Latest IS Codes	BIS	BIS
5	Design &Testing of Electrical Machines	M. V. Deshpande.	PHI Learning Pvt. Ltd., 2010
6	Installation, Maintenance and Repair of Electrical Machines	M. Gupta,	S.K. Kataria & Sons, Edition 2014
7	Maintenance &Repairs	Rosenberg.	Mc GRAW-HILL, 1st Edition, May 2003

8	Preventive Maintenance of Electrical Apparatus	S.K. Sharotri, Glencoe/	Mcgraw-Hill; 2ndEdition , June 1969

Course Curriculum Development Committee:

a. **Internal Faculty**

     i. I. N Khuspe

     ii. Mr. M. S. Narkhede

b. **External Faculty**

     i. Dr. Dilip Lulekar

Academic Coordinator   **Head of Department**   **Principal**

                              (Electrical Engineering)   **Govt. Polytechnic,**

Mumbai

Programme: **EE**		

Course Code:**EE16 408**	Course Title: **Microcontroller & Applications**

Compulsory / Optional: **Optional**

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	-	2	5	70	30	50*	-	-	150

Rationale:

This course deals with architecture and application of 8051 microcontroller. As the technology is changing, many electrical applications are now microcontroller based so it will be beneficial for students to learn the architecture, programming, interfacing & real world applications of microcontroller in the field of Electrical engineering.

Course Outcomes:

Student should be able to:

EE16408.1	Comprehend the concepts and basic architecture of 8051 microcontroller
EE16408.2	Interpret the difference between microprocessor and microcontroller
EE16408.3	Recalls 8051 instruction set &composes programs of 8051 microcontroller
EE16408.4	Analyzes and Interface different external devices to the processor according to the user requirements
EE16408.5	Implementation of 8051 in the field of Electrical Engineering

Course Content Details:

Unit No	Topics / Sub-topics

1	**Introduction Microcontrollers**
	    1.1 What is Microcontrollers
	    1.2 Microcontrollers Vs Microprocessors
	    1.3 Basic architecture
	        1.3.1 microcontroller chips
	        1.3.2 features of modern microcontroller
	        1.3.3 internal structure of microcontroller
	        1.3.4 Harvard Vs Princeton architecture
	        1.3.5 Micro coded and hard coded processor
	    1.4 Memory Types
	        1.4.1 ROM
	        1.4.2 EPROM
	        1.4.3 EEPROM
	        1.4.4 Flash
	    1.5 Memory Organization,
	    1.6 External Memory Interfacing, Stacks

2	**8051 Microcontrollers** 2.1 Introduction to Intel 8051 Microcontrollers 2.1.1Basic 8051 Architecture (Block Diagram & Features)

		2.1.2 Clock and Instruction Cycle
		2.2 Internal RAM Structure
		2.3 Internal Data Memory Map
		2.4 Special Function Register map
		2.5 Processor Status Word
		2.6 Addressing Modes
		2.6.1 Immediate
		2.6.2 Direct
		2.6.3 Register
		2.6.4 Register Indirect
		2.7 I/O Port Configuration (port0, port1, port2, port3)
		2.8 Interfacing of External Memory
3	**8051 Programming:**
	3.28051Microcontroller Instructions:
	3.2.1 Data Transfer Instructions,
	3.2.2 Arithmetic Instructions,
	3.2.4 Logical Instructions,
	3.2.5 Branch Instructions,
	3.2.6 Subroutine Instructions,
	3.2.7 Bit Manipulation Instruction
	3.3 Assembler Directives,
	3.4 Assembly Language Programs
	3.5 Time Delay Calculations.
4	**Interfacing with 8051 and Applications:**
	4.1Basics of I/O Concepts, I/O Port Operation,
	4.2 Interfacing 8051 to LCD, Keyboard,
	4.3 Interfacing with ADC, DAC,
	4.4 Stepper Motor Interfacing
	4.5 DC Motor Interfacing and Programming
5	**8051 Interrupts and Timers/counters:**
	5.1 Basics of Interrupts,
	5.1.1 Schematic Representation
	5.1.2 Types
	5.1.3 Interrupt Enable Register (IE)
	5.1.4 Priority Level Structure
	5.1.5 Interrupt Priority Register (IP)
	5.2 Timers / Counters
	5.2.1 Timer Control (TCON)
	5.2.2 Timer Modes
	5.2.3 Timer Mode Control (TMOD)

6	**8051 Serial Communication:**					

6.1 Serial Interface

    6.1.1   Serial Port Control Register (SCON)

    6.1.2   Power Mode Control Register (PCON)

    6.1.3   Data Transmission and Reception (only in mode 0 and 1)

6.2 8051 Serial Communication, Connections to RS-232,

6.3 Serial Communication Programming

6.4 8255A Programmable Peripheral Interface:,

6.5 Architecture of 8255A,

6.7 I/O Addressing,

6.8 I/O Devices Interfacing With 8051 Using 8255A.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction Microcontrollers	06	04	04	02	10
2	8051 Microcontrollers	12	02	04	02	08
3	8051 Programming	08	02	06	06	14
4	Interfacing with 8051 and Applications	08	04	02	06	12
5	8051 Interrupts and Timers/counters	08	04	04	06	14
6	8051 Serial Communication	08	02	04	06	12
	Total	**48**	**17**	**25**	**28**	**70**

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

List of Experiments/Assignments: (Please note that perform any 10 Experiments)

1		Develop a program to Blink LED for 1Second	02
2		Develop a program to interface Input Switches and output LEDs with development board (arduino).	02
3		Write a program for interfacing LCD to Microcontroller	04
4		Write a program for interfacing Keyboard to microcontroller	02
5		Write a program for Relay interfacing with microcontroller	02
6		Write a program for DC motor interfacing with microcontroller	02
7		Write a program for interfacing with Stepper Motor microcontroller	04
8		Write a program for temperature sensor LM35	02
9		Interfacing to 8051 and programming to Control stepper motor	04

10		Interfacing ADC to 8051	02
11		Interfacing DAC to 8051	02
12		Interfacing of Servomotor with 8051	04
		Total	**32**

References/ Books:

Sr.No.	Name of Book	Author	Publisher
1	Microcontrollers	Rajkamal	Pearson Education
2	The 8051 Microcontroller and embedded system using assembly and C	Muhammad Ali Mazidi	Pearson
3	The 8051 Microcontroller	Kenneth J. Aayala	Thomson
4	Programming and customizing The 8051 Microcontroller	Myke Predko	Tata McGraw-Hill

Course Curriculum Development Committee:

   a. **Internal Faculty**

      1) Ms. Pritam A. Khande
      2) Dr. P.N. Padghan

   b. **External Faculty**

       i. Dr. N.D.Chavan   KJ Somaiya Polytechnic, Mumbai

Academic Coordinator   **Head of Department**   **Principal**
                     (Electrical)   **Govt. Polytechnic, Mumbai**

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16408.1	3	2	2	2	-	-	-	-	-	-
EE16408.2	3	1	2	1	-	-	-	-	-	-
EE16408.3	1	1	2	2	-	-	-	1	-	1
EE16408.4	1	2	2	1	-	-	-	1	-	1
EE16408.5	2	2	3	2	-	1	1	1	-	2

CO Vs PSO Matrix

CO/PSO	PSO1	PSO2	PSO3
EE16408.1	-	1	1
EE16408.2	-	-	-
EE16408.3	-	-	-
EE16408.4	-	-	1
EE16408.5	2	1	2

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	Introduction Microcontrollers	EE16408.1, EE16408.2
2	2	8051 Microcontrollers	EE16408.1, EE16408.2, EE16408.4
3	3	8051 Programming	EE16408.3, EE16408.4
4	4	Interfacing with 8051 and Applications	EE16408.2, EE16408.3, EE16408.4, EE16408.5
5	5	8051 Interrupts and Timers/Counters	EE16408.3, EE16408.4
6	6	8051 Serial Communication	EE16408.4, EE16408.5

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 406**				Course Title: **Special Machines**					
Compulsory / Optional: **Optional**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**02**	**05**	**70 (3 Hrs.)**	**30**	**50*(Ext)**	**-**	**-**	**150**

Rationale:

In the changing scenario of today's highly automated world day by day the interest on special machines is increasing. These machines serve for several applications. Students are being introduced with special machines as these machines have wide applications in industry, robotic and automation. It is expected that the knowledge of construction, working principles, basic characteristics of these motor will bring deep sight ness in the students, which will enable them to work comfortably in the highly changing industry.

Course Outcomes:

Student should be able to

EE16406.1	Explain the construction, working and starting methods of 1 ϕ Induction Motors
EE16406.2	Describe concept of revolving field
EE16406.3	State advantages/ disadvantages of 1ϕ IM over 3ϕ IM
EE16406.4	Describe the construction and working of 1ϕ synchronous motors
EE16406.5	Describe working and phasor diagrams of compensated and repulsion motor.
EE16406.6	Describe construction, working and classify LIM, stepping motor
EE16406.7	Describe construction, working and classify Synchronous Reluctance Motor, Switched Reluctance Motor, BLDC, Permanent Magnet Synchronous Motors and their applications.

Unit No	Topics / Sub-topics
01	**Single Phase Induction Motors:** 1.1 Constructional details 1.2 Revolving field theory 1.3 Classification 1.4 Starting methods for Split Split Phase, Shaded Pole, Repulsion, Reluctance motors 1.5 Comparison with 3ϕ induction motors 1.6 Characteristics of split phase, shaded pole, repulsion, reluctance type 1ϕ induction motor and their applications.
02	**Single Phase Synchronous Motors:** Working principle, construction and applications of…. 2.1 1ϕ Reluctance Motor 2.2 Hysteresis motor 2.3 2ϕ servo motor 2.4 AC tachometers

03	**AC Commutator Machines:**	
	3.1 Necessity/ advantages of AC commutator motors	
	3.2 EMFs induced in commutator windings (E_r and E_t)	
	3.3 Emfs produced by rotating magnetic field E_{RT}	
	3.4 Torque Expression	
	3.5 Commutation in AC machines and EMF's under commutation	
	3.6 1ϕ Series Motors.	
	3.7 Phasor Diagram & Simplified Phasor Diagram (no derivation)	
	3.8 Compensated AC series motor	
	3.9 Phasor Diagram & Simplified Phasor Diagram (no derivation)	
	3.10 Repulsion motor, Phasor Diagram & Simplified Phasor Diagram (no derivation)	
04	**Linear Induction and Stepper motors:**	
	4.1 Classification, Construction and Working of linear induction motor.	
	4.2 Comparison between LIM and RIM (Advantages, disadvantages of LIM)	
	4.3 Derivation of linear force	
	4.4 Applications of linear Induction motor	
	4.5 Construction and Working of Stepper motor	
	4.6 Variable reluctance type, Permanent magnet type & Hybrid stepper motor.	
	4.7 Applications of Stepper motor	
05	**Advanced Electrical Machines:**	
	5.1 Synchronous Reluctance Motors, Constructional features – Types – Axial and radial air gap motors – Operating principle, Applications	
	5.2 Switched Reluctance Motors, Constructional features – Principle of operation, Applications	
	5.3 Permanent Magnet Brushless DC Motors, Principle of operation Types and Applications	
	5.4 Permanent Magnet Synchronous Motors, Principle of operation – EMF and torque equations, Applications	
	5.5 Amorphous core transformer	
	5.6 Introductions of soft starters	

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Single Phase Induction Motors**	12	08	04	04	16
2	**Single Phase Synchronous Motors**	08	02	04	04	10
3	**AC Commutator Machines**	10	06	04	04	14
4	**Linear Induction and Stepper motors**	08	06	04	04	14
5	**Advanced Electrical Machines**	10	08	04	04	16
	Total	48	30	20	20	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments:

Sr.	Unit	Experiment/Assignment	Approx.

No.			Hours
1	1	Plot torque speed characteristic of split phase I. M. by conducting brake test on the motor	02
2	1	Plot torque speed characteristics of single phase capacitor start induction run induction motor by conducting brake test on the motor	02
3	1	Plot torque speed characteristic of single phase capacitor start and run induction motor by conducting brake test on the motor.	04
4	1	Plot torque speed characteristics of shaded pole induction motor by conducting brake test on the motor	02
5	1	Plot torque speed characteristic of repulsion motor by conducting brake test on the motor	04
6	1	Plot torque and Speed characteristic of universal motor. (on AC & DC supply)	02
7	1	Dismantling and reassembling of single phase motors used for ceiling fans or universal motor for mixer	06
8	2	Plot torque speed characteristic of reluctance motor by conducting brake test on the motor	02
9	2	Plot torque speed characteristic of Hysteresis motor by conducting brake test on the motor	04
10	5	Demonstration of speed and reversal of direction of stepper motor	04
			32

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	The Performance and Design of Alternating Current Machines	M.G.Say	CBS Publishers, New Delhi
2	Generalized theory of Electrical Machines	Dr. P. S. Bimbhra	Prentice Hall India
3	Electrical Machines	S. K. Bhattacharya	Jaico Publication
4	AC Commutator machines	Taylor	New Age International
5	A Text book of Electrical Technology	B. L. Theraja & A. K. Theraja	S.Chand, New Delhi

Course Curriculum Development Committee:
  a. **Internal Faculty**
         i. Dr.M.S.Narkhede

        ii. Mr.S.B.Vishwarupe

  b. **External Faculty**

         i. Dr.S.V.Bhangale (Government Polytechnic, Awasari)

Academic Coordinator   Head of Department   Principal
                              (Electrical Engineering)   Govt. polytechnic Mumbai

Unit and CO mapping:

S.N.	Unit	COs
1	Single Phase Induction Motors	EE16406.1,EE16406.2, EE16406.3
2	Single Phase Synchronous Motors	EE16406.4
3	AC Commutator Machines	EE16406.5
4	Linear Induction and Stepper motors	EE16406.6
5	Advanced Electrical Machines	EE16406.7

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16406.1	3	3	2	1	1	1	1	1	1	1
EE16406.2	3	3	2	1	1	1	3	1	1	1
EE16406.3	3	3	3	1	3	1	1	1	1	1
EE16406.4	3	3	3	1	3	1	1	1	1	1
EE16406.5	3	3	3	1	1	1	1	1	1	1
EE16406.6	3	3	1	1	1	1	1	1	1	1
EE16406.7	3	3	1	1	1	1	1	1	1	1

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16406.1	3	1	1
EE16406.2	3	3	1
EE16406.3	3	2	1
EE16406.4	3	1	1
EE16406.5	3	1	1
EE16406.6	3	1	1
EE16406.7	3	1	1

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 407**				Course Title: **Industrial Automation**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
03	**00**	**02**	**05**	**70 (3 Hrs.)**	**30**	**50*(Ext)**	**-**	**-**	**150**

Rationale:

In changing economy now, a day more and more stress is being given up in increasing the throughput in industries. The basic tool for achieving this is automation. The aim of this course is to develop the technician to carry out the responsibilities in the industries related to industrial automation. Diploma holder employed in industry needs to operate, test and maintain the industrial drives and its power control. It is very essential for him to know the electrical logic, Input devices, Control supply, control devices and designing control circuits.

This subject covers design of electromagnetic control circuit, basics of PLC programming and introduction to SCADA, operation of hydraulic and pneumatic control systems. This knowledge will help the diploma holder to work as an automation engineer in the industry.

Course Outcomes:

Student should be able to

EE16407.1	Explain significance of Automation.
EE16407.2	Draw block diagram of PLC
EE16407.3	Understand ladder diagram development
EE16407.4	Know the working of SCADA and DCS
EE16407.5	Develop power and control circuit for different examples like Skip Hoist, Overhead Crane, Conveyor belt, compressor motor
EE16407.6	Understand use of potentiometer, synchros as error detector
EE16407.7	Know fundamentals of hydraulic system and Pneumatics systems

Unit No	Topics / Sub-topics
01	**Introduction to Industrial Automation:** 1.1 Importance of automation. 1.2 Advantages of Automation 1.3 Disadvantages of Automation 1.4 Classes (Types) of Automation 1.5 Requirements of Automation 1.6 General idea of control, manufacturing and assembly processes.
02	**Programmable logic controllers:** 2.1 Introduction definition and history of the PLC. 2.2 PLC advantages and disadvantages. 2.3 Types of PLC-Fixed and modular. 2.4 List of PLC manufacturers. 2.5 PLC Specifications.

	2.6	Comparison between PC and PLC.
	2.7	PLC block diagram- Central processing unit, Power supplies, I/O modules, Programming devices, Memory.
	2.8	Scan cycle of PLC.
	2.9	List of remote digital and analog I/Os.
	2.10	Comparison between Relay based and PLC based control systems.
	2.11	Comparison between PLC and PC
03	**PLC programming:**	
	3.1	PLC programming languages.
	3.2	Development of PLC ladder diagrams.
	3.3	Basic concept of ladder.
	3.4	Rules of ladder.
	3.5	Classification of PLC instructions.
	3.6	Bit type instructions- XIC, XIO, OTE, OTL, OUT, OSR.
	3.7	Logical instructions- OR, AND, NOT, XOR.
	3.8	Comparison instructions- EQU, NEQ, LES, LEQ, GRT, GERQ, LIM.
	3.9	Timer instructions- TON, TOFF, RTO.
	3.10	Counter instructions- CTU, CTD.
	3.11	Scaling instructions- SCP.
	3.12	Industrial process examples- Bottle filling plant, Starting of an Induction Motor with forward and reverse control, Traffic light control.
04	**Introduction to advanced control systems:**	
	4.1	SCADA- brief introduction to hardware & software used.
	4.2	Distributed Control System(DCS)-brief introduction to hardware & software used.
05	**Electrical control system components:**	
	5.1	The contactors- Working. Contact types according to application, position, Load utilization categories.
	5.2	The solenoid- Types - AC/DC, construction, working, applications
	5.3	Manual control switches- push buttons, selector switches – construction and working
	5.4	Pilot switches- Construction, Working and Applications of Limit switches, proximity switches, photoelectric switch, temperature actuated switches, level control switch, pressure-sensing switch, Overload sensing switch.
	5.6	Output devices – Applications of Contactors, Solenoid actuated valves, pilot lamps.
	5.7	Control circuit development – Basics and Thumb rule
	5.8	Control supply – control transformer – Definition, Use, specifications
	5.9	Power and control circuits for Skip Hoist, Overhead Crane, conveyor belt, compressor motor
06	**Electrical Actuators:**	
	6.1	Potentiometers – working and use as error detector
	6.2	Servomotors –ac and dc working principle.
	6.3	Synchros – transmitter, control transformer, use of as error detector.
	6.4	Stepper motor – PM & variable reluctance – working principle
	6.5	Tacho – generator
	6.6	Applications of above components as AC/DC control system.

07	**Hydraulic and pneumatic systems:**
	7.1 Brief comparison between electrical, hydraulic and pneumatic control system-merits and demerits. 7.2 Construction and working of different types of Hydraulic pumps – Hydrodynamic and Positive displacement (Gear, Lobe, Vane) 7.3 Need of accumulator and types of filters in hydraulic circuits 7.4 Components of Pneumatic system – Types of compressors, FRL unit and It's working. 7.5 Pneumatic output devices - Working of Single acting, double acting cylinder, Gear Motor, Vane motor. 7.6 Hydraulic and pneumatic control devices – Construction and working of different types of control valves (Globe, angle, spool, puppet). Classification and working of direction control valves, working of pressure control valve, working of flow control valves (plug, butterfly and ball). **7.7** Examples of application of hydraulic circuit – shaper circuit, sequence circuit.

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**Introduction to Industrial Automation**	03	02	02	00	04
2	**Programmable logic controllers**	08	04	06	02	12
3	**PLC programming**	10	04	08	04	16
4	**Introduction to advanced control systems**	03	00	02	02	04
5	**Electrical control system components**	08	06	02	04	12
6	**Electrical Actuators**	06	04	02	02	08
7	**Hydraulic and pneumatic systems**	10	06	04	04	14
	Total	48	26	26	18	70

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.

List of experiments/Assignments:

Sr. No.	Unit	Experiment/Assignment	Approx. Hours
1	**1**	To develop ladder diagrams for ON/OFF inputs to produce ON/OFF outputs.	**02**
2	**1**	To develop ladder diagrams for logic gates OR, AND, NOT, XOR.	**02**
3	**1**	To develop ladder diagrams for traffic light control system.	**04**
4	**2**	To develop ladder diagrams for counting objects.	**02**

5	2	To develop ladder diagrams for temperature measurement.	04
6	2	Measure step angle for a stepper motor in forward and reverse direction.	02
7	2	To develop simple programmes for comparison instruction.	02
8	2	Collect data from market- PLC brands and manufacturers	04
9	2	A) To plot the characteristics of potentiometer B) Use of potentiometer as error detector	04
10	3	Draw the Symbol sheet for different pneumatic and Hydraulic components	06
			32

References/ Books:

Sr. No.	Name of Book	Author	Publisher
1	Programmable Logic Controllers, Principles and applications	John W. Webb Ronald A Reis	Prentice Hall India
2	Hydraulics & Pneumatics	by Andrew Parr ,	Jaico Publication
3	Control of Electrical Machines	S. K. Bhattacharya Brijinder Singh	New Age International Publishers

Course Curriculum Development Committee:
  a. **Internal Faculty**
        i. Dr.M.S.Narkhede

        ii. Mr.S.B.Vishwarupe

  b. **External Faculty**

        i. Mr. L.S.Patil (Government Polytechnic, Nashik)

Academic Coordinator   **Head of Department**   **Principal**
                                  (Electrical Engineering)   **Govt. polytechnic Mumbai**

Unit and CO mapping:

S.N.	Unit	COs
1	Introduction to Industrial Automation	EE16407.1
2	Programmable logic controllers	EE16407.2
3	PLC programming	EE16407.3
4	Introduction to advanced control systems	EE16407.4
5	Electrical control system components	EE16407.5
6	Electrical Actuators	EE16407.6
7	Hydraulic and pneumatic systems	EE16407.7

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE16407.1	3	3	2	1	1	1	1	1	1	1
EE16407.2	3	3	2	1	1	1	3	1	1	1
EE16407.3	3	3	3	1	3	1	1	1	1	1
EE16407.4	3	3	3	1	3	1	1	1	1	1
EE16407.5	3	3	3	1	1	1	1	1	1	1
EE16407.6	3	3	1	1	1	1	1	1	1	1
EE16407.7	3	3	1	1	1	1	1	1	1	1

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE16407.1	3	1	1
EE16407.2	3	3	1
EE16407.3	3	2	1
EE16407.4	3	1	1
EE16407.5	3	1	1
EE16407.6	3	1	1
EE16407.7	3	1	1

Programme : **Diploma in Electrical Engineering**									
Course Code: **EE 16 313**			Course Title: **Industrial Training - II**						
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
00	**00**	**02**	**02**	-	-	-	**25***	**25**	**50**

Rationale:

The diploma engineers are required to work in industry to manufacture and test Semi finished/Finished Products, and in substations etc for diagnose problems and technical resolutions. The students need to have industry and workshop exposure, where they can experience real life equipment, materials, instruments and various kinds of Process & related Equipments. This course has been designed for the students to have real life experiences to help them prepare for their career. The Electrical sector needs skilled and managerial personnel who have technical expertise as well as entrepreneurial qualities to manage the industry and substation.

Course Outcomes:

EE 16 313.1	To give students the opportunity to apply the knowledge and skills they have acquired on campus in a real-life work situation.
EE 16 313.2	To provide students with opportunities for practical, hands-on learning from practitioners in the students' areas of specialization.
EE 16 313.3	To expose students to a work environment, common practices, employment opportunities and work ethics in their relevant field.
EE 16 313.4	To enhance the employability skills of the students.
EE 16 313.5	To provide opportunities for students to be offered jobs in the organizations in which they undergo their Industrial Training.

DURATION OF INDUSTRIAL TRAINING :

Total no. of weeks: 2 weeks before the beginning of 6th semester after finishing of final exam of 5th semester (during winter vacation of 6th Semester).

Training Area: Students can be trained in

1. electrical machines production units,
2. Generating stations,
3. electrical substations ,
4. domestic rewiring,
5. Electrical appliances maintenance shops/workshops,
6. Power system protection ,
7. Locomotives ,
8. Industry Automation,

9. Lifts / Elevators maintenance
10. Repairing of electrical measuring instruments
11. Renewable energy sources
12. Electrical contractor ,
13. Authorized Testing Laboratories workshop ,
14. Technical Consultant etc.

Role of Department:
1. Department have to send training request letter to various industries well in advance before commencement of training.
2. After getting sufficient number of seats from the industries, students will be placed in different industries for their 6th semester training (during winter vacation).
3. Students will have to fill up training form.
4. Department will issue an order letter to industry for the said training mentioning the name and registration number of students.
5. All above activities have to be carried out in advance of previous semester as plan out of placement in consultation with students. The students would normally be placed as per their choices, in case of more demand for a particular industry/service centre, students would be allocated place based on their relative merit (based on third semester results)
6. During the training period, the head of the department will maintain a schedule for follow up of industrial training and according to it he/she will send the faculty members to various industries.
7. The faculty member in touch with industry will check the progress of the student in the training, his/ her attendance, discipline and project report preparation.
8. At the end of the training internal faculty member will assess the work done by student based on his presentation at the institute and training report.

Role of Industry:
1. Industry will give effective training to the students for improving their practical skills
2. Industry is expected to assign group of the students under training to some middle management level person for supervision and guidance (Training-in-charge).
3. Training in-charge has to sign weekly diary (To certify the work done by students) with appropriate remarks.
4. Industry may allot project to individual or group of students under training and students has to prepare report on the same project.
5. Training in-charge are requested to guide students for preparing their project report.
6. Industry is expected to maintain attendance for the student under training and report any irregularity of the students to their parent college.
7. Industry is also expected to issue a certificate of attending training on their letter head with comments if any for student's record and motivation.

Guidelines for the Students
1. Students would interact with the identified faculty of the department to suggest his choices for suitable industry/service centre
2. Students have to fill the forms duly sealed and signed by authorities along with training order letter and submit it to training officer in the industry on the first day of training.

3. Student would carry with him/her the Identity card issued by institute during training period

4. He/she will have to get all the necessary information from the training officer regarding schedule of the training, rules and regulations of the industry. Student is expected to follow these rules, regulations, procedures etc obediently.

5. During the training period students has to keep record of all the useful information in Log book and maintain the weekly diary (attached here with form-1).

6. Prepare final report about the whole training for submitting to the department at the time of final presentation i.e. seminar.

Seminar

- Every student will prepare the Industrial training report and deliver the seminar.

- Seminar will be on the Industrial training completed by the student in the industry .

- Use of audio visual and / or power point presentation is desirable.

- Presentation will be for @ 15 minutes including 5 minutes of question and answer.

- Seminar should be presented during fifth semester.

FORM-1
GOVERNMENT POLYTECHNIC,MUMBAI
ELECTRICAL ENGINEERING DEPARTMENT

TRAINEES WEEKLY REPORT

Trainee Name:-

Name of Organization:-

Enrollment No:-

Dept. Sec:-

Week commencing from date _____ to date _____

Day & Date	Abstract of Work done (Details of work with details of Electrical)	Remarks from training supervisor: Excellent / very good / good/ average / below average /poor	Sign of Training Supervisor

Course Curriculum Development Committee:
  a. **Internal Faculty**
           i. Mrs. J. D. Waghmare
          ii. Dr. P. N. Padghan
          iii. Dr. M.S.Narkhede
  b. **External Faculty**
           i. Mr.

Academic Coordinator   **Head of Department**   **Principal**
                                  (Electrical Engineering)   **Govt. polytechnic Mumbai**

CO Vs PO matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
EE 16 313.1	3	3	3	3	3	3	3	3	3	3
EE 16 313.2	3	3	3	3	3	3	3	3	3	3
EE 16 313.3	3	3	3	3	3	3	3	3	3	3
EE 16 313.4	3	3	3	3	3	3	3	3	3	3
EE 16 313.5	3	3	3	3	3	3	3	3	3	3

CO Vs PSO Matrix:

CO	PSO1	PSO2	PSO3
EE 16 313.1	3	3	3
EE 16 313.2	3	3	3
EE 16 313.3	3	3	3
EE 16 313.4	3	3	3
EE 16 313.5	3	3	3

Undertaking Form

I hereby declare that during my Industrial Training at _____ , during the period from _____ to_____ , I will obey all the rules and regulations of the Industry . It will be my sole responsibility for my acts , deeds , any injury or accidents during this Industrial training.

<div align="right">

Signature of Candidate

Name:-_____

Enroll No:-_____

</div>

Date: _____

Undertaking from Parents /Guardians

I the undersigned father/guardian of_____ am well aware that my ward studying in 3rd/2nd year Electrical Engg. is going for Industrial Training at _____ , during the period from _____ to_____ , I will obey all the rules and regulations of the Industry . It will be fully responsibility of my ward for his acts , deeds , any injury or accidents during this Industrial training.

 Address with Mobile No

_____

_____

_____

Mobile No:-_____

Date:

Signature of Parent

Name of Parent

Industrial Training Report Format

1. Cover Page
2. Inner Pages
    a) Certificate with signature and seal by Industry/ Company/Factory
    b) Declaration by student
    c) Acknowledgement
3. Introduction about Industry/ Company/Factory
4. Training schedule
5. Table of Contents
6. List of Tables
7. List of Figures
8. Abbreviations and Nomenclature (If any)
9. Chapters
    1 Introduction to Project
    2 Tools & Technology Used
    3 Snapshots
    4 Work Done / Observations
    5 Specific Assignment / Project Handled
    4. Results and Discussions
    5. Conclusions and Future Scope
10. References
11. Data Sheet(If any)
12. Appendices (If any)

INSTRUCTIONS FOR TRAINING REPORT

1. A chapter may be further divided into several divisions and sub-divisions depending on type & volume of work.
2. The length of the training report may be about 20 to 30 pages.
3. The training report shall be computer typed (English- British, Font -Times Roman, Size-12 point) and printed on A4 size paper.
4. The training report shall be Hard Copy of Training Report (Spiral Binding) The training report shall be typed with 1.5 line spacing with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom. Every page in the report must be numbered. The page numbering, starting from acknowledgements and till the beginning

of the introductory chapter, should be printed in small Roman numbers, i.e, i, ii, iii, iv......
The page number of the first page of each chapter should not be printed (but must be
accounted for). All page numbers from the second page of each chapter should be printed
using Arabic numerals, i.e. 2,3,4,5... All printed page numbers should be located at the
bottom centre of the page.

5. **The table of contents** should list all headings and sub-headings.

6. **The list of tables** should use exactly the same captions as they appear above the tables
   in the text. One and a half spacing should be adopted for typing the matter under this
   head.

7. **The list of figures** should use exactly the same captions as they appear below the figures
   in the text. One and a half spacing should be adopted for typing the matter under this
   head.

8. The list of symbols, abbreviation & nomenclature should be typed with one and a half
   line spacing. Standard symbols, abbreviation etc should be used.

9. Subject matter must be typed on single side of the page.

All the pages must be numbered properly

INDUSTRIAL TRAINING REPORT
(Times New Roman, 24 pt. Bold)

TITLE OF THE PROJECT
(Times New Roman, 16 pt. Bold)

Submitted in partial fulfillment of the

Requirements for the award of

Diploma in Electrical Engineering

College LOGO

Submitted By (14 size)

Name: _____

Enrollment No._____

(Times New Roman, 14 pt. Bold)

SUBMITTED TO:

Department of Electrical Engineering (16 size)
GOVERNMENT POLYTECHNIC, MUMBAI

DECLARATION (16 Times New Roman)

I hereby declare that the Industrial Training Report entitled ("Title of the project") is an authentic record of my own work as requirements of Industrial Training during the period from _____ to_____ for the award of Diploma in Electrical Engineering, Government Polytechnic, Mumbai under the guidance of (Name of Project Guide).

(12 size)

<div align="right">

(Signature of student)
(Name of Student)
(Enrollment No.)

</div>

Date: _____

CERTIFICATE
(16 Times New Roman, bold)

This is to certify that Mr. / Ms._____ has partially completed / completed Industrial Training during the period from _____ to_____ in our Organization / Industry as a Partial Fulfillment of for the award of Diploma in Electrical Engineering, Government Polytechnic, Mumbai . He / She was trained in the field of _____   .

Signature & Seal of Training Manager

 Note: This certificate must be typed on the company letter head.

ACKNOWLEDGEMENT
(16 Times New Roman, bold)

CERTIFICATE

I hereby declare that the Industrial Training Report being presented in this report

entitled " -------------------------------------" is an authentic record of my own work carried out

under the supervision of Dr. Mr. / Ms. "----- *SUPERVISOR NAME* --------------------"

Enrollment No:-   Sign & Name of Student.

Date:-

Attended and submitted for the final oral examination held on

_____

(Internal Examiner)   (External Examiner)

Name:-   Name:-

Designation:-   Designation:-

Programme : **CE/ME/EC/CO/IF/IS/EE/LG/LT**	
Course Code: **MG 16 502**	Course Title: **Entrepreneurship Development**
Compulsory / Optional: **Compulsory**	

Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
1	2	-	3	-	-	-	25*	25	50

*External Examiner

Rationale:

Globalization, liberalization & privatization along with revolution in Information Technology, have thrown up new opportunities that are transforming lives of the masses. Talented and enterprising personalities are exploring such opportunities & translating opportunities into business ventures such as- BPO, Contract Manufacturing, Trading, Service sectors etc. The student community also needs to explore the emerging opportunities. It is therefore necessary to inculcate the entrepreneurial values during their educational tenure. This will help the younger generation in changing their attitude and take the challenging growth oriented tasks instead of waiting for white- collar jobs. The educational institutions should also demonstrate their uniqueness in the creation of enterprising personalities in their colleges. This subject will help in developing the awareness and interest in entrepreneurship and create employment for others.

Course Outcomes:

Student should be able to

CO1	Appreciate the concept of Entrepreneurship
CO2	Identify entrepreneurship opportunity
CO3	Understand the Marketing Strtegy .
CO4	Collect and use the information to prepare project report for business venture.
CO5	Develop awareness about enterprise management

Course Content Details:

Sr. No.	Contents
1.	**INTRODUCTION** • Definition of Entrepreneur. • Characteristics of Entrepreneur. • Functions of an Entrepreneur. • Barriers to Entrepreneur. • Distinction between Entrepreneur, Manager and Intrapreneur • Women Entrepreneur-problems and developing trends. • Entrepreneurship-definition, need.
2.	**FROM BUSINESS IDEA TO OPPORTUNITY** • Identifying trends, opportunities and ideas. • Creativity techniques for idea generation. • Evaluate business opportunities • Use of SWOT analysis.

3.	**MARKET ASSESSMENT AND PRODUCT FEASIBILITY** • Marketing -Concept and Importance • Market Identification, • Customer need assessment, • Market Survey • Meaning and definition of product feasibility • Technical, Market, Financial feasibility including break even analysis.
4.	**SUPPORT SYSTEMS** • **Information Sources** Information related to project, procedures and formalities • **Support Systems** • Business Planning & Requirements for setting up an SSI • Govt. & Institutional Agencies (Like MSFC, DIC, MSME, MCED, MSSIDC, MIDC, LEAD BANKS), Statutory requirements and agencies.
5.	**PROJECT/BUSINESS PLAN** • Meaning and Importance • Concept of vision and mission • Components of project report/profile
6.	**ENTERPRISE MANAGEMENT AND MODERN TRENDS** • Essential roles of Entrepreneur in managing enterprise • E-Commerce: Concept and process • Global trends and opportunities. • Steps in starting small scale industry • Causes Of Sickness

Suggested Specifications Table with Hours and Marks (Theory):

Unit No	Topic Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	**INTRODUCTION**	01				
2	**FROM BUSINESS IDEA TO OPPORTUNITY**	02				
3	**MARKET ASSESSMENT AND PRODUCT FEASIBILITY**	03				
4	**SUPPORT SYSTEMS**	02				
5	**PROJECT/BUSINESS PLAN**	04				
6	**ENTERPRISE MANAGEMENT AND MODERN TRENDS**	04				
	Total	16				

Legends: R- Remember; U-Understand; A- Apply and above levels (Bloom's revised Taxonomy).

Notes: *This specification table shall be treated as a general guideline and actual distribution of marks may slightly vary from table. But the questions from each topic should be asked as per marks weightage. Numerical questions are to be asked only if specified.*

Approved Copy

Academic Co-ordinator

Term Work

Term work consists of following interactive type assignments. Faculty acts as a facilitator in providing conducive, dynamic environment, exposing students to various aspects of entrepreneurship. Assignments are aimed at compelling the students to critically think and apply the concepts learnt, leading to better insight development.

Sr. No	Unit	Assignments	Hours
1		**Assimilation Of Profile Of A Successful Entrepreneurs** Every student will study the biography of a successful entrepreneur and make a write up of two pages, indicating milestone achievements. Summarize the important traits and share their understanding in the peer group.	
2		**Assess yourself as an entrepreneur?** Several skills and traits are essential in an entrepreneur, to achieve success. What is your potential in this regard?..Assess yourself and reflect upon the findings. Faculty will provide you a suitable instrument.	
3		**Brain Storm To Generate Business Ideas.** Brain storming is a group creativity exercise designed to come out with a number of solutions to a problem. Follow the steps. ✓ State the problem (Ex. What business would you start if you are given Rs Lacs?) ✓ Select the participants ✓ Select a leader ✓ Set the stage Rules to be followed are, • Focus on quantity • Postpone criticism • Build on others ideas • Encourage crazy ideas • Work with a dead line	
4		**Identify A Business Opportunity Suitable For You** ✓ This activity will help you to identify opportunity that may be right for you. Once identified you will use this business idea to carry out the mini project, throughout the session. ✓ List your interests and hobbies. List the business ideas that relate to each interest. Use the following steps to end up with the opportunity. ✓ Make SWOT analysis of self, cross out those ideas that no longer seem suitable for you. ✓ Assess your aptitude and identify those ideas that match with	

		your aptitude ✓ Make a matrix of advantages and disadvantages of remaining ideas, find which one is of maximum advantage ✓ Use internet or library and find out at least one source of information for each idea. ✓ Choose one of the business opportunities that suit your life style requirements. ✓ Write vision and mission statement. Set personal financial and non financial goals you hope to achieve in five years perspective. Be realistic and be sure to include specific activities for each plan.	
5		**Begin To Develop Your Business Plan** ✓ Write a vision and mission statement for the business enterprise ✓ Describe one page report that fully describes your product or service and how it differs from what is currently available. ✓ List your short, medium and long term goals. What steps do you need to achieve each of these goals? Do you foresee any obstacles in attaining them? What are they? ✓ What are the economic, technological or growth trends in this industry? Is the location of your business is a critical factor in its success? Why or why not?	
6		**Design A Market Strategy** ✓ Identify the market for your business. Use the secondary data source that could help you assess demand for your product or service. ✓ Based on secondary data, develop a customer profile. Figure out which market segment of your industry you are targeting. be specific. ✓ Develop a questionnaire to conduct primary data research.Coduct a mock survey and analyze the results. Determine what course of action you will take? ✓ Determine who your competitor are, both direct and indirect. Analyse each competitor in terms of price, location, facility, strength and weakness. Determine strategy to deal with each competitor. ✓ Write down your strategies for maintaining customer loyalty, and describe why you think each one will work.	
7		**Find Out Break Even Point For Your Business** Perform a break even analysis for your business. How many units you are required to sell to break even? Is this a feasible number? Why or Why not? Can you think of ways to lower the breakeven point?	
8		**Feasibility Study Reports** Make a feasibility study analysis of sample reports provided and discuss your observations in the class.(Group work each consisting 4 students)	
9		**Interactive Session With An Entrepreneur** In live conversation with an entrepreneur raise the issues of your interest pertaining to various aspects of entrepreneurship and make	

		a report on it.	
10		**Mini Project** Develop a mini project on a business opportunity incorporating various aspects as per the standard format provided. This activity should be carried out on continual basis, under the guidance of the concerned faculty. Components of Project Report: 1. Project Summary (One page summary of entire project) 2. Introduction (Promoters, Market Scope/ requirement) 3. Project Concept & Product (Details of product) 4. Promoters (Details of all Promoters- Qualifications, Experience, Financial strength) 5. Manufacturing Process & Technology 6. Plant & Machinery Required 7. Location & Infrastructure required 8. Manpower (Skilled, unskilled) 9. Raw materials, Consumables & Utilities 10. Working Capital Requirement (Assumptions, requirements) 11. Market (Survey, Demand & Supply) 12. Cost of Project, Source of Finance 13. Projected Profitability & Break Even Analysis 14. Conclusion.	

Notes: *If possible an industrial visit should be arranged or videos should be shown of different die and operations.*

Learning Resources:
  1) **Reference Books:**

Sr.No.	Name of Book	Author	Publisher
1	Entrepreneurship Development	Preferred by Colombo plan staff college for Technical education.	Tata Mc Graw Hill Publishing co. ltd. New Delhi.
2	A Manual on How to Prepare a Project Report	J.B.Patel D.G.Allampally	EDI STUDY MATERIAL Ahmadabad (Near Village
3	A Manual on Business Opportunity Identification & Selection	J.B.Patel S.S.Modi	Bhat , Via Ahmadabad Airport & Indira Bridge), P.O. Bhat 382428 , Gujrat,India
4	National Directory of Entrepreneur Motivator & Resource Persons.	S.B.Sareen H. Anil Kumar	P.H. (079) 3969163, 3969153 E-mail :
5	New Initiatives in Entrepreneurship Education & Training	Gautam Jain Debmuni Gupta	ediindia@sancharnet.in/olpe@ ediindia.org
6	A Handbook of New Entrepreneurs	P.C.Jain	Website :

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7	Evaluation of Entrepreneurship Development Programmes	D.N.Awasthi , Jose Sebeastian	http://www.ediindia.org
8	The Seven Business Crisis & How to Beat Them.	V.G.Patel	
9	Entrepreneurship Development	Special Edition for MSBTE	McGraw Hill Publication
10	Entrepreneurship Development	-	TTTI, Bhopal / Chandigarh

2) VIDEO CASSETTES

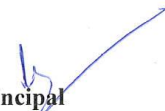| NO	SUBJECT	SOURCE
1	Five success Stories of First Generation Entrepreneurs	EDI STUDY MATERIAL Ahmedabad (Near Village Bhat , Via
2	Assessing Entrepreneurial Competencies	Ahmadabad Airport & Indira Bridge), P.O.
3	Business Opportunity Selection and Guidance	Bhat 382428 , Gujrat,India P.H. (079) 3969163, 3969153
4	Planning for completion & Growth	E-mail :
5	Problem solving-An Entrepreneur skill	ediindia@sancharnet.in/olpe@ediindia.org Website : http://www.ediindia.org

Course Curriculum Development Committee:
    a. **Internal Faculty**
          i. Mr. S.V.Joshi.
         ii. Mr. B.B.Kulkarni.

    b. **External Faculty**

Academic Coordinator   **Head of Department**   **Principal**
(DT. R.A. Patil)   **(Mechanical Engineering)**   **Govt. polytechnic Mumbai**

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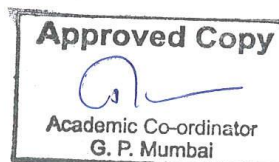
Course Name:- Entrepreneurship Development   Course Code:- me 16 502

CO Vs PO matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	1	3	-	-	1	-	2	2	2	3
CO2	1	3	-	-	1	-	2	2	2	3
CO3	1	3	-	-	1	-	2	2	2	3
CO4	1	2	-	-	1	-	2	2	2	3
CO5	1	3	-	-	1	-	2	2	2	3

CO Vs PSO matrix

CO/POs		PSO1	PSO2	PSO3
CO1	Appreciate the concept of Entrepreneurship	-	3	2
CO2	Identify entrepreneurship opportunity	-	3	2
CO3	Understand the Marketing Strtegy.	-	3	2
CO4	Collect and use the information to prepare project report for business venture.	-	2	2
CO5	Develop awareness about enterprise management	-	3	2

Unit Number and COs

Sr. No.	Unit No.	Topic Title	COs
1	1	INTRODUCTION	CO1
2	2	FROM BUSINESS IDEA TO OPPORTUNITY	CO1 & 2
3	3	MARKET ASSESSMENT AND PRODUCT FEASIBILITY	CO2 & 3
4	4	SUPPORT SYSTEMS	CO3 & 4
5	5	PROJECT/BUSINESS PLAN	CO4 & 5
6	6	ENTERPRISE MANAGEMENT AND MODERN TRENDS	CO1, 2 & 4

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Programme : **Diploma in Mechanical Engineering/IS/EE/RT/EC**									
Course Code: **MG16501**				Course Title: **Industrial Organization and Management**					
Compulsory / Optional: **Compulsory**									
Teaching Scheme and Credits				Examination Scheme					
TH	TU	PR	Total	TH	TS	PR	OR	TW	Total
3	--	--	03	70 # (3 Hrs.)	30	--	--	--	100
(#) Indicates Online Exam									

Rationale:

Our diploma pass outs are normally placed at the supervisory level when they go to industries.Where they are expected to handle labour, material and machinery to get the targeted output. This requires knowledge of managing different resources of the organizations effectively. This course deals with different aspects of management, which helps technician to manage the changed environment in the industry.

Course Outcomes:After studying the course student will be able to:

CO1: Get acquainted with the industrial environment.

CO2: Know the different levels and process of management.

CO3: Describe the organizational structure.

CO4: Manage different industrial resources efficiently.

CO5: Apply various rules and regulations concerned with Business.

Unit No	Contents
1	**Overview Of Business:** 1.1: Definition of Business. 1.2: Types of Business: Service, Manufacturing, and Trade 1.3: Globalization: Importance, Advantages and Disadvantages. 1.4: Intellectual Property rights: Objectives. Meaning of Patent, Copy right and Trade mark
2	**Management Process:** 2.1 What is Management?Various definitions, Concept of management. 2.2 Levels of management.Difference between Administration and Management. Concept of Scientific management. 2.3: Fourteen principles of Management. 2.4: Basic Functions of Management: Planning, Organizing, Staffing, Directing and Controlling.
3	**Organizational Management:** 3.1 Organization :- Definition and Steps in forming organization 3.2 Types of organization: Line, Line & staff, Functional and Project. 3.3 Forms of ownership: Proprietorship, Partnership, Joint stock Company, Co-operative Society,Government Sector.
4	**Human Resource Management:** 4.1 Personnel Management: Definition and Functions. 4.2 Staffing • Introduction to human resource planning and recruitment procedure. 4.3 Personnel: Training & Development • Types of training. • Induction. • Skill Enhancement.
5	**Industrial Safety and legislation:** 5.1 Causes of accident 5.2 Safety precautions 5.3 Introduction to • Factory Act 1948 • ESI Act • Workmen Compensation Act • Industrial Dispute Act • Goods and Services Tax
6	**Financial Management:** 6.1. Objectives & Functions. 6.2. Capital Generation • Types and Sources of Capital. 6.3. Budgets and accounts: • Types of Budgets • Production Budget (including Variance Report) • Labor Budget • Introduction to Profit & Loss Account and Balance Sheet. • Elements of costing.

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7	**Materials Management:**
	
	 7.1. Inventory Management: Definition of inventory and inventory control. Objectives of inventory control.
	 7.2 ABC Analysis, graphical representation
	 7.3 Economic Order Quantity (E.O.Q.)
	    • Graphical Representation and Calculation of E.O.Q.
	 7.4 Purchasing:
	    • Objectives of Purchasing.
	    • Functions of Purchase department.
	    • Steps in Purchasing.

8	**Project Management:** 8.1 Project Management: Definition and meaning of project. 8.2 Introduction to C.P.M.& P.E.R.T., Preparationof network, calculation of project duration and floats. 8.3 Concept of Break Even Analysis. 8.4 Introduction to KAIZEN, 5 "S".

Specification Table with hours and marks (Theory)

Unit No.	Topic title	Teaching hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Overview Of Business	4	4	--	--	04
2	Management Process	6	2	--	4	06
3	Organizational Management	8	2	4	4	10
4	Human Resource Management	5	2	4	4	10
5	Industrial Safety and Legislation	5	2	4	4	10
6	Financial Management	7	2	2	6	10
7	Materials Management	6	2	2	6	10
8	Project Management	7	2	2	6	10
	Total	48	18	18	34	70

Course Outcomes (C.O.) Vs Program Outcomes (P.O.) matrix

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	2	2	3	3	1	1	2	2	1	2
CO2	3	3	2	2	1	1	2	2	1	3
CO3	1	2	2	3	2	1	1	2	1	3
CO4	3	3	3	3	2	2	2	3	2	3
CO5	3	3	3	3	2	2	3	3	3	3

C.O. Vs P.S.O. matrix

Course Outcome No.	Course Outcomes (CO's)	PSO1	PSO2
CO1	Get acquainted with the industrial environment.	2	-
CO2	Know the different levels and process of management.	2	1
CO3	Describe the organizational structure.	2	2
CO4	Manage different industrial resources efficiently.	2	2
CO5	Apply various rules and regulations concerned with Business.	-	2

Enter correlation levels 1, 2 or 3 as defined below:
1: Slight (Low)   2: Moderate (Medium)   3: Substantial (High) *If there is no correlation, put "-"*
CO: Course Outcomes, PSO: Programme Specific Outcomes, PO: Programme Outcomes

TOPICS AND COURSE OUTCOMES

Unit No.	Topic Title	COs
1	Overview Of Business	CO1
2	Management Process	CO2
3	Organizational Management	CO3
4	Human Resource Management	CO4
5	Industrial Safety and Legislation	CO5
6	Financial Management	CO4
7	Materials Management	CO4
8	Project Management	CO1,CO2,CO3,CO4,CO5

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