



Cusrow Wadia Institute of Technology
Pune – 411 001

Electrical Engineering Department

Mul ti Point Entry and Credit System 2018
(MPECS - 2018)

CURRICULUM
[W.E.F. JUNE - 2018]

CURRICULUM

(MPECS-2018)

**Diploma in Electrical
Engineering**

A note on CURRICULUM REVISION (2018)

1. Preamble :

- Cusrow Wadia Institute of Technology, Pune was granted Academic Autonomy in the year 1985 by Government of Maharashtra vide letter No. PTI 2483/119915(234)/TE-I (B) dated 27/2/1985.
- Initially the Institute adopted the Model Curriculum prepared by then TTTI, Western Region, Bhopal. Subsequently, the revisions in the curriculum were made as per the needs of the Society.
- The Institute adopted Multi Point Entry and Credit System w.e.f. June 1998.
- The earlier revision of the curriculum was carried out in 2014. This curriculum was reviewed later while teaching learning process and feedback were collected by then current students. Accordingly changes were made in the curriculum and detailing of the documents regarding outcome based curriculum, its implementation methods and assessments norms were discussed and finalized during the year 2016-2017. Thus , our outcome based curriculum MPECS-2018 was framed.
- The feedback was taken from various stake holders and it was strongly felt that with the rapid strides in the field of Information Technology, Computers and Manufacturing Processes and allied processes, a dynamic curriculum need to adopt the benefits of the fast changing expectations in the contents as well as the Teaching Learning Methodology. As such, the present curriculum is being reviewed since 2016-2017. The observations were being noted down.
- The Institute has strengthened the hardware and software which is constantly consolidated and upgraded to match the needs of the society in general and the Industries in particular.
- Students should be proficient in the use of computers and related software irrespective of the branch of Engineering they are studying. The students shall be made to make maximum use of software packages and use Internet to derive and update their knowledge.
- The contemporary needs of the user system and more thrust on Learning Management System, Skill development and overall development of the students is the governing factor in the revision of 2018 curriculum.
- The present outcome based curriculum will come into force with effect from June 2018.

2. Approach for Curriculum Revision :

- Scientific system approach will be adopted in the revision of curriculum.

- A curriculum revision model showing various steps will be presented.
- Analysis of the existing curriculum is being done by taking feedback from the faculty implementing the curriculum, Alumni, Industry / Field Personnel, Programme wise board of studies committee members and the Experts in the field of Education.
- Entry behavior of the students was assessed. Basic entry qualification for Diploma in SSC or equivalent .However, higher entry qualification like 12th Science, 12th MCVC, and ITI etc. Were also considered.
- Curriculum documents of MSBTE, other Boards and other Autonomous Institutions and its implementation strategy for inclusion of new courses and analysis of contents of existing and newly inducted courses.
- The curriculum is rationalized as per the AICTE and MSBTE norms and guidelines.
- Recently, AICTE has designed a model curriculum and MSBTE also has revised its curriculum. However, these curriculums are designed by considering the needs at national / State level. As an Autonomous Polytechnic, our curriculum may be governed by local factors / needs.
- The team members were identified for conducting Search Conference, collecting feedback from stake holders and interviews with Experts for noting the suggestions about the courses and necessary modifications. The Interactive Sessions were proposed to arrange through Search Conference in which the Experts from Industry and Academia were invited.

3. Roles to be played and functions to be performed by a diploma holder:

- A Diploma holder may be employed in the Industry as a Technician or Supervisor for Production, Installation, Repairs and Maintenance. He also may be employed in drawing, estimation or as an Assistant in IT related activities. He may be an Entrepreneur, be assigned a job of Purchase/ Marketing Department. Diploma holder should have basic knowledge of the various subjects of his branch in Engineering and also the related Inter-disciplinary subjects. He should be aware of the present technologies and be able to adopt the changes in future. He shall acquire the necessary skill sets in the Engineering subjects.
- His role in the Society is that of a responsible individual and should conduct himself as regards the values and cultures. He should acquire the necessary professional, presentation and managerial Skills.

4. Outcome Based Education (OBE):

- The induction of India in the Washington Accord in 2014 with the permanent signature status of The National Board of Accreditation (NBA) is considered a big leap forward for the higher education system in India. It means that an engineering graduate from India can be employed in any one of the other countries who have signed the Washington Accord. For Indian Engineering Institute to get accredited by NBA according to the pacts of the accord, it is compulsory that engineering institutions follow the Outcome Based Education (OBE) model.
- Cusrow Wadia Institute of Technology has adopted outcome based Education (OBE) Model in revision of its curriculum effective from year 2018. Development of curriculum based on OBE model is noteworthy step towards further improvement in quality of technical education at polytechnic level in this institute.
- Outcome based education (OBE) is student centered teaching, learning model that focuses on measuring students performance through outcomes.
- Outcomes include knowledge, skills and attitude. Its focus remains on evaluation of outcomes of the programme by stating the knowledge, skill and behavior of diploma holder is expected to attend upon completion of every course(course outcomes) and after three years of diploma programme(Programme outcomes).
- Programme specific outcomes (PSOs) are statement that describes what the graduates of specific engineering program should be able to do.
- This OBE model measures the progress of the diploma holder in three parameters, which are
 - 1) Programme educational objectives (PEO).
 - 2) Programme outcomes(PO)
 - 3) Course outcomes(CO)
- Programme educational objectives (PEO) are broad statements that described the career and professional accomplishment that the programme is preparing the graduates to achieve. PEOs are expected to be attend 4-5 years after graduation/completion of diploma.
- Programme outcomes are narrower statements that describe what students are expected to know and be able to do by the time he/she completes diploma education. They must reflect the seven graduate attributes as described by NBA for polytechnic education programme. Course outcomes are measureable parameters which evaluates each students performance for each course that the student under takes in every semester.
- The assessment of outcomes is divided in two parts direct assessment and indirect assessment.
Direct assessment includes mid and end semester examinations, tutorials, assignments, project work, and orals/practical examination, continues lab work

assessment presentations and all these things are clubbed and assigned weightage of 80%.

An indirect assessment involves assessment through student's feedback, alumina feedback, parent's feedback etc and carries 20% weightage. These course outcomes are mapped to programme outcome based on relevance. This pattern of evaluation aids in effectively measuring the programmed outcome. The programmed educational objective is measured through employer satisfaction survey, alumina survey, placements records and higher education records.

5. Analyzing Job Functions and Deriving Curriculum Objectives:

- The role of a Diploma holder, as a Technician on the job, is analyzed in four domains of Professional Skills, Life Long Learning, Personal Development and Social Development.
- The curriculum should help the students to acquire professional skills and inculcate attitudes in order that the student will be able to discharge the role and functions effectively on the societal and employment front.
- Goals and objectives of each program are newly reviewed & framed during curriculum revision. The courses common to several programmes and the courses relevant to particular programmes were classified under various categories. Same categories may be considered in this revision.
- The overall course structure and Teaching Examination Scheme was prepared in last revision in 2014. Various administrative issues like the total workload of the department , balancing of the load in both the terms, the existing staff / faculty position as approved by the Government were also considered in the last revision. As majority of the administrative issues have been sorted out in the existing structure, it is proposed to retain almost similar structure except inclusion of industrial training of 6 weeks duration which will be compulsory for all students after finishing fourth semester.
- The contents of various courses were finalized by considering the feedback from stake holders through interviews, Search Conference and discussions.
- The course structure and the contents was validated by the Courses Committees (PBOS).
- Study of the Diploma programmes offered by MSBTE, other State Boards and other Autonomous Institutions was being done to widen the perspective .
- This curriculum is outcome based curriculum hence for each course outcomes are framed.
- Vision and mission of the programme are framed.

- The role of a Diploma holder, as a Technician on the job, is analyzed in 'Program Educational Objectives (PEO) mapped with the mission of the departments.
- The Program outcome (PO) suggested by NBA is incorporated with proper thought and understanding and three 'Program Specific Outcomes' (PSO) are defined after discussion with stake holder.
- Courses Outcome (CO) for each course is meticulously defined and mapped with POs and PSOs.
- The course common to several programmes and the course relevant to particular programmes were classified under various categories.
- The overall course structure and Teaching Examination Scheme were prepared.
- The contents of various courses were finalized by considering the feedback from stakeholders through search conference and discussions.

6. Evolving the TEACHING- LEARNING PROCESS:

- No. of weeks – 16 (Actually provided= 17-19 weeks /term , @36weeks)
(2x4= 08 weeks for Exam.)
- Average days per week- 5.5
- No. of contact hours per day – 7
- No. of hours per week for instruction and pre-decided Co-curricular activities – 38.
- Each course shall be taught for sixteen weeks and two weeks shall be utilized for revision in that term.

7. Course Categories:

- Foundation(1)
- Allied(2)
- Core(3)
- Applied(4)
- Specialized(5)
- Number of courses for a programme – 38.
- Number of courses for award of class – 11
- Number of Elective courses - 4
- Number of credits to be earned for obtaining Diploma – 191.
- One credit is = one hour of lecture / practical per week for a course.
- Ratio of theory to practical hours per week : Approx. 55:45

8. EXAMINATION SCHEME:

- Theory paper – 80 marks

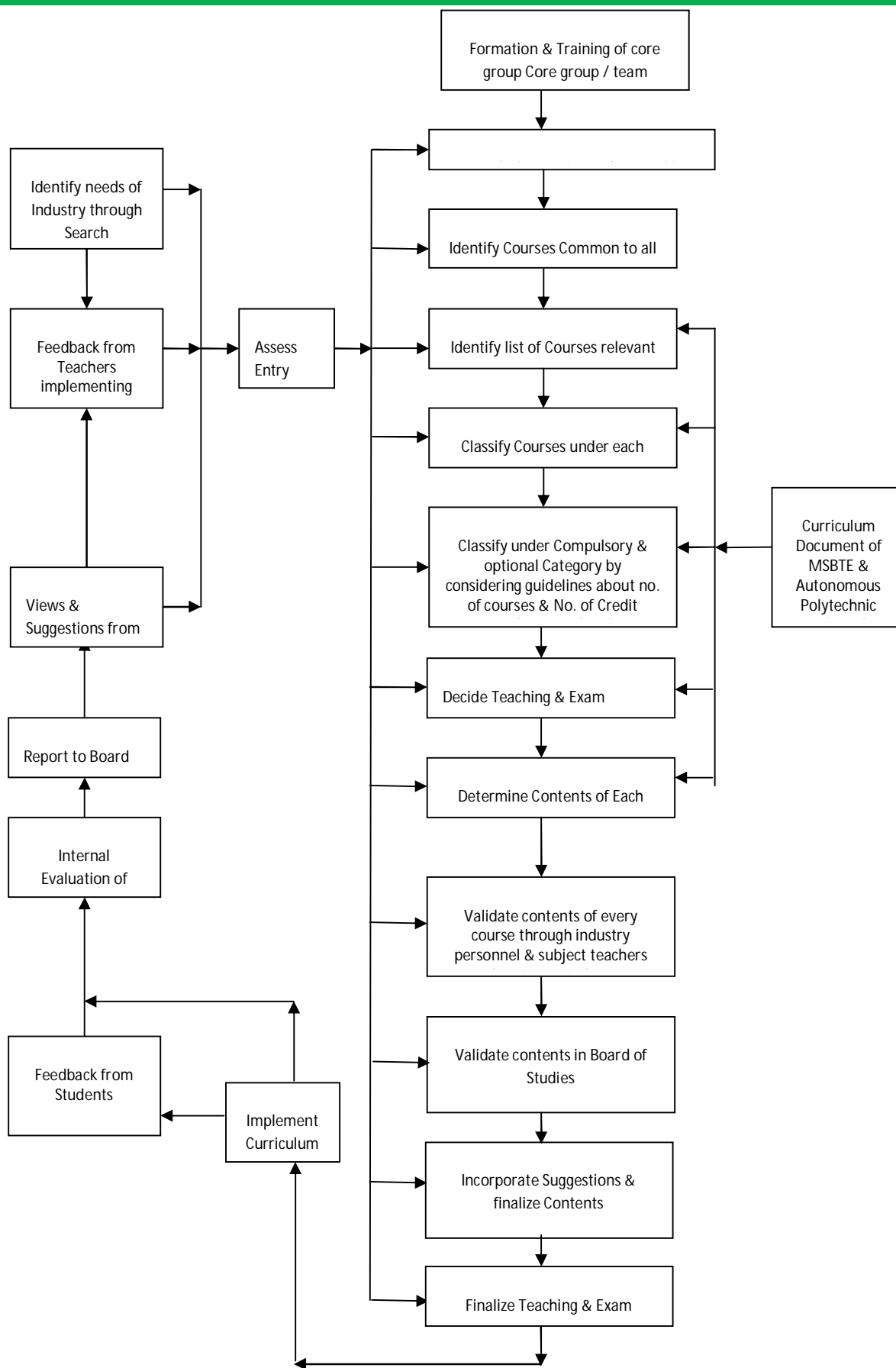
- Test – 20 marks
- Term Work – 25-100 marks
- Practicals -25 – 50 marks
- Viva voce- 25 – 75 marks
- Project Work -100 + 50 marks
- Grand total – 4700 marks , Grand total of marks for award of class – 1700.

9. Course-wise content detailing:

- For finalization of course structure from Courses Committee, Examination Committee and Board of Studies, various processes in the Curriculum Revision Model were followed. Also the documents of MSBTE and Autonomous Polytechnics were referred.
- Contents were decided by taking into consideration, the expectations of the stake holders, specific needs of Industry, Interviews, Discussions and Experts opinions.
- Every course has a unique code e.g. R18EE3301. 'R18' means the course is from the curriculum revised in 2018. EE implies Electrical Engineering Department will teach this course.
'3' indicates that it is Core Course Category in the programme Structure. '3' means the course is to be taught by Electrical Engineering Programme. '01' is the serial number of the course in Core Courses Category.
- The 7th character in the above 9 digit code is assigned for the programme ,e.g. 1 – Civil, 2 – Mechanical, 3 – Electrical, 4 –Computer and 5 – Electronics & Telecommunication Engineering and 7 – Common courses for all programs taught by Science Department.
- A rationale giving the importance of the course in the curriculum is vividly explained. The proficiency expected to be developed through the course is defined. The course outcomes are derived indicating the purpose to teach the course / subject.
- The Practicals, assignments, tutorials and Seminars are spelt out along with assessment technique in the form of rubrics.
- The inputs for students activates are included in most of courses so that students will be able to learn contents beyond syllabus.
- The curriculum document prescribes learning resources for students e.g. Reference books, Textbooks, Websites, Handbooks, Printed notes etc.
- Use of Learning Management System, Audio Visual Aids be increased for enhancing the Teaching Learning Process.

10. Curriculum implementation strategies:

- Members of the faculty shall continuously undergo Induction Training Programme, Content upgrading programme conducted by ISTE , NITTTR and other Organizations.
- The faculty members will be deputed to attend Refresher courses and Training programs so as to help them keep abreast with latest developments and technology.
- Faculty members will be trained/updated in respect of various aspects and methods of evaluation systems, Paper setting etc.
- Faculty will be trained for monitoring the curriculum implementation.
- Library will be constantly modernized with additions of latest titles and books .The Library will have open access to the students. Library will be open for extended hours.
- The Books Bank Facility is supporting the demand of the students.
- The Laboratory Manuals will be structured and standardized so that the students can spend more time for doing practicals, understanding the significance, discussions and result analysis rather than only writing the journals.
- The Examination rules will be revised to suit the curriculum and will have similarity as regards to principles followed by MSBTE and other Examination bodies.
- The Evaluation Systems and marking schemes will be commensurate with the input hours and importance of the topics in the course.
- 24 X 7 Internet connection of 100mbps bandwidth is available for faculty, staff and Students. Also Wi-Fi connectivity provided in all classrooms and laboratories which support the modern methods of teaching.
- Uninterrupted Power Supply and captive power is made available to take over the load shedding in all laboratories.
- Laboratories, equipments and computers are maintained in working conditions. Models, charts and exhibits are displayed for getting attention of the student.
- Industrial visits, Field visits, Study tours are arranged regularly in a preplanned and structured manner so as to have focus on learning of technical aspects.
- Guest faculty is invited to deliver lectures on recent trends, technology, materials and processes in industries. These activities are planned in the beginning of the term. The students should imbibe various life skills, generic skills, learn stress management and adjust help and appreciate colleagues especially during group activities, study tours and industrial visits etc.



CURRICULUM REVISION MODEL USED AT CWIT- 2018

ABOUT DIPLOMA IN ELECTRICAL ENGINEERING PROGRAMME

A diploma holder in Electrical Engineering is generally employed in industry, in middle management level as a supervisor, in production or maintenance department depending upon the type of organization. In more sophisticated Electrical Engineering Industry, he has to work as a technician in research & development department or involved in testing of the product as per relevant standard. In power sector establishment engaged in transmission & distribution of power, he has to prepare estimate & supervise the work done by workers. As an entrepreneur he can start his own establishment as an electrical installation, electrical maintenance contractor requiring various skills & abilities in addition to skills & abilities required by employed electrical engineers.

The real description of the job profile is complex & while designing the curriculum the requirement of representative industry & organization are to be considered understanding the role of middle management level supervisor.

CUSROW WADIA INSTITUTE OF TECHNOLOGY, PUNE -1.

Vision and Mission of the Institute

Vision

To be a resourceful institute that develops technically competent and socially responsible citizen for futuristic needs of industry and society

Mission

M1: To impart technical knowledge and skills along with ethical and social values.

M2: To continually enhance curricula and learning resources as per latest trends in technology.

M3: To develop the faculty and enable them to implement innovative teaching methods.

M4: To strengthen association with industry and alumni.

M5: To adopt and implement various e-governance practices for benefits of stakeholders.

Vision and Mission of the Electrical Engineering Department

Vision

To develop electrical professionals with technical competency, high socio-ethical values to serve industry and society.

Mission

M1: To impart latest theoretical knowledge and practical skills by adopting innovative technique.

M2 : To update and upgrade the learning resources in association with stake holders to achieve lifelong learning.

M3 : To inculcate students with leadership qualities, environmental, social and ethical responsibilities.

RATIONALE

The growing utilization of the electricity is a decisive prerequisite for fast developments in industry and society. With the rapid expansion of the technology over the last few decades, the demand of skilled manpower in Electrical Engineering field has risen.

Diploma Electrical Engineers are well positioned in engineering areas to serve societies in sectors like energy, drives, illumination, transportation, health, smart technologies and automation and control. The program aims to achieve measurable and observable, goals and learning experiences for technicians and engineers working in industry, society.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: *To apply the knowledge of mathematics, science and electrical engineering fundamentals to analyze and solve problems in electrical domains.*

PEO2: *To acquire adequate technical skills and abilities to communicate and work effectively in multi disciplinary environment individually and in a team.*

PEO3: *To exhibit professional and ethical attitude, leadership qualities, good marketing skills and entrepreneurial talents to serve the nation.*

PROGRAMME OUTCOMES (POs):

The diploma holder from the department of Electrical Engineering has the following abilities, knowledge, characteristics and skills:

- a. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
- b. **Problem Analysis:** Identify and analyze well-defined engineering problems using codified standard methods.
- c. **Design /Development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
- d. **Engineering Tools Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.

e. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.

f. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.

g. **Life-long learning:** Ability to analyze individual needs and engage in updating in the context of technological changes.

MAPPING OF PROGRAMME EDUCATIONAL OBJECTIVES AND PROGRAMME OUTCOMES:

Sr. No.	Programme Educational Objectives(PEOs)	Programme Outcomes (POs)
1	<i>To apply the knowledge of mathematics, science and electrical engineering fundamentals to analyze and solve problems in electrical domains.</i>	a, b, c, f, g
2	<i>To acquire adequate technical skills and abilities to communicate and work effectively in multi disciplinary environment individually and in a team.</i>	c, d, g
3	<i>To exhibit professional and ethical attitude, leadership qualities, good marketing skills and entrepreneurial talents to serve the nation.</i>	d, e, g

MAPPING OF PROGRAMME OUTCOMES AND COURSES

Sr. No.	Programme Outcome (POs)	Contributing Courses
1.	Basic knowledge and Discipline specific knowledge	Basic Mathematics Engineering Mathematics Basic science Applied science Engineering Graphic skills Basic Electronics Gen Mechanical& civil Engineering Elect. Engg. Skills and drawing DC circuits and DC machines AC fundamentals and AC circuits
2.	Problem Analysis	Electrical Measurement & Instrumentation Industrial Electronics Transformers Electrical engg. Materials and Appliances LT and HT Switchgear Electrical Estimation and costing A.C. Motors and generators Elect. Power Generation Transmission& distribution of Electrical Power
3.	Design /Development of solutions	Engineering Graphic skills Mechanical Engineering Industrial Electronics Illumination engg. A.C. Motors and generators LT and HT Switchgear Electrical Estimation and costing Installation, Maintenance& repair Elect. Energy audit & conservation Elect. motor control Elect. Design and drawing
4.	Engineering Tools Experimentation and Testing	Basics of Computer Engineering Graphic skills Workshop Practice Elect. Design and drawing Electrical engg. Materials and Appliances Installation, Maintenance& repair Elect. motor control

5.	Engineering practices for society, sustainability and environment	Environmental Engg. Elect. Energy audit & conservation Elect. motor control Elect. Engg. Skills and drawing Entrepreneurship Development Marketing management Electrical Estimation and costing Illumination engg.
6.	Project Management	Entrepreneurship Development Project work and seminar Industrial Organization and Management Marketing Management Electrical Estimation and costing Illumination engg. Elect. Energy audit & conservation
7.	Life-long learning	Basics of Computer Engineering Graphic skills Workshop Practice Elect. Design and drawing Elect. Energy audit & conservation Electrical Estimation and costing Illumination engg. Installation, Maintenance& repair Project work and seminar

PROGRAMME: ELECTRICAL ENGINEERING DEPARTMENT
SCHEME: MPECS 2018

Sr. No .	Category		Course Code	Course Title	Pre-Requisite	C/ O	Teaching Scheme			CR	Examination Scheme					
							L	T	P		TH	TT	PR	OR	TW	Total
1	Foundation Courses	1	R18SC 1701	Basic Mathematics	-	C	4	1	-	5	80	20	-	-	-	100
2		2	R18SC 1710	Engineering Mathematics	-	C	4	1	-	5	80	20	-	-	-	100
3		3	R18SC 1704	Basic Science	-	C	4	-	4	8	80	20	-	-	50	150
4		4	R18SC 1707	English	-	C	2	-	2	4	80	20	-	-	25	125
5		5	R18SC 1708	Business Communication	-	C	1	-	2	3	-	-	-	25@	25	50
6		6	R18SC 1709	Applied Science	-	C	4	-	4	8	80	20	-	-	50	150
7		7	R18ME 1202	Engineering Graphic Skills	-	C	2	-	4	6	-	-	-	-	50	50
8		8	R18EE 1301	Basics of Computers (Electrical)	-	C	1	-	4	5	-	-	25@	-	25	50
9		9	R18EE 1302	Electrical Engineering Skills & Drawing	-	C	-	-	2	2	-	-	-	25@	25	50
			Total				22	02	22	46	400	100	25	50	250	825
10	Allied Courses	1	R18ME2201	General Mechanical & Civil Engineering	-	C	2	-	4	6	-	-	-	-	50	50
11		2	R18ME2202	General Engineering (Workshop)	-	C	-	-	2	2	-	-	-	-	50	50
12		3	R18EE2303	Industrial Organization & Management	-	C	3	-	-	3	80	20	-	-	-	100
13		4	R18EE 2301	Environmental Engineering	-	C	1	1	-	2	-	-	-	25@	25	50
14		5	R18EX2510	Basic Electronics (Electrical)	-	C	3	-	2	5	80	20	-	-	25	125
15		6	R18EX2511	Industrial Electronics	R18EX2510	C	3	-	2	5	80	20	-	-	25	125
16		7	R18ME2204	Total Quality Management	-	Any one	1	-	2	3	-	-	-	25@	25	50
17		8	R18EE2302	Marketing Management	-		1	-	2	3	-	-	-	25@	25	50
18		9	R18ME2205	Entrepreneurship Development	-		1	-	2	3	-	-	-	25@	25	50
			Total				13	01	12	26	240	60	-	50	200	550
19	Core Courses	1	R18EE3301	Electrical Engg. Materials and Appliances	-	C	3	-	4	7	80	20	-	-	50	150
20		2	R18ME3302	Mechanical Engineering	R18ME2201	C	3	-	2	5	80	20	-	-	25	125
21		3	R18EE3303	DC circuits and DC Machines	-	C	3	-	2	5	80	20	50@	-	25	175
22		4	R18EE3304	AC Fundamentals and AC circuits	-	C	4	-	2	6	80	20	50	-	25	175
23		5	R18EE3305	Electrical Measurements & Instrumentation	-	C	4	-	2	6	80	20	50	-	25	175
24		6	R18EE3306	Electrical Power Generation	-	C	3	-	2	5	80	20	-	-	50	150
25		7	R18EE3307	L.T. and H.T. Switch Gear	-	C	3	-	2	5	80	20	-	50	25	175
26		8	R18EE3308	Transformer	R18EE3304	C	4	-	2	6	80	20	50	-	50	200
Total							27	-	18	45	640	160	200	50	275	1325

PROGRAMME: ELECTRICAL ENGINEERING DEPARTMENT
SCHEME: MPECS 2018

27	Applied Courses	1	R18EE4301	Transmission, Distribution & Protection of Electrical Power	-	C	4	-	2	6	80	20	-	25	50	175
28		2	R18EE4302	A.C. Motors & Generators	R18EE3304	C	4	-	2	6	80	20	50	-	25	175
29		3	R18EE4303	Electrical Design & Drawing	R18EE3308	C	-	-	4	4	-	-	-	50	25	75
30		4	R18EE4304	Utilization of Electrical Energy	-	C	3	-	-	3	80	20	-	-	-	100
31		5	R18EE4305	Electric Motor Control	R18EE4302	C	4	-	2	6	80	20	-	50	25	175
32		6	R18EE4306	Electrical Estimation & Costing	R18EE3301	C	3	-	4	7	80	20	-	50	25	175
33		7	R18EE4307	Installation, Maintenance & Repair	-	C	3	-	2	5	80	20	-	-	25	125
34		8	R18EE4308	Electrical Traction Systems	-	C	4	-	2	6	80	20	-	25	25	150
35		9	R18EE4309	Illumination Engineering	-	C	2	-	4	6	-	-	-	50	50	100
36		10	R18EE4310	Industrial Training	-	C	-	-	6^	6^	-	-	-	75	75	150
37		11	R18EE4311	Project Work & Seminar	100CR	C	-	-	4	4	-	-	-	50	100	150
Total							27	-	26	53	560	140	50	375	425	1550
38	Specialized Courses	1	R18EE5301	Programmable Logic Controller & SCADA	-	Any Three	3	-	2	5	80	20	-	25	25	150
39		2	R18EE5302	Electrical Energy Audit & Conservation	-		3	-	2	5	80	20	-	25	25	150
40		3	R18EE5303	Electrical Substation Engineering & Practices	-		3	-	2	5	80	20	-	25	25	150
41		4	R18EE5304	Vehicular Electrical Systems	-		3	-	2	5	80	20	-	25	25	150
42		5	R18EE5305	Electrical Maintenance of Building Complexes	-		3	-	2	5	80	20	-	25	25	150
Total							09	-	06	15	240	60	-	75	75	450
Total of Marks=4700 ; Credits = 185							98	03	84	185	2080	520	275	600	1225	4700
							101									
GRAND TOTAL							4700									
@ =Internal Orals/Practicals exam							#= Tutorial			^ = Every student should undergo In Plant Training						

NOTE: ^ = 06 Weeks Industrial Training is compulsory after 4th semester. Though 06 credits are allocated for industrial training, these are only for awarding marks. As far as teaching load/ time table preparation is considered, each faculty would be assigned one batch of student's equivalent to practical batch size for guiding students about preparation of industrial training report and power point presentation for its evaluation purpose. For this, teaching load of one hour would be considered/allocated in the 5th semester.

PROGRAMME: ELECTRICAL ENGINEERING DEPARTMENT
SCHEME: MPECS 2018
SCHEME FOR CLASS DECLARATION: MPECS 2018

Sr. No.	Category		Course Code	Course Title	Pre-requisite	C/O	Teaching Scheme		CR	Examination Scheme				
							L	P		WE	TT	PR	OR	TW
1	Allied Courses	1	R18EE2303	Industrial Organization & Management	-	C	3	-	3	80	20	-	-	-
2	Core Courses	2	R18EE3308	Transformer	R18EE3304	C	4	2	6	80	20	50	-	50
3	Applied courses	3	R18EE4301	Transmission, Distribution & Protection of Electrical Power	-	C	4	2	6	80	20	-	25	50
4		4	R18EE4302	A.C. Motors & Generators	R18EE3304	C	4	2	6	80	20	50	-	25
5		5	R18EE4305	Electric Motor Control	R18EE4302	C	4	2	6	80	20	-	50	25
6		6	R18EE4308	Electrical Traction Systems	-	C	4	2	6	80	20	-	25	25
7		7	R18EE4310	Industrial Training	-	C	-	6^	6^	-	-	-	75	75
8		8	R18EE4311	Project Work & Seminar	100CR	C	-	4	4	-	-	-	50	100
9	Specialized courses	1	R18EE5301	Programmable Logic Controller & SCADA	Any Three	O	3	2	5	80	20	-	25	25
10		2	R18EE5302	Electrical Energy Audit & Conservation		O	3	2	5	80	20	-	25	25
11		3	R18EE5303	Electrical Substation Engg. and Practices		O	3	2	5	80	20	-	25	25
12		4	R18EE5304	Vehicular Electrical Systems		O	3	2	5	80	20	-	25	25
13		5	R18EE5305	Electrical Maintenance of Building complexes		O	3	2	5	80	20	-	25	25
Total							32	26	58	720	180	100	300	400

The maximum theory marks = 900
 The maximum practical marks = 800
 Theory credits: Practical credits ratio = 55: 45
 Theory marks: Practical marks ratio = 53: 47

CLASS DECLARATION =1700
 Total no. of theory courses = 09
 Total no. of practical/ oral courses = 10
 Industrial training = 01
 Total Courses = 11

Summary of Credits & Marks

Course	Teaching Scheme			CR	Examination Scheme					
	L	T	P		WE	TT	PR	OR	TW	Total
Foundation Courses	22	02	22	46	400	100	25	50	250	825
Allied Courses	13	01	12	26	240	60	-	50	200	550
Core	27	-	18	45	640	160	200	50	275	1325
Applied Courses	27	-	26	53	560	140	50	375	425	1550
Specialized Courses	09	-	06	15	240	60	-	75	75	450
Total	98	03	84	185	2080	520	275	600	1225	-----
					2600		2100			
Grand Total	185				4700					

- Total Courses = 37 + 01 (IPT)
- The total no. of courses to be completed = 33 (Compulsory) + 4 (Optional)
- The no. courses having theory exam = 26
- The no. Practical/ Oral examination = 06 Internal + 16 External
- Credits Ratio Theory: Practical = 55 : 45
- Marks Ratio Theory: Practical = 55.3 : 44.7

CUSROW WADIA INSTITUTE OF TECHNOLOGY, PUNE – 1

PROGRAMME: DIPLOMA IN ELECTRICAL ENGINEERING

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DIPLOMA PROGRAMME: CIVIL/MECH/ELECT./COMP./E&TC. ENGINEERING**COURSE: BASIC MATHEMATICS****COURSE CODE: R18SC1701****COURSE CATEGORY: FOUNDATION****CREDIT: 05****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
TH	PR	TU	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
04	-	01	03	80	20	-	-	-	100

Rationale:

Mathematics is an important prerequisite for the development and understanding of engineering concepts. The aim of the course is to acquire some essential competencies in Mathematics by the students of diploma in Engineering. The course will help the students to think logically and systematically. The students will develop the attitude of problem solving. Hence the course provides the ability to analyze Engineering problems using determinants, matrices, trigonometry, statistics and graphs.

Course Outcomes:

1. Apply the rules and formulae of trigonometry to solve engineering problem.
2. Use determinant and matrices to solve simultaneous equations for engineering problem.
3. Analyze the given data using measures of central tendency and dispersion.
4. Plot the graph of functions used in Engineering field.

Course Details:

The following topics/subtopics should be taught and assessed in order to develop LOs in cognitive domain for achieving the COs to attain the identified competency.

NAME OF THE TOPIC	LEARNING OUTCOME	HRS	MKS
Unit1-Trigonometry 1.1 Trigonometric ratios of an angle Definition of positive and negative angles. Unit of measurement of an angle. Signs of trigonometric ratios of an angle in the four quadrants.(ASTC RULE) Trigonometric ratios of negative angles. 1.2 Trigonometric ratios of compound and allied angles. 1.3 Trigonometric ratios of multiple and sub-multiple angles.	1a. Apply the concept of Compound angle, allied angle, and multiple angles to solve the given simple engineering problem(s). 1b. Apply the concept of Sub-multiple angle to solve the given simple engineering related problem(s).	12	12

Unit2-Trigonometry 2.1 Factorization and de-factorization formulae. 2.2 Inverse Circular function Definition of inverse circular function. Principal value of inverse circular function. Properties of inverse circular function.	2a. Apply concept of factorization and de-factorization formulae to solve the given simple engineering problem(s). 2b. Investigate given simple problems utilizing inverse trigonometric ratios.	10	12
Unit3-Algebra 3.1 Determinant: Definition of determinants. Problems on expansion of determinants of order 3. Solution of simultaneous equation in three unknowns (Cramer's Rule). 3.2 Partial Fractions: Definition of fraction, proper and improper fraction. Resolve the given proper fraction into partial fraction for the cases a. Factors of denominator are linear and non-repeated b. Factors of denominator are linear but repeated. Factors of denominator are quadratic, non-repeated and irreducible.	3a. Calculate the area of the given triangle with vertices A, B, C using determinant. 3b. Solve the system of linear equations using determinant method for given simple engineering problem. 3c. Resolve the given proper fraction into partial fractions	14	16
Unit4-Matrices 4.1 Definition of a Matrix. Types of Matrices. 4.2 Algebra of matrices: Addition, subtraction and multiplication of matrices. 4.3 Transpose of a matrix. Adjoint of a matrix. Inverse of a matrix by adjoint method. 4.4 Solution of simultaneous equation by matrix method.	4a. Solve the system of linear equations using matrix method and determinant method for given simple engineering problem.	12	16
Unit5- Statistics Measures of dispersion: 5.1 Mean deviation about mean of raw, ungrouped and grouped data. 5.2 Standard deviation of raw, ungrouped and grouped data. 5.3 Variance and coefficient of variation. 5.4 Comparison of two sets.	5a. Calculate the mean deviation of the given statistical observations of an experiment 5b. Calculate the standard deviation, variance and coefficient of variation of the given data 5c. Justify the consistency of the given simple sets of data	8	12

Unit6- Functions 6.1 Functions and Limits: Definition of functions and Notation. Different types of functions. Limits -Concept of limits 6.2 Graphs: Graph of linear function. Graph of quadratic equation. Graph of trigonometric function. Graph of exponential function.	6a. Find the value of the given function 6b. Plot the graph of the given simple function	8	12
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SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Trigonometry	12	2	4	6	12
2	Trigonometry	10	2	4	6	12
3	Algebra	14	4	4	8	16
4	Matrices	12	4	4	8	16
5	Statistics	8	-	6	6	12
6	Functions	8	2	4	6	12
	Total	64	14	26	40	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy) **Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

SUGGESTED EXERCISES/PRACTICALS

Sr. No.	Unit No.	Tutorials	Appro. Hrs.Re quired
1	3	Solve problems on determinant to find area of triangle, and solution of simultaneous equation by Cramer's Rules.	1
2	4	Solve elementary problems on Algebra of matrices.	1
3	4	Solve elementary problems on Algebra of matrices.	1
4	4	Solve solution of Simultaneous Equation using inversion method.	1
5	3	Resolve into partial fraction using linear non repeated, repeated linear factors.	1
6	3	Resolve into partial fraction using quadratic, irreducible factors.	1
7	1	Solve problems on Compound and Allied angles	1
8	1	Solve problems on multiple and sub-multiple angles	1

9	2	Practice problems on factorization and de factorization formula	1
10	1&2	Solve problems on trigonometry (All mixed)	1
11	2	Solve problems on inverse circular trigonometric ratios.	1
12	5	Solve problems on finding mean deviation about mean.	1
13	5	Solve problems on standard deviation.	1
14	5	Solve problems on coefficient of variation, comparison of two sets.	1
15	6	Solve problems on functions	1
16	6	Plot the graph of the given function	1
Total			16

SUGGESTED STUDENT ACTIVITIES

1. Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
2. Use graphical software: EXCEL, DPLLOT and GRAPH for related topics.
3. Prepare a seminar on any relevant topic.

SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- I. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- II. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- III. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the UOs/COs through classroom presentations

SUGGESTED LEARNING RESOURCES

A) Books :

Sr. No.	Title of Book	Author	Publication
1	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi, 2015 ISBN: 8174091955
2	Advanced Engineering Mathematics	Kreszig, Ervin	Wiley Publications, New Delhi, 2014 ISBN :978-0-470-45836-5
3	Engineering Mathematics (third edition).	Croft, Anthony	Pearson Education, New Delhi, 2014 ISBN 978-81-317-2605-1
4	Advanced Engineering Mathematics	Das, H.K.	S. Chand & Co.; New Delhi; 2008, ISBN-9788121903455

B) Software/Learning/ Simulations Websites

www.dplot.com/ - DPlot

www.allmathcad.com/ - MathCAD

www.wolfram.com/mathematica/ - Mathematica

<https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>

www.easycalculation.com

www.math-magic.com

Mapping matrix of PO's and CO's: (with Justification of each cell)

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ developme nt of solutions	PO4 Engineering Tools, Experiment ation and testing	PO5 Engineering practices for society, sustainabilit y & environment	PO6 Project Manage ment	PO7 Lifelong learning
CO1	3	2	1	--	--	--	1
CO2	3	2	1	--	--	--	1
CO3	3	2	1	--	--	--	1
CO4	3	2	1	--	--	--	1

3: High 2: Moderate and 1:Low Relationship

DIPLOMA PROGRAMME: ELECT/COMPE&TC ENGINEERING**COURSE: ENGINEERING MATHEMATICS****COURSE CODE: R18SC1710****COURSE CATEGORY: FOUNDATION****CREDIT : 5****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
TH	PR	TU	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
04	-	01	03	80	20	-	-	-	100

Rationale:

Mathematics is an important prerequisite for the development and understanding of engineering concepts. The subject intends to teach students basic facts, concepts and principles of Mathematics as a tool to analyze engineering problems. It also aims to teach students to apply the basic facts of Mathematics to solve engineering problem.

Course Outcomes:

1. Apply the rules and methods of derivatives to engineering field.
2. Evaluate integration of a function as anti derivative.
3. Apply appropriate methods of integration to engineering problem.
4. Apply appropriate methods of differential equation to engineering problems.
5. Convert the given complex number to its polar form.

Course Details:

NAME OF THE TOPIC (with Details)	LEARNING OUTCOME	HRS	MKS
Unit 1- Derivatives 1.1 Concept and definition of derivative. Derivatives of standard functions. 1.2 Laws of derivatives :- Addition law. Subtraction law. Multiplication law. Division law.	1a. Solve the given simple problems based on rules of differentiation.	8	12
Unit 2- Derivatives 2.1 Derivatives of composite functions (Chain rule) Methods of Derivatives: 2.2 Derivative of parametric functions. 2.3 Derivative of implicit functions. Concept of higher order derivatives	2a. Solve the given problems of differentiation for composite functions. 2b. Solve the given problems of Differentiation for parametric and implicit functions.	12	12
Unit 3 - Integration	3a. Obtain the given simple	16	16

3.1 Definition of integration as anti-derivative. 3.2 Integration of algebraic functions. 3.3 Integration by substitution. 3.4 Integration by parts. 3.5 Integration by partial fraction	integral(s) using substitution method. 3b. Integrate given simple functions using the integration by parts. 3c. Evaluate the given simple integral by partial fractions.		
Unit 4 - Application of Derivatives and Integration Application of Derivatives: 4.1 Geometrical meaning of derivative. (slope of tangent and normal to the given curve) 4.2 Maxima and minima using derivative. Application of Integration: 4.3 Mean value of the function 4.4 Root mean square value	4a. Apply the concept of differentiation to find slope of tangent and normal to the given curve. 4b. Apply the concept of differentiation to calculate maxima and minima of given problem. 4c. Invoke the concept of definite integration to find the mean value and RMS value of the function.	8	16
Unit 5 - Differential Equation: 5.1 Definition of differential equation. Order and degree of differential equation. 5.2 Solution of differential equation of 1 st order and 1 st degree. Variable separable differential equation. Linear differential equation.	5a. Find the order and degree of the differential equation. 5b. Solve the differential equation using the method of variable separable for the given engineering problem. 5c. Solve the linear differential equation for the given engineering problem.	10	12
Unit 6 - Complex Number: 6.1 Definition of complex number. Algebra of complex number i.e. addition, subtraction, multiplication and division of complex numbers. To express given complex number in $x + iy$ form. 6.2 Modulus and amplitude of complex number. Polar form of a complex number.	6a. Solve the given problem using algebra of complex numbers. 6b. Express the given complex number in polar form. Find the powers of complex number using De-Moivre's theorem.	10	12

SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Derivatives	8	4	8	-	12
2	Derivatives	12	-	8	4	12
3	Integration	16	4	4	8	16
4	Application of Derivatives & Integration	8	-	4	12	16
5	Differential Equation	10	4	-	8	12
6	Complex Number	10	2	2	8	12
Total		64	14	26	40	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy) **Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

SUGGESTED EXERCISES/PRACTICALS :

Sr. No.	Unit No.	Tutorials	Appro. Hrs. Required
1.	1	Solve the given simple problems based on rules of differentiation.	1
2.	2	Solve the given problems based on chain rule of differentiation	1
3.	2	Solve the given problems of differentiation on parametric functions.	1
4.	2	Solve the given problems of differentiation on logarithmic functions.	1
5.	1&2	Solve engineering problems on differentiation.	1
6.	3	Solve the given simple integral(s) as anti derivative.	1
7.	3	Solve the given integral(s) using substitution method.	1
8.	3	Solve the given integral(s) using integration by parts and by partial fraction.	1
9	3	Solve engineering problems on integration.	1
10	4	Solve problems on slope of tangent & normal at given point on the curve and on finding maxima minima of function.	1
11	4	Solve problems on finding Mean value and RMS value of the function.	1
12	4	Solve engineering problems on application of differentiation and integration.	1
13	5	Find order and degree of given differential equation.	1
14	5	Solve differential equation based on variable separable and Linear differential equation.	1
15	6	Express the given complex number in a + ib form and polar form.	1
16	6	Find the powers of complex number using De-Moivre's theorem.	1
Total			16

SUGGESTED STUDENT ACTIVITIES

1. Identify engineering problems based on real world problems and solve with the use of free tutorials available on the internet.
2. Use graphical software: EXCEL, DPLLOT and GRAPH for related topics.
3. Prepare a seminar on any relevant topic based on application of integration.
4. Prepare a seminar on any relevant topic based on application of differentiation.

INSTRUCTIONAL STRATEGIES (if any)

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- I. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- II. 'L' in item No. 4 does not mean only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- III. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the UOs/COs through classroom presentations

SUGGESTED LEARNING RESOURCES**Books :**

Sr. No.	Title of Book	Author	Publication
5	Higher Engineering Mathematics	Grewal, B.S.	Khanna publications, New Delhi, 2015 ISBN: 8174091955
6	Advanced Engineering Mathematics	Krezig, Ervin	Wiley Publications, New Delhi, 2014 ISBN :978-0-470-45836-5
7	Engineering Mathematics (third edition).	Croft, Anthony	Pearson Education, New Delhi, 2014 ISBN: 978-81-317-2605-1
8	Advanced Engineering Mathematics	Das, H.K.	S. Chand & Co.; New Delhi; 2008, ISBN-9788121903455

Software/Learning/ [Simulations](#) Websites

www.dplot.com/ - DPlot

www.allmathcad.com/ - MathCAD

www.wolfram.com/mathematica/ - Mathematica

<https://www.khanacademy.org/math?gclid=CNqHuabCys4CFdOJaAoddHoPig>

www.easycalculation.com

www.math-magic.com

Mapping matrix of PO's and CO's: (with Justification of each cell)

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ developm ent of solutions	PO4 Engineerin g Tools, Experimen tation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Managem ent	PO7 Lifelong learning
CO1	3	1	1	--	--	--	1
CO2	3	1	1	--	--	--	1
CO3	3	1	1	--	--	--	1
CO4	3	1	1	--	--	--	1
CO5	3	1	1	--	--	--	1

3: High 2: Moderate and 1:Low Relationship

DIPLOMA PROGRAMME IN: CIVIL/MECH/ELECT./E&TC. ENGINEERING**COURSE : BASIC SCIENCE****COURSE CODE: R18SC1704****COURSE CATEGORY : FOUNDATION****CREDITS : 08****Teaching and examination scheme:**

Teaching Scheme			Examination Scheme						
Title	TH	PR	Online Exam Hrs.	TH	TT	PR	OR	TW	TOTAL
B.Physics	02	02	01	40	10	-	-	25	75
B.Chemistry	02	02	01	40	10	-	-	25	75

Rationale

Basic Sciences like Physics and Chemistry are the pillars of engineering and technology. It is very essential to learn the basic sciences to understand the fundamental concepts and principles. The course content is chosen so that it should be more relevant to fulfill the needs of industries. The study of basic principles in Electrochemistry, Corrosion, Chemical Bonding, Heat, Electricity, Magnetism and Semi-Conductors will help in understanding the technical courses where emphasis is on application of these in various fields.

Course outcomes (COs)

1. Estimate errors in measurements of physical quantities measured with appropriate measuring instruments.
2. Apply principles of Electricity, Magnetism and Semi-Conductors to solve engineering problems.
3. Apply Gas laws, use basic principle of Heat and Temperature to related engineering problems.
4. Identify different types of bonds of different compounds.
5. Apply concepts of Electrochemistry and Corrosion to solve engineering problems.
6. Describe Polymers, Lubricants and Adhesives.

Course details:

The following topics should be taught and assessed in order to develop UOs in cognitive domain for achieving the COs

Name of the topics and subtopics	Learning outcomes	Hrs	Mks
Unit1 – Units and Measurements 1.1 Physical quantity, fundamental and derived physical quantity with examples. Unit of physical quantity, fundamental units with examples and derived units with examples. 1.2 System of units (C.G.S., M.K.S., F.P.S. and S.I.) Rules and Conventions for writing units in SI system. Tables of fundamental and derived S.I. units. Multiples and sub multiples of units. Significant figures, rules for determining the significant figures. 1.3 Dimensions and dimensional formulae	1a.Describe the concept of given physical quantities with relevant unit of measurement. 1b.State various systems of units and its need for the measurement of the given physical quantities. 1c.Determine the dimensions of given physical quantities. State the error in the given	9	12

1.4 Errors, types of errors (Instrumental, systematic and random error) and methods for minimization of errors, 1.5 Estimation of errors (Absolute error, average absolute error, relative error and percentage error), Propagation of errors in measurement, Numerical	measurement with justification.		
Unit2-Electricity, Magnetism and Semiconductors 2.1 Concept of charge, Coulomb's inverse square law, Electric field, Electric lines of force and their properties, Electric field intensity, Electric potential and potential difference, Electric flux density, Electric current, Ohm's law, Specific resistance, Resistance by using color code, Laws of series and parallel resistance, Heating effecting of electric current, Electric power, Electric energy in kWh, Electric bill, Numerical. 2.2 Magnetic field, magnetic field intensity and their units, Magnetic lines of force and their properties, magnetic flux. 2.3 Conductors, semiconductors, insulators and their energy band diagrams. 2.4 Intrinsic or pure semiconductor, extrinsic or impurity doped semiconductors, pentavalent impurity doped N-type semiconductor and trivalent impurity doped P-type semiconductor. p-n junction diode, 2.5 Forward and reverse biasing of p-n junction diode, I-V characteristics of p-n junction, and applications of p-n junction diode.	1c. Calculate electric field, potential and potential difference of the given static charge. 1d. Describe the concept of given magnetic intensity and flux with relevant units. 1e. Explain the heating effect of the electric current. 1f. Apply laws of series and parallel combination in the given electric circuits. 1g. Distinguish the given conductors, semiconductors and insulators on the basis of energy bands. Explain the I-V characteristics and applications of the given p-n junction diodes.	14	16
Unit3-Heat , Temperature and Gas laws 3.1 Heat, units of heat, calorie-joule conversion, Latent heat and sensible heat. Temperature, Temperature scales, Absolute zero temperature, relations of temperatures on Celsius scale, Fahrenheit scale and Kelvin scale, Difference between heat and temperature, Numerical. 3.2 Conduction, Flow of heat along a bar, Steady state of temperature Coefficient of thermal conductivity by Searle's method. (For good conductor), Convection, Radiation, Comparison of conduction, convection and radiation.. 3.3 Applications of conduction, convection and radiation, Thermal Expansions (linear, areal, cubical), Numerical. 3.4 Principle, Construction and working of Bimetallic thermometer, Resistance thermometer and Thermocouple thermometer 3.5 Boyle's law, Charle's law and Gay-Lussac's law. General gas equation, Specific heats (C_p , C_v) of gases and their ratio, Numerical.	3a. Convert the given temperature in different temperature scales. 3b. Distinguish the properties of the good and bad conductors of heat. 3c. Relate the characteristics of the three gas laws. 3d. Determine the ratio of specific heats for the given gas materials. 3e. Describe the phenomena of total internal reflection for the given mediums. Describe light propagation in the given type of optical fiber.	9	12
Unit4Atomic Structure and Chemical Bonding 4.1. Filling of electrons in the orbitals-Hund's rule of	4a. Describe rules for arrangement of electrons 4b. Write electronic	9	12

<p>maximum multiplicity, Pauli exclusion principle, Aufbau's principle</p> <p>4.2. Electronic configuration, octet rule & duplet rule .(Electronic configuration up to atomic number 30)</p> <p>4.3. Electronic theory of valency Chemical bonds: types and characteristics , electrovalent bond(NaCl,CaCl₂),covalent bond(Cl₂,O₂,N₂)co-ordinate bond (SO₂,SO₃,Ozone (O₃),metallic bond(Sodium and Copper metal).</p> <p>4.4. Basic Concepts of Volumetric Analysis- Titration, Titrate, Titrant, Normality , Molarity, End Point, Strength, Equivalent weight.</p> <p>4.5. Types of Titrations- Acid Base Titration A) Strong acid and strong base B) Weak acid and weak base Redox Titration, Precipitation Titration ,Complexometric Titration.</p>	<p>configuration of different elements.</p> <p>4c. Distinguish the properties of given material based on the bond formation</p> <p>4d. State the concepts included in the volumetric analysis.</p>		
<p>Unit 5 Electrochemistry and Corrosion</p> <p>5.1. Electrolyte – strong and weak , Non – Electrolyte, Electrolytic cell, Electrochemical cell, cathode ,anode , Electrode potential-oxidation and reduction , construction and working of Daniel cell , Ionization and Dissociation</p> <p>5.2. Faraday's first and second law and Numerical based on Faraday's law</p> <p>5.3. Electrolysis-Definition, mechanism of electrolysis of CuSO₄ and NaCl using Platinum electrodes , Electroplating and electro-refining of copper</p> <p>5.4. Primary cell and secondary cell- mechanism, examples and application of the types of cells.</p> <p>5.5. Corrosion-Types of corrosion- Dry corrosion, Wet corrosion, Oxidation corrosion (Atmospheric corrosion due to oxygen gas), mechanism, Types of oxide film, Wet corrosion mechanism (Hydrogen evolution in acidic medium) Concentration cell corrosion-Oxygen absorption mechanism in neutral or alkaline medium.</p> <p>5.6. Factors affecting the rate of corrosion control- Modification of environment, Use of protective coatings- coating of less active metal like Tin (Tinning), coating of more active metal like Zinc (Galvanizing) Anodic and cathodic protection.</p>	<p>5a. Differentiate the salient features of the given electrolytic cell, electrochemical cell.</p> <p>5b. Distinguish the given primary and secondary electrolytic cells</p> <p>5c. Describe the process of electrolysis for the given electrolyte</p> <p>5d. Describe the process of electroplating for the given material</p> <p>5e. Describe the phenomenon of the given type of corrosion and its prevention</p> <p>5f. Identify the different factors affecting the rate of corrosion for the given type of material.</p> <p>Select the protective measures to prevent the corrosion in the given corrosive medium</p>	12	12
<p>Unit 6 Polymers, Lubricants and Adhesives.</p> <p>6.1. Polymer and monomer , Classification on the basis of Molecular structure , on the basis of monomer</p> <p>a) homopolymer -Synthesis ,properties and application of Polyethylene, PVC, Teflon</p> <p>b) copolymer/heteropolymer-Nylon-6, Nylon 6,6 on the basis of thermal behaviour -Thermoplastics and thermosetting.</p> <p>6.2. Types of polymerization reaction , Addition polymerization, Condensation polymerization</p> <p>6.3. Definition of lubricant, function of lubricant</p>	<p>6a. Differentiate the given type of structural polymers</p> <p>6b. Describe the polymerization process of the given polymer</p> <p>6c. State the properties and uses of the given polymers</p> <p>6d. Describe lubricants ,its function and classification</p> <p>6e. State the types of lubrication.</p> <p>6f. Describe the physical</p>	11	16

and classification 6.4. Definition of lubrication, types of lubrication. 6.5. Physical properties-viscosity, viscosity index, oiliness, flash and fire point, volatility, cloud and pour point. 6.6. Chemical properties-acid value, saponification value, emulsification. 6.7. Properties and names of lubricants used for various machines like delicate instruments, heavy load and low speed machine, gears, cutting tools, I.C engine, steam engine 6.8. Definition, characteristics of adhesives, classification of adhesives and its uses	and chemical properties of lubricants 6g. Explain selection of lubricants for various machines 6h. State the properties and uses of adhesives Describe the application of relevant adhesives		
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SUGGESTED SPECIFICATION TABLE WITH MARKS

Unit no	Unit title	Teching hours	Distribution of theory marks			
			R LEVEL	U LEVEL	A LEVEL	TOTAL
	PHYSICS					
I	Units and Measurements	9	3	5	4	12
II	Electricity, Magnetism and Semiconductors	14	5	5	6	16
III	Heat, Temperature and Gas laws	9	3	5	4	12
Total		32	11	15	14	40
	CHEMISTRY					
IV	Atomic structure & Chemical Bonding	9	5	4	3	12
V	Electro-chemistry and Corrosion, its prevention.	12	3	4	5	12
VI	Polymers, lubricants and adhesives	11	5	4	7	16
Total		32	13	12	15	40

Legends: R-Remembrance (Knowledge), U- Understanding, A- Application and above levels (Revised Bloom's taxonomy)

Note-This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

SUGGESTED PRACTICALS:

The practical in this section are psychomotor domain PrOs (i.e sub-components of the COs), to be developed and assessed in the student to lead to the attainment of the competency. **Any 10 practical of Physics & Chemistry should be conducted during the Term.**

Sr. No.	Unit No.	Practical Outcomes (PrOs)	Hrs.
Physics			
1	I	Measurement of (i) Length, Breadth and Height of a block ,(ii) Internal, External diameter and Height of a hollow cylinder, Using Vernier Callipers of different least counts.	2

2	I	Measurement of (i) Diameter of Sphere and Wire, (ii) Thickness of a plate by using Micrometer Screw Gauge.	2
3	I	Measurement of (i) Radii of concave and convex surfaces, (ii) Thickness of plate by using Spherometer.	2
4	II	Measurement of Specific resistance by voltmeter ammeter method.	2
5	II	Verification of Ohm's law	2
6	II	Measurement of Resistance in series.	2
7	II	Measurement of Resistance in parallel.	2
8	II	Magnetic lines of forces of Bar Magnet.	2
9	II	Study of PN junction diode forward and reverse bias	2
10	II	Study the effect of temperature on the resistance of – thermistor and copper coil.	2
11	II	Determination of co-efficient of thermal conductivity of a good conductor by Searle's method.	2
12	III	Verification of Boyle's law.	2
Total			20
Chemistry			
1	I	Prepare the solutions of different Concentrations.	2
2	I	Determine the Strength of given acid solution using standard base solution.	2
3	I	Determine the neutralization point of weak acid and weak base using conductivity meter.	2
4	I	Precipitation titration of BaCl_2 with H_2SO_4 using conductivity meter.	2
5	II	Determine electrochemical equivalent of Cu metal using Faraday's first law.	2
6	II	Determine equivalent weight of metal using Faraday's second law.	2
7	II	Determine the electrode potential of Copper metal.	2
8	II	Determine the voltage generated from chemical reaction using Daniel Cell.	2
9	III	To determine the viscosity of oil lubricant by using Ostwald's Viscometer.	2
10	III	Determine the Acid value of given oil.	2
11	III	Determine the effect of temperature on viscosity for given lubricating oil using Redwood viscometer-1	2
12	III	Determination of saponification value of an oil.	2
Total			20

STUDENT ACTIVITIES: Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

- 1) Prepare charts of vernier caliper, micrometer screw gauge, spherometer and travelling microscope.
- 2) Library survey regarding engineering material used in different industries.
- 3) Power point presentation or animation for showing different types of bonds or molecules.
- 4) Seminar on any relevant topic.

SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- i. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- ii. Not only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- iii. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the UOs/COs through classroom presentations (see implementation guideline for details).
- iv. Teachers need to ensure to create opportunities and provisions for co-curricular activities.

SUGGESTED LEARNING RESOURCES

A) BOOKS

Sr. no.	Author	Title	Publisher
1	J.V.Naralikar,A.W.Joshi	Physics Textbook XI (part1 &2)	National Council of Education Research and Training New Delhi
2	J.V.Naralikar,A.W.Joshi	Physics Textbook XII (part1 &2)	National Council of Education Research and Training New Delhi
3	D.Haliday& R. Resnick	Fundamentals of Physics	Jhon Wiley and Sons , USA
4	R.K.Gaur, S.L.Gupta	Engineering Physics	DhanpatRai and Sons Publications.
5	Jain P.C. & Jain Monika	Engineering Chemistry	DhanpatRai Publishing Company (P) Ltd., New Delhi.
6	S.S.Dara	Engineering Chemistry	S. ChandPublication
7	Bagotsky V S	Fundamental of electrochemistry	Wiley international NJ USA

B) Web site for references:

www.physicsclassroom.com
www.hyperphysics.com
www.physicsinfo.com <http://nptel.ac.in/course.php?disciplineId=115>
<http://nptel.ac.in/course.php?disciplineId=104>
<http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html>
www.physicsclassroom.com
www.physics.org
www.fearofphysics.com
www.sciencejoywagon.com/physicszone
www.science.howstuffworks.com
www.in.wikipedia.org
www.nptel.iitm.ac.in

C) Video

www.Youtube.com (elasticity, surface tension, viscosity, sound)

D) PPTwww.khanaacademy.comwww.slidehare.net**Mapping matrix of PO's and CO's:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ develop ment of solution s	PO4 Engineerin g Tools, Experiment ation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Manage ment	PO7 Lifelong learning
CO1	3	2	1	1	1	1	1
CO2	3	1	1	1	1	1	1
CO3	3	1	1	1	1	1	1
CO4	3	1	1	1	1	1	1
CO5	3	1	1	1	2	1	1
CO6	3	1	1	1	2	1	1

3: High 2: Moderate and 1:Low Relationship

DIPLOMA PROGRAMME: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING**COURSE : ENGLISH****COURSE CODE: R18SC1707****COURSE CATEGORY : FOUNDATION****CREDIT : 04****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
02	02	03	80	20	-	-	25	125

Rationale:

Competency in English enhances the employability of an engineering professional. In today's competitive world English is important for students in their academics as well as in their prospective career. The students, after passing Diploma from any discipline, need to use English as a medium of communication in various formal as well as informal situations. They need to be proficient in the four skills of language i.e. listening, speaking, reading and writing. This curriculum is need based and is designed to help the students to communicate in English effectively.

Course Outcomes:

1. Formulate grammatically correct sentences.
2. Use relevant words as per context.
3. Comprehend given passages and dialogues.
4. Prepare speeches in given formal situations.
5. Distinguish between various types of communication
6. Communicate effectively by avoiding barriers in various formal and informal situations

Course Details:

NAME OF THE TOPIC	LEARNING OUTCOME	HRS	MKS
Unit1 Applied Grammar 1.1. Parts of Speech [Noun, Pronoun, Verb, Adverb, Adjective, Preposition, Conjunction, Interjection] 1.2. Tenses 1.3. Articles 1.4. Punctuation 1.5. Direct-indirect speech 1.6. Active and Passive voice	1a. List the various Parts of Speech 1b. Define different Parts of Speech 1c. Identify the part of speech of the given word 1d. Use appropriate prepositions to construct meaningful sentences. 1e. Use appropriate conjunctions to connect phrases and clauses in the given sentences. 1f. Use correct form of tenses in given situation. 1g. Use relevant articles in constructing sentences. 1h. Punctuate the given sentences by using correct punctuation marks. 1i. Change the narration for the given situation. 1j. Change the voice of a given sentence	08	12
Unit2 Vocabulary Building 2.1 Synonyms and Antonyms. 2.2 Spellings	2a. Use synonyms and antonyms correctly. 2b. Correct the spelling errors in given sentences. 2c. Select appropriate word for the given	08	16

2.3 Words often confused 2.4 One word substitution 2.5 Engineering vocabulary	context. 2d. Substitute given phrase/ sentence by one meaningful word. 2e. Apply the engineering vocabulary in the new /given context		
Unit3 Reading Comprehension 3.1 Comprehension based on dialogues 3.2 Comprehension based on unseen passage	3a. Answer the questions on a given unseen passage/ dialogue. 3b. Answer the questions orally on the given unseen passage with correct pronunciation	04	12
Unit4 Public Speaking 4.1 Importance of public speaking 4.2 Characteristics of a good speech 4.3 Vote of thanks 4.4 Farewell speech 4.5 Introducing a guest	4a. State importance of public speaking 4b. State features of a good formal speech 4c. State characteristics of a good vote of thanks speech 4d. Write a vote of thanks speech for the given situation. 4e. State characteristics of a good farewell speech 4f. Write a farewell speech for the given situation. 4g. State characteristics of a good speech for introducing a guest 4h. Write a speech for introducing a guest in the given situation. 4i. Deliver a speech on a given situation	04	12
Unit5 Basics of Communication 5.1 Definition 5.2 Need and importance of communication 5.3 Communication cycle and elements 5.4 Encoding and decoding 5.5 Types of communication 5.6 Verbal and non-verbal 5.7 Oral and written 5.8 Formal and informal 5.9 Difference between verbal and non-verbal, oral and written, formal and informal communication 5.10 Merits and demerits of oral and written communication	5a. Define communication 5b. State the importance of communication in business 5c. Enlist elements of communication 5d. Explain the various elements of communication. 5e. Identify the different communication elements in a given situation 5f. Draw a neat sketch of communication cycle for a given situation 5g. Explain encoding and decoding 5h. List types of communication 5i. Define verbal, non-verbal, oral, written, formal, informal communication 5j. Identify the type of communication in a given situation 5k. Distinguish between various types of communication 5l. State merits and demerits of oral and written communication 5m. Communicate effectively in a given formal and informal situation.	04	12
Unit6 Effective Communication 6.1 Barriers in communication. • Mechanical • Physical • Psychological [Prejudice, status block,	6a. Define “barrier in communication” 6b. List types of barriers in communication 6c. Explain mechanical, physical, psychological, linguistic, and cultural barriers with suitable examples 6d. Identify the communication barriers in a given situation	04	16

negative emotions like fear, ego, low confidence] • Linguistic • Cultural 6.2 Overcoming barriers 6.3 Principles of communication • Clarity • Conciseness • Correctness • Completeness • Feedback • Informality • Media selection • Flexibility	6e. Suggest remedies to overcome the given barriers. 6f. List principles of effective communication 6g. Describe the various principles of communication with suitable examples. 6h. Apply the various principles in oral and written communication		
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SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Applied Grammar	08	03	03	06	12
2	Vocabulary Building	08	04	04	08	16
3	Reading Comprehension	04	02	08	02	12
4	Public Speaking	04	02	02	08	12
5	Basics of Communication	04	04	04	04	12
6	Effective Communication	04	04	04	08	16
	Total	32	19	25	36	80

SUGGESTED EXERCISES/PRACTICALS

S. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs.
1	V	Pronounce basic English words correctly.	02
2	V	Meet and greet people formally.	02
3	V	Talk about your family.	02
4	VI	Give directions about places in town.	02
5	VI	Describe your neighbourhood and region.	02
6	III	Answer the questions orally on the given unseen	02
7	IV	Deliver any one of the following speeches: Vote of	02
8	I	Rewrite the given sentences using correct articles.	02
9	I	Change the narration of given sentences from direct to	02
10	II	Solve the exercise based on vocabulary.	02
Total			20

SUGGESTED STUDENT ACTIVITIES

5. Group reading: Read one news item from a standard English newspaper or magazine. Form a group of 4-5 students. Discuss the news from various angles (contents, grammar, and vocabulary) with your group.
6. Conduct quiz on spellings in small groups.

SPECIAL INSTRUCTIONAL STRATEGIES

1. Show video/animation, film to improve language skills
2. Use flash cards to demonstrate how to use flash cards to improve vocabulary.

SUGGESTED LEARNING RESOURCES**Books**

Sr. No.	Title of Book	Author	Publication (with year)
1	Applied Grammar and Composition	M.P. Bhatia	M.I. Publications (Eighth Revised Edition), Agra.
2	Advanced English Grammar and Composition	Alok Pandey and Deepak Pandey	Sahni Publication, Delhi-7.
3	Intermediate English Grammar	Raymond Murphy	Cambridge University Press, (Second Edition), New Delhi.
4	Essential English Grammar	Raymond Murphy	Cambridge University Press, New Delhi, ISBN: 9780-0-521-67580-9
5	Effective English with CD	Kumar, E. Suresh; Sreehari,P.; Savithri, J.	Pearson Education, Noida, New Delhi, 2009 ISBN: 978-81-317-3100-0
6	English Grammar at Glance	Gnanamurali, M.	S. Chand and Co. New Delhi, 2011 ISBN:9788121929042
7	Living English Structure	Allen, W.S.	Pearson Education, New Delhi, Fifth edition, 2009, ISBN:108131728498,99
8	English Reading Comprehension	R. Gupta	Ramesh Publishing House, New Delhi
9	The Art of Public Speaking	Dale Carnegie	Ocean Paperbacks
10	Essential Communication Skills	Shalini Aggarwal	Ane Books Pvt Ltd
11	A Course in Communication Skills	Dutt, Rajeevan, Prakash	Foundation Books
12	Word Power Made Easy	Norman Lewis	Pocket Books / Goyal Publishers & Distributors
13	Words Often Confused	Dr. B. R. Kishore	New Light Publishers
14	Perfect Your Spelling Power	Raymond Hill	Maanu Graphics Publishers

C) Major Equipment/ Instrument with Broad Specifications

Lingua phone language laboratory software

D) Software/Learning

- a. <https://english.wifi-study.com/>
- b. <https://www.britishcouncil.in/english/learn-online>
- c. <http://learnenglish.britishcouncil.org/en/content>

Websites

- d. <http://www.talkenglish.com/>
- e. www.languagelearning.com
- f. www.wordsworthel.com
- g. www.learn4good.com
- h. www.fluentzy.com
- i. www.edufind.com
- j. www.khake.com
- k. www.learnenglish.org.uk
- l. www.english4engineer.com
- m. www.owl.english.purdue.edu

Mapping matrix of PO's and CO's: (with justification of each cell)

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ developm ent of solutions	PO4 Engineerin g Tools, Experimen tation and testing	PO5 Engineerin g practices for society, sustainabili ty & environme nt	PO6 Project Managem ent	PO7 Lifelong learning
CO1	2	--	--	--	--	2	2
CO2	2	--	--	--	--	2	2
CO3	2	--	--	--	--	2	2
CO4	2	--	--	--	--	2	2
CO5	2	--	--	--	--	2	2
CO6	2	--	--	--	--	2	2

3: High 2: Moderate and 1: Low Relationship

DIPLOMA PROGRAMME: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING**COURSE: BUSINESS COMMUNICATION****COURSE CODE: R18SC1708****COURSE CATEGORY: FOUNDATION****CREDIT: 03****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
01	02	-	-	-	-	@25	25	50

@ = Internal Oral Examination

Rationale:

Communication is life blood of any business. To be able to communicate effectively is considered one of the foremost employability skills. Fluency and correct pronunciation makes a world of difference in any business situation like meetings, conferences, seminars, presentations etc. Along with that, a business professional has to be proficient in written communication. Hence in this curriculum, speaking and writing skills are emphasized to help the students in interviews, presentations, and other oral as well as written communication situations.

Course Outcomes:

1. Give presentation using ICT.
2. Face a mock interview.
3. Write business letters for given formal situations
4. Draft notice, memorandum, and circular in given formal situations.
5. Draft reports on given formal situations.

Course Details:

NAME OF THE TOPIC	LEARNING OUTCOME	HRS
Unit1 Presentation Skills 1.1 Need and importance 1.2 Effective presentation – guidelines for effective presentation 1.3 Use of positive Body language for effective presentation 1.4 Guidelines to prepare an effective Power Point Presentation	1a. Use different types of verbal and non-verbal communication during a presentation.	02
Unit2 Interview Techniques 2.1 Preparation stage: Preparing for an interview, pre-interview research. 2.2 Factors affecting performance during the interview: stress, self-awareness, presence of mind. 2.3 Post-interview follow-up	2a. Face a mock interview using appropriate communication skills	02
Unit3 Business Correspondence-Part-I 3.1 Letter of Enquiry 3.2 Letter of Order 3.3 Letter of Complaint	3a. Draft formal business letters in given situations	04

Unit4 Business Correspondence-Part II 4.1 Letter of Job Application 4.2 Letter of Resignation 4.3 Joining letter 4.4 Leave application	4a. Draft formal letters related to employment in given situations.	04
Unit5 Office Drafting 5.1 Notice 5.2 Circular 5.3 Memo 5.4 Email writing	5a. Draft notice, memo, circular in given situations	02
Unit6 Report Writing 6.1 Visit report 6.2 Accident report 6.3 Progress report	6a. Draft Visit, accident, and progress report in given situations	02

SUGGESTED EXERCISES/PRACTICALS

Sl. No.	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. Required
1	II	Face a mock Interview	04
2	I	Talk about different jobs and types of work	02
3	I	Talk about your hobbies and enquire about those of other people	02
4	I	Enquire about people's programmes, plans and booking facilities	02
5	IV	Draft a letter of Job Application with resume	02
6	III	Draft a request letter for everyday institute activities	02
7	V	Draft a Circular/ Notice on a given situation	02
8	VI	Email a Visit Report/ Accident Report to given email addresses	02
9	I	Preparation of PPT /report on micro-project	04
10	I	Presentations on micro-project using ICT	06
Total			28

SUGGESTED STUDENT ACTIVITIES :

1. Summarize the contents of a famous book/books.[fiction/nonfiction]
2. Write a report on various formal events in your college.
3. Identify a good business leader, study his presentations and prepare a report on it.

SPECIAL INSTRUCTIONAL STRATEGIES :

1. Show video/animation, film to improve business communication

SUGGESTED LEARNING RESOURCES : Books :

Sr. No.	Title of Book	Author	Publication
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1	Communication Skills	MSBTE	MSBTE, Mumbai
2	Effective Communication Skills	M Ashraf Rizvi	Tata McGraw-Hill
3	Communication Skills	Sanjay Kumar and PushpLata	Oxford University Press
4	Personality Development and Soft Skills	Barun K. Mitra	Oxford University Press
5	Kumar's Group Discussions and Interviews	Dr. B. R. Kishore , D. S. Paul	Vee Kumar Publications Private Limited, New Delhi-110008.
6	PowerPoint Presentations that Sell	Adam B. Cooper	McGraw Hill Professionals.
7	Business Communication	R. C. Bhatia	Ane Books India, New Delhi.
8	Developing Communication Skills	Krishna Mohan, Meera Banerji	Macmillan India Ltd., New Delhi.

Major Equipment/ Instrument with Broad Specifications :

Linguaphone language laboratory software

Software/Learning Websites:

- British council – [LearnEnglish website](http://learnenglish.britishcouncil.org/en/) – <http://learnenglish.britishcouncil.org/en/>
- British council – [LearnEnglish website](http://learnenglish.britishcouncil.org/en/study-break) – fun and games – <http://learnenglish.britishcouncil.org/en/study-break>
- British council – [LearnEnglish website](http://learnenglish.britishcouncil.org/en/business-and-work) – business and work – <http://learnenglish.britishcouncil.org/en/business-and-work>
- <http://www.talkenglish.com>
- www.wordsworthelt.com
- www.notesdesk.com
- n. <http://totalcommunicator.com/>
- o. www.speaking-tips.com
- p. www.skillstudio.co.uk
- q. www.mindtools.com
- r. www.storynory.com

Mapping matrix of PO's and CO's: (with justification of each cell)

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ developme nt of solutions	PO4 Engineering Tools, Experimenta tion and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Manage ment	PO7 Lifelong learning
CO1	--	--	--	--	--	2	2
CO2	--	--	--	--	--	2	2
CO3	--	--	--	--	--	2	2
CO4	--	--	--	--	--	2	2
CO5	--	--	--	--	--	2	2

H3: High 2: Moderate and 1: Low Relationship

DIPLOMA PROGRAMME: CIVIL/MECH./ELECT./COMP./E&TC. ENGINEERING**Course: Applied Science****Course Code: R18SC1709****Course Category: Foundation****Credits: 08****TEACHING AND EXAMINATION SCHEME:**

Teaching Scheme			EXAMINATION SCHEME						
	TH	PR	ONLINE EXAM HRS	TH	TEST	PR	OR	*TW	TOTAL
A. Physics	2	2	1	40	10	-	-	25	75
A. Chemistry	2	2	1	40	10	-	-	25	75

TW includes 10 marks for Science Micro Project.*RATIONALE:**

Diploma engineers have to deal with various materials, methods and machines. Adequate knowledge of basic principle of Physics and Chemistry will help the students to understand the concepts better in any field of engineering. The course will develop analytical capabilities of students so that they can characterize transform and use material in engineering and apply knowledge gained in solving related engineering problems. It will develop the habit of scientific reasoning in students so that they can work with open and enquiring mind. They must learn and apply the concepts and principles of science like Metals, Alloys, Insulators, Cells, Batteries, Water, Electricity, Magnetism and LASERS.

COURSE OUTCOMES (COs) :

The theory, practical experiences and relevant soft skills associated with this course are to be taught and implemented, so that the student demonstrates the following industry oriented COs associated with the above mentioned competency:

1. Select appropriate Capacitors and Resistance in circuits.
2. Apply the principle of Electricity and magnetism for use of various measuring instruments.
3. Use equipments based on principle of LASER and Optical fibre in industrial application .
4. Use appropriate Water Treatment process to solve water related problems.
5. Select appropriate Batteries for different applications.
6. Select and use appropriate Metals, Alloys and Insulating materials in various applications.

COURSE DETAILS :

The following topics should be taught and assessed in order to develop UO's in cognitive domain for achieving the CO's

Unit	Unit Outcomes (UOs)	Topics and Subtopics	Hrs	Mks
1 Current Electricity, Capacitors and Capacitance	1a. Calculate the EMF of the given cell using potentiometer. 1b. Calculate the voltage across various components of electric circuit. 1c. Calculate the value of the given resistance by Meter Bridge using the principle of Wheatstone's bridge. 1d. Explain working of a capacitor. 1e. Calculate the equivalent capacity and energy stored in the combination of capacitors	1.1 Concept of EMF of cell, internal resistance of cell, difference between EMF and potential difference, Kirchhoff's laws. 1.2 Wheatstone's bridge, balancing condition of Wheatstone's bridge, Meter bridge, 1.3 Potentiometer, principle of potentiometer, potential gradient, balancing condition of potentiometer, measurement of EMF by potentiometer, Numerical. 1.4 Capacitance and capacitor, unit of capacitance, parallel plate capacitor, effect of dielectric on capacitance, combination of capacitors in series and parallel and energy stored in a capacitor, Numerical.	9	12
2 Magnetic effect of electric current	2a. Describe the concept of magnetic intensity and flux with relevant units. 2b. Explain magnetic effect of current carrying conductor. 2c. Describe the conversion of Galvanometer into Ammeter. 2d. Describe the conversion of Galvanometer into Voltmeter.	2.1 Magnetic effect of electric current, lines of induction due to a straight conductor, right-hand thumb rule, magnetic induction (direction and magnitude), concept of uniform magnetic field. 2.2 Force of a magnetic field on current carrying conductor, Fleming's left-hand rule, couple acting on a rectangular coil placed in the uniform magnetic field, Numerical. 2.3 Principle, construction and working of moving coil galvanometer. 2.4 Conversion of galvanometer into ammeter and expression for shunt resistance. Conversion of galvanometer into voltmeter and expression for series resistance, Numerical.	14	16
3 Lasers and Fiber Optics	3a. Describe the construction and working of three energy level laser system. 3b. Describe the phenomena of total internal reflection for the given mediums. 3c. Describe light propagation in the given type of optical fiber.	3.1 Excitation of particle, optical pumping, types of transitions – non radiative and radiative. 3.2 Spontaneous and stimulated emission, population inversion, resonance cavity, active system, 3.3 Types of lasers, Ruby laser, Helium–Neon laser, and comparison between ruby and He–Ne lasers, Uses of lasers. 3.2 Reflection, refraction, laws of refraction, Total Internal Reflection (TIR). Principle, types, properties and applications of optical fibers.	9	12

4 Water Treatme nt and Analysi s	4a. Define hardness of Water 4b. Calculate the hardness of water for the given data 4c. Describe the effects of hard water in boilers 4d. Explain the given type of water softening process 4e. Describe the purification of municipal water for the given process 4f. Describe the reverse osmosis for the given type of water 4g. Describe the process of desalination of water 4h. State the concept of pH and pOH numerical related with it. 4i. Applications of pH in engineering.	4.1. Hardness-types, EDTA method, degree of hardness of the water in terms of equivalent amount of CaCO_3 , Numericals based on degree of hardness 4.2. Effect of hard water in boilers and prevention: Boiler corrosion, Caustic embrittlement, priming and foaming, scales and sludges 4.3. Water softening: zeolite process, ion exchange process (cation exchange and anion exchange) 4.4. Municipal water treatment - Sedimentation, Coagulation, Filtration and Sterilization 4.5. Waste water- Characteristics, Dissolved oxygen, BOD and COD, Sewage treatment, recycling of waste water 4.6. De-salination of brackish water process by a) reverse osmosis b) Electrodialysis 4.7. Definition of pH and pOH, pH scale, Numerical problem on pH and pOH and Industrial applications	12	16
5 Electro- chemistr y and batteries	5a. Differentiate the electrical conductance in metals and electrolytes 5b. Identify factors affecting conductivity of the given solution 5c. Describe construction of given electrodes 5d. Describe the process of calculation of the strength of acid and base 5e. Calculate specific and equivalent conductance of given electrolyte 5f. Describe construction and working of given type of battery. 5g. Describe the construction, working of electrochemical sensors 5h. Describe the classification of conducting polymers.	5.1. Electrical conductance in metals and electrolytes, specific conductance, equivalent conductance, cell constant 5.2. Electrodes-Hydrogen electrode, Calomel electrodes and glass electrodes 5.3. Batteries – Dry cell, alkaline battery, Lead acid storage cell and Ni-Cd battery, $\text{H}_2\text{-O}_2$ fuel cell, Lithium ion battery and Invertors. 5.4. Electrochemical sensors-definition, working, principle, advantages and applications 5.5. Conducting polymers – Definition and categories or classification	10	12
6 Metals, alloys and insulato rs	6a. Describe the properties of the given metal. 6b. Select relevant thermocouple alloy for given application 6c. Describe the properties and uses of the given insulator. 6d. Select relevant insulator for given system. 6e. Describe the techniques of unit operations.	6.1. Properties of metals like Copper, Aluminium, Tungsten, Platinum and Nickel 6.2. Thermocouple alloy- Composition and characteristics of nickel alloy, Platinum/Rhodium, Tungsten/Rhenium, Chromel – gold/Iron a. Electrical insulators – Classification- a) Solid ceramics porcelain, Mica,	10	12

		asbestors , Urea –Formaldehyde resin, Bakelite and glass 6.3.Liquid -silicon fluid ,Gaseous- inert Gases , Hydrogen and nitrogen gas 6.4.Types of rubber- natural and synthetic, Processing of natural rubber. a. Synthetic Rubber- Properties and application of Buna-N, Thiokol, Neoprene.		
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SUGGESTED PRACTICALS :

*The practicals in this section are psychomotor domain PrOs (i.e sub-components of the COs), to be developed and assessed in the student to lead to the attainment of the competency **Any 10 practical of Physics and Chemistry should be conducted during the Term.***

Sr. No.	Practical Outcomes (PrOs)	Unit No.	Hours.
PHYSICS			
1	Verification of law of condensers in series.	I	2
2	Verification of law of condensers in parallel.	I	2
3	Measurement of EMF of cell by potentiometer.	I	2
4	Comparison of EMF of two cells by single cell method using potentiometer	I	2
5	Comparison of EMF of two cells by sum and difference method using potentiometer.	I	2
6	Measurement of internal resistance of a cell using potentiometer.	I	2
7	Measurement of unknown resistance using meter bridge.	I	2
8	Conversion of Galvanometer to Ammeter.	II	2
9	Conversion of Galvanometer to Voltmeter.	II	2
10	Use of magnetic compass to determine neutral point.	II	2
11	Measurement of divergence of light beam by laser.	III	2
12	Study the phenomenon of Total Internal Reflection and determine critical angle of incidence.	III	2
CHEMISTRY			
1	Determine the Alkalinity of water sample.	I	2
2	Determine Chloride content in the given water sample by Mohr's method.	I	2
3	Determine the Total Hardness (Temporary Hardness and Permanent Hardness) of water sample by EDTA method.	I	2
4	Determine the Dissolved Oxygen present in the water sample by using Winkler's method.	I	2
5	Determine the pH value of given solution using pH meter.	II	2
6	Find the Cell constant of the conductivity cell.	II	2
7	Determine Specific Conductance and Equivalence Conductance of given salt sample solution.	II	2

8	a)Prepare buffers and standardization of pH meter (pH 4 to 9) b)Determine the molarity of HCl pH-metrically ,provided M/10 NaOH	II	2
9	Prepare Urea Formaldehyde resin.	III	2
10	Determine percentage of Copper from the brass.	III	2
11	Determine Phosphate in a given water sample by using Spectrophotometer.	I	2
12	Estimation of Calcium in Cement sample.	I	2

SUGGESTED SPECIFICATION TABLE WITH MARKS :

UNIT NO	UNIT TITLE	Teaching Hours	DISTRIBUTION OF THEORY MARKS			
			R LEVEL	U LEVEL	A LEVEL	TOTAL MARKS
	PHYSICS					
I	Current Electricity, Capacitors& Capacitance	9	3	5	4	12
II	Magnetic effect of electric current	14	5	5	6	16
III	Lasers and Fiber Optics	9	3	5	4	12
Total		32	11	15	14	40
	CHEMISTRY					
1	Water Treatment and analysis	12	4	6	6	16
2	Electrochemistry and batteries	10	3	4	5	12
3	Metals, alloys and Insulators	10	3	4	5	12
Total		32	10	14	16	40

Legends: R-Remembrance (Knowledge), U- Understanding, A- Application and above levels (Revised Bloom's taxonomy)

Note-This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from the above table.

SUGGESTED STUDENT ACTIVITIES:

Other than the classroom and laboratory learning, following are the suggested student-related co-curricular activities which can be undertaken to accelerate the attainment of the various outcomes in this course:

1. Market survey of different resins and compare the following points.
 - i. Structure
 - ii. Properties
 - iii. Applications.
2. Library survey regarding engineering material used in different industries.
3. Seminar on any relevant topic.

SUGGESTED SPECIAL INSTRUCTIONAL STRATEGIES:

These are sample strategies, which the teacher can use to accelerate the attainment of the various outcomes in this course:

- i. Massive open online courses (MOOCs) may be used to teach various topics/sub topics.
- ii. Not only the traditional lecture method, but different types of teaching methods and media that are to be employed to develop the outcomes.
- iii. About 15-20% of the topics/sub-topics which is relatively simpler or descriptive in nature is to be given to the students for self-directed learning and assess the development of the LOs/COs through classroom presentations (see implementation guideline for details).
- iv. Teachers need to ensure to create opportunities and provisions for co-curricular activities.
- v. Guide student(s) in undertaking micro-projects.

SUGGESTED MICRO-PROJECTS:

Only one micro-project is planned to be undertaken by a student that needs to be assigned to him/her in the beginning of the semester. She/he ought to submit it by the end of the semester to develop the industry oriented COs.

Each micro-project should encompass two or more COs which are in fact, an integration of practicals, cognitive domain and affective domain LOs. The micro-project could be industry application based, internet-based, workshop-based, laboratory based or field-based

- i) **Optical Fiber and TIR:** Prepare models by using water and diode laser to demonstrate total internal reflection and the working of optical fiber.
- ii) **Battery and Cell:** Collect wastage material from lab and household and prepare working model of cell.
- iii) **Adhesives:** Prepare model to demonstrate the applications of various adhesives.
- iv) **Polymer:** Collect the samples of different polymers and list their uses.
- v) **Series and parallel resistances:** Prepare models for combination of series and parallel resistances using bulbs/ LED.
- vi) **Systems and units:** Prepare chart on comparison of systems of units for different physical quantities.
- vii) **Magnetic flux:** Prepare models to demonstrate magnetic lines of lines of forces of different types of magnets.
- viii) **Types of bonds:** Prepare chart and models displaying different types of bonds with examples.
- ix) **Ionization:** Prepare chart displaying ionization phenomenon.
- x) **Properties of Laser:** Use Key chain laser to differentiate laser with ordinary light.
- xi) **Water analysis:** Collect water samples from different water sources and find the characteristics like acidity, conductivity, dissolved solids, suspended particles.
- xii) **Water treatment:** Collect 3 to 5 water samples to find the dosage of bleaching powder required for its sterilization.
- xiii) **Water analysis:** Prepare model to find the soap foaming capacity of bore water on addition of soda ash.
- xiv) **Fuels:** Prepare chart showing different types of liquid fuels showing their calorific values and uses.
- xv) **Cement:** Collect different samples of cement and find their initial and final setting time.
- xvi) **Refractory materials:** Prepare chart showing properties of refractory materials.
- xvii) **Metal properties:** Prepare chart showing different industrial application of metal and relate it with required property or properties using internet.
- xviii) **Alloy steel:** Find the effect of alloying elements like Mn, Cr, Ni, W, V, Co on properties of steel. Prepare chart of showing percentage composition, properties and industrial applications of different types of steel based on above alloying elements using internet.
- xix) **Capacitors:** Prepare the models of various types of capacitors.
- xx) **Current electricity:** Make one circuit with bulbs/ LED/ connected in parallel or series.
- xxi) **LASER:** Prepare the presentation on the industrial application of LASER.
- xxii) **Water analysis:** Collect water samples from different water sources and determined the acidity, conductivity, dissolved solids, suspended particles in the sample.
- xxiii) **Water treatment:** Collect 3 to 5 water samples from borewell and determined the dosage of bleaching powder required for its sterilization.

- xxiv) Water analysis:** Determine the soap foaming capacity of bore water on addition of soda ash.
- xxv) Energy sources:** Prepare chart showing different types of energy sources with their advantages.
- xxvi) Electrolytic Cells:** Collect fruit and vegetable and prepare working model of cell.
- xxvii) Electric Insulators:** Collect the samples of different insulators and list their industrial applications.
- xxviii) Thermocouple:** Prepare chart showing different types of thermocouples with their characteristics used in electronic and electrical industry.

SUGGESTED LEARNING RESOURCES:

A. BOOKS :

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	R.K.Gaur, S.L.Gupta	Engineering Physics	DhanpatRai and Sons Publications.
2	Prof.M.P.Kurian Prof.R.B.Birhade Prof.A.A.Mokashi	Applied Physics	Reliable Publications.
3	Dr.A.P.Saxena& Others	Principles of Physics	J.K.Jain Brothers TTTI, Bhopal.
4	Kamat&Rao	Applied Physics	Jeevan Deep Prakashan.
5	Mrs.V.C.Chinchwadkar	Text Book in Physics	Somaiya Publications, Bombay.
6	Umrani, Joshi,	Applied Physics	NiraliPrakashan.
7	Jain P.C. & Jain Monika	Engineering Chemistry	DhanpatRai Publishing Company (P) Ltd., New Delhi.
8	VedPrakash Mehta	Polytechnic Chemistry	Jain brothers, New Delhi.
9	C. V. Agarwal	Chemistry of Engineering Materials	Tara Publications Waranasi
10	B.K. Sharma	Industrial chemistry	Goel Publication
11	S.S.Dara	Engineering Chemistry	S. ChandPublication

B. Web site for references:

www.physicsclassroom.com

www.hyperphysics.com

www.physicsinfo.com <http://nptel.ac.in/course.php?disciplineId=115>

<http://nptel.ac.in/course.php?disciplineId=104>

<http://hyperphysics.phy-astr.gsu.edu/hbase/hph.html>

www.physicsclassroom.com

www.physics.org

www.fearofphysics.com

www.sciencejoywagon.com/physicszone

www.science.howstuffworks.com

C. Video

www.Youtube.com (surface tension, viscosity, sound)

D. PPTwww.khanaacademy.comwww.slidehare.net**PO-COMPETENCY-CO MAPPING:**

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ develop ment of solutions	PO4 Engineerin g Tools, Experiment ation and testing	PO5 Engineering practices for society, sustainabilit y & environment	PO6 Project Manage ment	PO7 Lifelong learning
CO1	3	1	1	1	1	2	1
CO2	3	1	1	1	1	2	1
CO3	3	1	1	1	1	2	1
CO4	3	1	1	1	2	2	1
CO5	3	1	1	1	1	2	1
CO6	3	1	1	1	1	2	1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE: ENGINEERING GRAPHIC SKILLS****COURSE CODE: R18ME1202****COURSE CATEGORY: FOUNDATION****CREDIT:06****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
2	4	-	-	-	-	-	50	50

Rationale:

Drawing which is known as the language of engineers is widely used means of communication among the designers, engineers, technicians & craftsmen in an industry. The translation of ideas into practice without the use of this graphic language is really beyond imagination. Thus for the effective & efficient communication among all those involved in an industrial system, it becomes necessary for a diploma engineer to acquire the appropriate skills in the use of graphic language. This preliminary course aims at building a foundation for the further courses in drawing and other allied subjects.

Course Outcomes:

1. Use of various drawing instruments.
2. Redraw the given figures using geometrical construction.
3. Draw engineering curves with different methods.
4. Draw orthographic and sectional views of the given object.
5. Construct an isometric view from the given views.

Course Details:

UNIT	NAME OF THE TOPIC (with Details)	LEARNING OUTCOME	HRS
UNIT NO.1 Geometrical construction & tangent exercises	1.1 Use of instruments, types of lines, types of letterings, full, enlarging and reducing scales, dimensioning technique. 1.2 Geometrical constructions: - To construct a regular polygon of given side. - To construct a regular polygon in a given circle. - To inscribe a circle in a given polygon. - To circumscribe a circle around a given polygon. - To draw circles touching each other and sides of a given polygon internally & externally.	1. Explain elements of engineering graphics. 2. Draw various types of geometrical constructions in Engineering Graphics.	10

	1.3 Tangent exercises :- - To bisect a given straight line/ arc /angle. - To divide a given straight line into given number of equal parts. - To draw a normal to a given straight line/ arc from a given point within or outside it. -To draw a straight line parallel to a given straight line /arc through point/at a given distance. -To draw an arc touching to two straight lines / two arcs (internally/externally)/ one line & one arc. - To draw an internal/ external tangent to two given arcs apart from each other.	3. Draw various types of tangent exercises in Engineering Graphics.	
UNIT NO.2 Redraw Figures & Engineering Curves	2.1 Redraw figures: - To redraw the given figures (using the knowledge of Geometrical constructions & tangent exercises). 2.2 Constructions of curves: To study the construction of following curves using the method mentioned against them Ellipse -Directrix focus method, arcs of circle method & concentric circles method. Parabola -Directrix focus method, rectangle method. Involutes - of a polygon, circle & combination of polygon & circle.	1. Redraw figures by using geometrical constructions & tangent exercise. 2. Draw Conic curves, & know their applications. 3. Draw helix, involute,	06
UNIT NO.3 Orthographic Projections	3.1 Conversion of given pictorial views into orthographic projections using First angle and third angle method of projections. Dimensioning the Views.	1. Visualize, interpret & draw orthographic views from given pictorial view.	04
UNIT NO.4 Sectional Views	4.1 Conversion of given pictorial views into sectional (full sectional) orthographic projections using first angle & third angle method of projections. Dimensioning the views.	1. Visualize, interpret & draw sectional views from given pictorial view.	04
UNIT NO.5 Isometric projection & Views	5.1 Construction & use of isometric scale. Conversion of given orthographic views into isometric projections/views (objects including curves, slots on sloping planes).	1. Differentiate natural scale and isometric scale. 2. Visualize, interpret & draw isometric view and isom. projection.	06
UNIT NO.6	6.1 The ends and thread profiles, Conventional representation of threads, Types of nuts, bolts, washers, set screws. Types of rivet heads and riveted joints. 6.2 Types of sections full, half, revolved, removed offset. 6.3 Conventional breaks for circle and rectangular sections.		02

TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

SUGGESTED EXERCISES/PRACTICALS:

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	1	Geometrical construction, tangent exercises & redraw figure.	8
2.	2	Engineering curves.	8
3.	3	Orthographic projection	14
4.	4	Sectional views	14
5.	5	Isometric projections and views :	10
6.	6	Freehand sketches	10
Total			64

MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr.No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1	Mini drafter	All
2	Solid models	3,4

**SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:
Not Required****SPECIAL INSTRUCTIONAL STRATEGIES (if any)**

- Show video/animation film to demonstrate the working principles, constructional features, testing and maintenance of different types of electronic and magnetic instruments.
- Arrange a visit to nearby small scale manufacturing unit and make a report of tools and equipments used.
- Use Flash/Animations to explain the working of different instruments.
- Give Mini projects to students.

SUGGESTED LEARNING RESOURCES**REFERENCE BOOKS:**

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	N.D. Bhatt	Engineering Drawing	Charotar Publication, Anand.
2.	Mali and Chaudhary	Engineering Drawing	Vrinda Publications, Jalgaon.
3.	Kamat & Rao	Engineering Drawing	Jeevandeep Publicatons, Mumbai
4.	N.Y. Prabhu	Geometrical Engineering Drawing	Pune Vidyarthi Griha, Publications, Pune.
5.	Ozarkar & Utturkar	Engineering Drawing	Maharashtra Publishing House
6.	K. Venugopal	Engineering Drawing	New Age International Ltd., Delhi.
7.	SP 46-1988	Code of practice for general engineering drawing	Bureau of Indian Standards.(BIS)

MAPPING MATRIX OF PO'S AND CO'S:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Lifelong learning
CO1	1	2	--	--	1	--	3
CO2	1	--	--	--	1	--	1
CO3	1	--	--	--	1	--	1
CO4	1	2	2	--	1	--	3
CO5	1	3	2	--	1	--	3

3: High 2: Moderate and 1:Low Relationship

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course: Basics of Computer (Electrical)****Course code: R18EE1301****Course Category: Foundation****Credits: 05****Teaching and Examination scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
1	4	-	-	-	25@	-	25	50

Rationale: Computers are becoming mandatory in day-to-day life to a large extent. This foundation course is aimed at making student familiar with computer hardware, operating system, preparation of a document through MS Word, creating tables using MS Excel and preparing presentations using MS Power Point, Electrical drawings using AUTOCAD and make simple programs in C language.

Course Outcomes: The students will be able to -

1. Identified different hardware components.
2. Create document, table, and presentation using MS-OFFICE software.
3. Use various tool bars of AutoCAD and draw the electrical drawings.
4. Do the simple programming in C language.

Course details:

Unit No.	Unit Learning outcome	Course Content	Hrs
1. Computer Fundamentals	1. Identify different hardware components used in computer. 2. Discriminate between various networks used to connect no. of computers 3. Familiar with software' used in computers	1.1 Introduction: Introduction to computer and applications: Representation of data in computers - bit, byte, and ASCII, binary system, conversion of decimal to binary, memory size in terms of bytes, kilo bytes, giga bytes & tera bytes. 1.2 Computer network: LAN, MAN, WAN, Firewall, intranet, extranet, Internet, Topology (star, bus, ring) Components of computer. 1.3 Hardware: Processors, Memory (RAM, ROM, PROM, EPROM, EEPROM), Input devices (Voice recognition system, scanner), Output devices, Storage devices. 1.4:Software: System software like Operating systems, assembler, compiler, application software like MS-Office, AutoCAD, Introduction to programming language (C, C++)	2

2. MS Office	<ol style="list-style-type: none"> 1. Make word documents using commands in Ms Word. 2. Make Excel sheet and do the simple calculations and prepare graphs using Ms Excel. 3. Make professional presentations with animations and pictures using Ms Power point. 	<p>2.1 MS-Word: Introduction, Starting of MS-Word. Creating and Editing a document. Formatting a document:- Font and type size, paragraph formatting, justification, copy and paste, inserting, preview and printing, indent, footer, header, macro, mail-merge, hyperlink. Other features: - find and replace, tables, grammar and spell check.</p> <p>2.2 MS-Excel: Introduction, Starting of MS-Excel. Creating and Formatting a document. Features: - Auto sum, drag and drop, auto fill, insert clipart, row and column. Charts: - Column, bar, pie, line area. Formula and functions: - Types, terms like cell address, types of references, values, objects, add ins.</p> <p>2.3 MS-Power Point: Introduction, Application- presentation and slide show Creating and displaying a presentation. Advantages. MS-access-introduction & basic, creating a database and handling queries.</p> <p>2.4 Internet: History and use, Basics of www., Various domain name, Search Engines, E- commerce, E- mail and chat, Internet protocols, viruses and anti-viruses</p>	2
3. Basics AutoCAD command	<ol style="list-style-type: none"> 1. Draw simple drawings using various commands of AutoCAD. 2. Format, modify, view the drawings made by him. 	<p>3.1 Introduction: - version, need, changes after its implementation. Advantages, basic shapes and objects, co-ordinate system (Cartesian, polar, absolute, relative.). Starting with A-Cad: - Creating, editing and saving the file, various commands.</p> <p>3.2 Basic Commands: Draw command: - line, mline, spline, polygon, rectangle, arc, circle, spline, donut, ellipse, hatch, text, text style, point example.</p> <p>3.3 Modify command: - Erase, copy, mirror, offset, array, move, rotate, trim, extend, break, chamfer, fillet, explode, example. 3.4 Formatting command:- properties, match properties, hatch edit, pedit, spline edit, ddedit (for text), chprop, osnap.</p> <p>3.4 Dimensioning command:- linear, angular, radial, aligned.</p> <p>3.5 View command:- zoom, pan, redraw, regen, regen all.</p> <p>Editing single line text, Entering multiline text, editing multiline text, ddedit(for text)</p> <p>3.6 Settings: - Limits, scale, grid, unit, calling various toolbars.</p>	2
4. AutoCAD commands	<ol style="list-style-type: none"> 1. Set, text, give the dimensions the drawing sheets. 2. Make hatching for particular shape in the diagram. 	<p>4.1: Set the limits of drawing creating new drawing with wizards & Templates, editing & saving the files. Co-ordinate entry methods, viewing the drawing snap and grid, object snap setting. Getting information about object in drawing.</p> <p>4.2 Dimensioning: Dimensioning Command: Dimensioning concept, types of dimensioning. Linear, Angular, radial, aligned, ordinate, dimension style. 6.3: Dimension Styles: Zoom, pan, redraw, regen, regenall</p> <p>4.3 Settings: Limits, scale, grid, unit, calling various toolbars</p> <p>4.4 Hatching: Hatch Command: Hatch pattern, pattern properties, selecting a boundary, view selections, inherit properties, composition, preview & apply hatch.</p>	2

		Introduction to 3D and autolisp.	
5. Programming in C	<ol style="list-style-type: none"> 1. State the history of C 2. Draw Basics structure of c 3. Explain Input and Output Library Functions. 4. Do the simple programmes in C language. 	5.1 History of C language 5.2 Basics of C, Algorithm and Flowchart in C, Steps for executing C program 5.3 C Character set, data types, constants and variables, keywords, declaration of variable and constants. 5.4 Structure of C program, Rules for writing a C program 5.5 Operators - Arithmetic, Relational, Logical and conditional Operators, getchar(), putchar(), gets() and puts() , Expressions 5.6 Formatted input, output statement printf, scanf 5.7 Control Statements - Decision making and branching : if Statement, nested if-else Switch, break, continue, While, do – while, for Statements. Exit function	4
6. Arrays and Functions in C	<ol style="list-style-type: none"> 1. Use array in program to make multiple identical functions. 2. Use and apply controlled looping 3. Use the commands of functions in program 	6.1 Arrays – Array Declaration and one dimensional and two dimensional array 6.2 Strings - Declaration and initialization of string variables, string handling functions from standard library [strlen(), strcpy(), strcat(), strcmp()]. 6.3 Functions – use of function,, defining functions, calling function, return values.	4

Term Work:

The term work shall consist of the following assignments –

Sr. No.	Title	Hrs.
1	Create Résumé/Bio data as assignment on MS Word.	2
2	Create document on electrical topic as assignment on MS Word.	2
3	Create SSC mark sheet as assignment on MS Excel.	2
4	Create a presentation on electrical topic as assignments on MS PowerPoint.	2
5	Internet	2
6	Draw diagram in AutoCAD and Make block outline of drawing sheet	2
7	Draw diagram in AutoCAD and Make block outline of drawing sheet	2
8	Draw diagram in AutoCAD and Make block outline of drawing sheet	2
9	Draw diagram in AutoCAD and Make block outline of drawing sheet	2
10	Draw diagram in AutoCAD and Make block outline of drawing sheet	2
11	Draw diagram in AutoCAD using draw command and Dimensioning	2
12	Draw diagram in AutoCAD using draw command and Dimensioning	2

13	Draw diagram in AutoCAD using draw command and Dimensioning	2
14	Draw diagram in AutoCAD using Hatching, texting	2
15	Draw diagram in AutoCAD using Hatching, texting	
16	Write a Program with its flowchart, print "HELLO" message on the screen as Assignments based on C programming.	2
17	Write a Program with its flowchart, to print addition of the 2 numbers as Assignments based on C programming.	2
18	Write a Program with its flowchart, Addition of digits of 4 digit number as Assignments based on C programming.	2
19	Write a Program with its flowchart, to find greater number among three numbers as Assignments based on C programming.	2
20	Write a Program with its flowchart, to find greater number among two numbers as Assignments based on C programming.	2
21	Write a Program with its flowchart, to check bigger no among two numbers as Assignments based on C programming.	2
22	Write a Program with its flowchart, to print Factorial of a number as Assignments based on C programming.	2
23	Write a Program with its flowchart, to print the age for full ticket as Assignments based on C programming.	2
24	Write a Program with its flowchart, to print reverse of number using while loop as Assignments based on C programming.	2
25	Write a Program with its flowchart, to print numbers from 1 to 10 using for loop as Assignments based on C programming.	2
26	Write a Program with its flowchart, to print multiplication of digit using for loop as Assignments based on C programming.	2
27	Write a Program with its flowchart to print Fibonacci using for loop as Assignments based on C programming.	2
28	Write a Program with its flowchart, to print a total number of digits in number as Assignments based on C programming.	2
29	Write a Program with its flowchart, to perform scanf functions to print HAPPY OR NOT HAPPY as Assignments based on Decision making in C programming.	2
30	Write a Program with its flowchart, to check whether the no is palindrome or not, as Assignments based on Decision making in C programming.	2
31	Write a Program with its flowchart, WAP to check whether the number is Armstrong no or not, as Assignments based on Decision making in C programming.	2
32	Write a Program with its flowchart, to print the number is prime or not as Assignments based on Decision making in C programming.	2

Magazines: 1) Digit
2) PC Quest

Websites: www.computercourseguide.com

www.smarter.com

www.tutorial45.com

Books:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	Moseley & Boodey	Mastering MS-Office Professional	BPB Pub
2.	D.D. Voisonet	Introduction to CAD	McGraw Hill, New Delhi 6.
3.	Alan and Miller	ABC's of AUTOCAD	The BPB Pub 7
4.	Balguruswami	Programming in Ansi C	McGraw Hill, New Delhi 6.
5.	Yashwant Kanetkar	Working with C	BPB Publications(2009)
6.	Yashwant Kanetkar	Let us C Solutions	BPB Publications(2011)

CO/PO MATRIX

Co \ PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and environment	Project Management	Life-long learning
1. Identified different hardware components.	3	--	--	1	2		1
2. Create document, table, and presentation using MS-OFFICE software.	3	3	3	3	2	2	1
3. Use various tool bars of AutoCAD and draw the electrical drawings.	3	3	2	3	2	1	1
4. Do the simple programming in C language.	3	3	3	3	3	--	1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course: Electrical Engineering Skills & Drawing****Course code: R18EE1302****Course Category: Foundation****Credit: 02****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
--	2	--	--	--	--	25@	25	50

@ Internal Oral Exam

Rationale: A student has to complete the following assignments so as to acquire some of the basic skills in electrical work required in laboratory or in the industry. S/he is required to understand and interpret the drawing prepared by others.

Course Outcome: The student should be able to –

CO1 Read and interpret the given electrical circuit diagram by understanding the meaning of Standard symbols.

CO2 Suggest the meter, equipment and accessories for the connections of circuits as per drawn circuit diagram.

CO3 Identify the equipments, meter rating, machine rating, & chose correct meter for appropriate use.

CO4 Connect the various meters as per the laws & convention of the electrical engineering following the safety rules.

CO5 Draw the power & lighting circuits by using standard symbols.

Term work:

Part I: Electrical Engineering Skills: *Eight* practical and Assignment write-ups based on the following list –

Sr. No.	Experiment	Hrs.
1	Introduction to general Electrical Safety Rules and regulation.	02
2	Study of supply system used in Residential, Commercial and Industrial sector	02
3	Study of different tools necessary in wiring.	02
4	Reading the circuit diagram and connecting D.C. and A.C. ammeter & voltmeter as per circuit diagram.	02
5	Reading the circuit diagram and connecting wattmeter /energy meter as per circuit diagram & calculation of their multiplying factor.	02
6	Study and connection of single-phase transformer.	02
7	Study and connection of A.C./ D.C. motors.	02
8	Study and connection of a rheostat as potential dividers & as a variable resistance.	02
9	Study of types of wires & terminations by lugs & connectors.	02
10	Hands on for Wire jointing methods & soldering technique.	02
11	Study of cable glands, supports and understanding its importance.	02
12	Use of Megger, tong tester & earth tester.	02

Part II: Electrical Engineering Drawing: The term work shall consist of **sheet number01 is Compulsory.** And the from remaining two drawing sheets any one of A2 size.

Sr. No	Description of the drawing Sheet	Hrs.
1.	Symbols as per BIS for wiring, machines & power system components & any two circuit diagrams using these symbols.	04
2.	Panel wiring diagrams of panels installed at metering / distribution room in the Wadia College campus.	04
3.	Simple House wiring diagram for student's residential complex.	04

Library Related Activity:

Go to library and Find IS copy related to Electrical Engineering and prepare the list of available IS :name and number with related equipment /process.OR preparation of Essay / Wall chart and participate and exhibit them in Department during various occasions like VachanPrernaDiwas, [वाचनप्रेरणादिवस] Marathi Bhasha Din [मराठीभाषादिन] VidyutSuraskhaSaptahal [विद्युतसुरक्षासप्ताह].

Professional Practice:

1. Preparing a small electrical Extension Board with at least two switches and two Plug points with fuse and indicator
2. Showing Video/ Slides on Cable Termination and Jointing.

Web sites for references:

- 1) www.en.wikipedia.org 2) www.electricals-tutorials.com 3) www.indianscientificinstrument.com

CO-PO-PSO MAPPING:

CO/PO/PSO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1 Read and interpret the given electrical circuit diagram by understanding the meaning of Standard symbols.	3	3	2	2	1	1	3	1	2	1
CO2 Suggest the meter, equipment and accessories for the connections of circuits as per drawn circuit diagram.	3	3	2	3	1	1	1	-	2	1
CO3 Identify equipments, meter rating, machine rating, & chose correct meter for appropriate use.	3	3	2	3	3	1	2	1	2	2
CO4 Connect various meters as per laws & conventions of the electrical engineering following the safety rules.	3	2	2	2	2	1	2	1	2	3
CO5 Draw the power & lighting circuits by using standard symbols.	3	3	1	1	1	1	2	1	2	3

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course
Name****General Mechanical & Civil Engineering****Course code : R18ME2201****Course Category : Allied****Credits : 06****Teaching & Examination Scheme**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
2	4	-	-	-	-	-	50	50

RATIONALE: A diploma holder in Electrical Engineering has to deal with Mechanical system and its components while controlling the Electrical systems & its equipments. In this course the student will learn about the basics, construction and working of steam generator, steam turbine, I.C. Engine, Pumps and various power transmission devices. An Electrical Engineer during his/her career has to deal with various aspects in Civil Engineering like Selection and installation of drive components, preparation of foundation for electrical equipments like transformers, motors etc. In this course the students will learn about basics of Civil Engineering.

COURSE OUTCOMES: After completion of this course the students will be able to,

- 1 To understand properties of steam, basic parts and functions of steam generator and steam turbine.
- 2 To identify different parts of IC engine and pumps.
- 3 To understand the use of different power transmission devices for various applications and identify them.
- 4 To carry out survey with linear measures and leveling.
- 5 Select the material small and simple for construction.
- 6 Supervise small and simple construction work.

COURSE DETAILS:-

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hrs
1. Properties of steam, steam generator and steam turbine.	1. Compare fire tube and water tube boiler.	1.1 Properties of steam: steam formation, definition of various terms, introduction to steam table & its use.	06
	2. Define different conditions of steam.	1.2 Boiler: Basic concepts of various types of boilers, High pressure boiler and critical pressure boiler, Water tube and Fire tube boiler, Rankine cycle.	
	3. Draw layout of ranking cycle. 4. Classify steam turbine.	1.3 Steam Turbine: Principles of working of steam turbines, Classification of steam turbine & their operation.	
2. I.C. Engine and Pump	1. Classify I.C. Engine	2.1 I.C. Engines: Construction & classification of I.C. Engines, Otto and Diesel cycle, Introduction to hybrid cars.	06

	<ol style="list-style-type: none"> Differentiate Otto cycle and diesel cycle. Explain construction and working of pumps. 	2.2 Introduction to pumps: Classification of pumps, construction & working of Centrifugal & reciprocating pumps.	
3. Power transmission components	<ol style="list-style-type: none"> Classify transmission devices Compare various transmission devices. Classify different types of bearings. 	3.1 classification & study of various power Transmission components like pulleys, belts, chain, ropes, couplings & gearboxes.	04
		3.2 Classification & selection of various types of bearings	
4. Surveying & leveling	<ol style="list-style-type: none"> Measure distance and area. Carryout leveling and finding difference in elevations. 	4.1 Surveying: Definition, Principles. Introduction to distance measuring instruments like 20 m, chain, steel/plastic tape & ranging rods. Chaining & ranging procedures. Offset & offsetting by open cross staff. 4.2 Leveling: Definition of leveling, introduction to dumpy level & leveling staff. Finding out difference in elevation by simple & compound leveling.	5
5. Civil Engineering Materials:	<ol style="list-style-type: none"> Describe the various test conducted on material. Study the different materials, uses along with its specifications. Discuss requirement of brick, steel & suggest suitability of it under different situation 	Civil Engineering Materials: 5.1 Bricks- conventional & IS size, IS specification of cement-type's requirements field tests. Aggregates-necessity, IS specifications. 5.2 Steel- types & characteristics of structural steel. 5.3 Concrete- Definition, types (RCC & PCC), steps in manufacture, grades, and requirement in fresh & hardened state.	5
6. Construction Technology :	<ol style="list-style-type: none"> Enumerate the different types of structure & foundations. Concept of bearing capacity & introduction to machine foundation. Describe different component parts of building, its function and procedure for construction. 	Construction Technology : 6.1 Types of structure- Load bearing & framed. 6.2 Foundation- Definition, types of foundations. Concept of bearing capacity & introduction to machine foundations. 6.3 Various Components- general procedure of construction of masonry & plastering. Introduction to structural components like slabs, beams, columns-principles of their design & important points to be observed during their construction.	5

1. **TEACHING METHODOLOGY:** Chalk-Board, Group Discussion, Power Point Presentation, Videos, Expert Lectures.

2. LIST OF PRACTICALS / ASSIGNMENTS / EXPERIMENTS. For Mechanical

Minimum eight (08) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	I	Study of boiler	4
2	I	Study of steam turbine	4
3	II	Study of I.C. Engine	4
4	II	Study of centrifugal pump	4
5	II	Study of reciprocating pump.	4
6	III	Study of various types of couplings.	4
7	III	Study of pulleys & belts.	4
8	III	Study of bearings & gearboxes.	4

1. LIST OF PRACTICALS / ASSIGNMENTS / EXPERIMENTS. For Civil

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	4	Study of distance measuring equipments like 20m chain, tapes & ranging rods.	4
2	4	Chaining & ranging a line about 50m length.	4
3	4	Chain & cross staff survey of small area.	4
4	4	Study of dumpy level, its adjustments & leveling staff.	4
5	4	Compound leveling & fly leveling.	4
6	5	Testing of concrete for workability & compressive strength.	4
7	5	Study of bonds for half & one brick masonry	4
8	5	Listing of material requirements, work outputs, material & labor rate for some common construction items like- half & one brick masonry in cement mortar.	4

3. LEARNING RESOURCES:**A) Books:**

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	R.K.Rajput	Thermal Engineering	Laxmi Publication, New Delhi.
2	V.Ganeshan	I.C.Engine	McGraw Hill Publications, New Delhi.
3	R.S. Khurmi	Theory of Machines	S Chand Publication
1	Kanetkar	Surveying and Leveling	McGraw Hill Co., IND
2	Dr.B.C.Punmia	Surveying	Laxmi Publications, Delhi.
3	Shelar, Mali, Patil	Surveying	NiraliPrakashan , Pune.

B) Web sites for references:

<https://www.youtube.com/watch?v=nL-J5tT1E1k>
<https://www.youtube.com/watch?v=SPg7hOxFtI>
<https://www.youtube.com/watch?v=fTAUq6G9apg&t=79s>
<https://www.youtube.com/watch?v=TxqPAPg4nb4>
<https://www.youtube.com/watch?v=j7njMZ22izc>
www.wikipedia.com
www.surveying.otago
www.amerisurv.com
www.thecivilengineer.net
www.surveyofindia.gov.in

4. CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	Ps01	Pso2	Pso3
CO1	01	00	00	00	01	00	01	00	00	00
CO2	01	00	00	00	01	00	01	00	00	00
CO3	01	01	00	00	01	00	01	00	00	00
CO4	03	-	-	03	01	03	-	-	-	-
CO5	03	-	-	02	01	01	-	-	-	-
CO6	03	-	-	01	01	-	01	-	-	-

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE: GENERAL ENGINEERING (WORKSHOP)****COURSE CODE: R18ME2202****COURSE CATEGORY: ALLIED****CREDIT:02****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
-	2	-	-	-	-	-	50	50

Rationale:

Workshop Practice is a basic practical engineering course. The knowledge of basic workshops such as tin smithy, welding, and turning shop is essential for technician to perform his/her duties in industries. Students are able to perform various operations using hand tool equipment and machineries in various shops. Working in workshop develops the attitude of group working and safety awareness. This course provides miniature industrial environment in the educational institute.

Course Outcomes:

1. Select tools and machinery according to job.
2. Use hand tools in different shops for performing different operation.
3. Operate equipment and machinery in different shops.
4. Prepare job according to drawing.
5. Maintain workshop related tools, equipment and machinery.

Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME
UNIT NO.1 General Workshop Practice	1.1 Safety practices, causes of accidents, general safety rules, safety signs and symbols	1. Describe the ways to maintain good house keeping in given situation.
UNIT NO.2 Hand Tools & Equipments	Introduction to hand tools like screw drivers, spanners, files, vices and pliers used in workshop	1. Describe the operation of given hand tools 2. Describe the procedure to maintain tools, equipments.
UNIT NO.3 Machine Tools	3.1 Construction, working of various machine tools like a) center lathe b) milling machine c) drilling machine	1. Describe the construction and working of given machine tools 2. Describe the procedure to maintain the given machine tool.
UNIT NO.4 Metal Joining	4.1 Arc welding hand tools: electrode holder, cable connector, cable lugs, chipping hammer, earthing clamp, wire brush and their specifications.	1. Describe the procedure to identify & use the given metal joining tools. 2. Explain the given type of welding procedure.

	4.2 Operation of machineries in welding shops- arc welding transformer their specifications and maintenance. 4.3 Welding electrode, filler rod ,fluxes.	
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SUGGESTED EXERCISES/PRACTICALS:

S. No.		Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
01.		Prepare a sheet metal job using the following operations(tin smithy shop): 1]Cutting & bending 2] Edging 3] End curling 4] lancing 5] Soldering and riveting	05
02.		Prepare a job using the following operations(turning and drilling): 1]turning operation as per drawing 2] step turning operation as per drawing 3]Facing operation as per drawing 4] Chamfering operation as per drawing 5] Drilling operation as per drawing 6] Tapping operation as per drawing	06
03.		1] Fabrication operation involves measuring, marking, cutting, edge preparation, welding.	05
		TOTAL	32(Hrs)

Note:

i. A suggestive list of practical LOs is given in the above table, more such practical LOs can be added to attain the COs and competency.

TEACHING SCHEME:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	General Workshop Practice	01				
2	Hand Tools & Equipments	03				
3	Machine Tools	06				
4	Metal Joining	06				

MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

SR.NO.	EQUIPMENT NAME WITH BROAD SPECIFICATIONS	EXPERIMENT SR. NO.
01	Work benches	01,03
02	Power saw machine	02,03
03	Bench grinder	02
04	Vernier height gauge	03
05	Surface plate	03
06	Welding machine	03
07	Bench Vice	01,03
08	Center lathe machine	02
09	Sheet cutting and sheet bending machine	01
10	Cutting Tools: turning tools ,drills, reamers,tap set,	02
11	Arc welding hand tools – electrode holder,cable connector,cable lugs,chipping hammer , earthing clamp, wire brush.	03
12	Sheet metal hand tools- snip,shears,sheet gauge,straight edge,L-Square,scriber,divider,trammel,punches,pliers	01

TEACHING METHODOLOGY:

Chalk-Board, Discussions, Charts, Models.

I) Intellectual Skills:

- Identify joining methods for fabrication.
- Ability to read and interpret job drawings.
- Ability to identify and select proper material , tools and machines

ii) Motor Skills:

- Identify, select and use various marking, measuring and holding, cutting tools and equipments in various shops.
- Adopt safety practices while working on various machines.
- Operate various machine tools.
- Produce jobs as per specified dimensions.
- Inspect the job for specified dimensions.

SUGGESTED STUDENT ACTIVITIES:

Other than the classroom and laboratory learning, following are the suggested student related co-curricular activities which can be undertaken to accelerate the attainment of various outcomes in this course:

- Prepare work diary based on practical performed in workshop. Workdiary consist of job drawing , operations to be performed , required raw materials , tools , equipments, date of performance with teacher signature.
- Prepare a journal consist of free hand sketches of tools and equipments in each shop, detail specifications and precautions to be observed while using tools and equipments.
- Prepare /download specifications of –
 1. Various tools and equipments in various shops.
 2. Precision equipment in workshop.
 3. Various machineries in workshop.

SUGGESTED LEARNING RESOURCES:**A) REFERENCE BOOKS:**

S. No.	Title of Book	Author	Publication
1.	Workshop Practice	Bawa, H.S.	McGraw Hill Education, Noida; ISBN: 978-0070671195
2.	A Textbook of Manufacturing Process (Workshop Tech.)	Gupta, J.K.; Khurmi, R.S.	S.Chand and Co. New Delhi ISBN:81-219-3092-8
4.	Introduction to Basic Manufacturing Process & Workshop Technology	Singh, Rajender	New Age International, New Delhi; 2014, ISBN: 978-81-224-3070-7

B) SOFTWARE/LEARNING WEBSITES :

- <http://www.asnu.com.au>
- <http://www.abnertools.com/downloads/Woodworking%20Carpentry%20Tools.pdf>
- <http://www.weldingtechnology.org>
- <http://www.newagepublishers.com/samplechapter/001469.pdf>
- <http://www.youtube.com/watch?v=TeBX5cKKHWY>
- <http://www.youtube.com/watch?v=QHF0sNHnttw&feature=related>
- <http://www.youtube.com/watch?v=Kv1zo9CAxt4&feature=relmfu>
- <http://www.pichtoolco.com>
- [http://sourcing.indiamart.com/engineering/articles/materials used hand tools/](http://sourcing.indiamart.com/engineering/articles/materials%20used%20hand%20tools/)
- https://www.youtube.com/watch?v=9_cnkaAbtCM

Mapping matrix of P MAPPING MATRIX OF CO'S AND PO'S:

CO's	PO1 Basic knowledge	PO2 Discipline knowledge	PO3 Experiments &Practice	PO4 Engineering Tools	PO5 The engineer &Society	Environment & Sustainabilit	PO7 Ethics	PO8 Individual & team work	PO9 Communicat ion	P10 Lifelong learning
C01	H	M	M	0	L	L	0	H	L	M
C02	H	M	H	L	L	0	0	M	L	H
C03	H	L	M	0	L	0	0	M	L	H
C04	H	H	M	M	L	0	0	M	M	H
C05	M	M	M	M	0	0	0	M	0	H

H: High M: Moderate and L:Low Relationship

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course: Industrial Organization and Management****Course code: R18EE2303****COURSE CATEGORY: ALLIED****CREDIT: 03****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	-	3	80	20	-	-		100

Rationale:

This course is classified under human sciences and is intended to teach students about structure of organization, types of organization, principles of management, functioning of personnel department, industrial laws, and inventory control methods. It also envisages giving exposure to accountancy principles and various networking methods.

Course Outcomes:

CO1. Overview of business and understand management process in organization.

CO2. Know types of business organization structures, organizational principals, departmentation and types of ownerships.

CO3. Identify different human resources and its management. Know different acts, wages, and incentives for execution of factory work.

CO4. Understand financial resources and its management.

CO5. Identify different sources of material and its storage management.

CO6. Understand marketing management, project management techniques.

Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	Hrs	Marks
UNIT NO.1 Business & Management processes.	1.1 Types of business- Service industry, Manufacturing industry, Trading industry. 1.2 Industrial sectors: Types and features of Engineering industry, process industry, textile, chemical, agriculture, information technology, banking, insurance, retail, hospitality, automobiles, paper, cement, petro chemical, sugar, steel and healthcare etc. 1.3 Globalization: effect on Indian market. 1.4 Management: definitions of management, level of management, administration & management, scientific management. 1.5 Principles of management: Henry	1.1 Classify different business and explain characteristics, nature of each business with suitable example. 1.2 Explain various industrial sectors with its product nature. 1.3 Meaning of globalization and its effect on Indian market. 1.4 What is management? Explain the history of evolution of management. 1.4.2 To know the different level of management. 1.4.3 Differentiate between management versus administrations. Differentiating between conventional and scientific management. 1.5 Understand Henry Fayol principals of management. 1.6 Understand of functions of management and use of its in actual	06	12

	<p>Fayol principles.</p> <p>1.6 Functions of management: planning, organizing, staffing, co – coordinating, directing and controlling.</p>	field.		
UNIT NO.2 Organizational Management	<p>2.1 Organization: - definition, organization formation steps.</p> <p>2.2 Types of organization- Line, staff, line and staff.</p> <p>2.3 Departmentation: - Departmentation by product, departmentation by function & departmentation by process.</p> <p>2.4 Principles of organization:- Authority and responsibility, centralization and decentralization of authority, span of control, balance, stability and flexibility.</p> <p>2.5 Forms of ownership:- Proprietorship, partnership, Joint stock (private Ltd, public Ltd), co-operative society, government sector (government department, public corporation, public company</p>	<p>2.1 Understand the meaning of organization. Also explain the steps in organization formations.</p> <p>2.2 Describe different types of organization with respect to its nature, characteristics etc.</p> <p>2.3 Differentiate between line versus staff types of organization</p> <p>2.4 Explain the concept of departmentation, meaning and types of departmentation.</p> <p>2.5 Describe various principles of organization and actual applications on field.</p> <p>2.6 Explain different forms of ownerships with respect to its nature, characteristics, Advantages, limitations and applications.</p>	06	12
UNIT NO.3 Human Resource Management	<p>3.1 Personnel management: Duties and responsibilities of personnel management, Manpower planning, Sources of employment, recruitment, selection. Various methods of testing, training and development of workers and supervisors, duties and authorities of supervisors, morale maintenance, motivation.</p> <p>3.2 Wages and Incentives: Definition of wages, wage payment plans, Concept of incentive.</p> <p>3.3 Safety management: Causes and effects of accident, Safety programmes.</p> <p>3.4 Labour Laws: Factory act, Employee's State Insurance act, Workmen's Compensation act, Dispute act.</p>	<p>3.1 Explain duties and responsibilities of personnel management in organization.</p> <p>3.2 Describe manpower planning for different department. Explain meaning of recruitment.</p> <p>3.3 Describe source, selection procedure, method of testing, training methods during recruitment.</p> <p>3.4 Explain qualities of good supervisor and its duties.</p> <p>3.5 Explain importance of moral and motivation in the department.</p> <p>3.6 Describe wage and incentive plan, safety management and labor laws applied in industry.</p>	09	16
UNIT NO.4 Financial Management	<p>4.1. Financial Management: - Objectives & Functions.</p> <p>4.2. Capital Generation- Types of Capital, Sources of raising capital.</p> <p>4.3. Budgets Types of Budgets-production, sales, cash, labour, material and financial budget.</p> <p>4.4 Types of account- profit & Loss Account balance sheet.</p> <p>4.5 Terminology used in financial management- Journal, ledger, liability and assets etc.</p>	<p>4.1 Describe the main objectives, functions of financial managements</p> <p>4.2 Explain different types of capitals, and describe it with respect to nature, characteristics.</p> <p>4.2.1 Know the different source of raising the capital.</p> <p>4.3 Explain the meaning of budget and various accounts used in finance department.</p> <p>4.3.1 Describe main types of budgets.</p> <p>4.4 Explain various accounts used.</p> <p>4.5 Differentiate between profits versus</p>	09	16

	4.6 Taxes —classification of taxes, meaning and example of excise, service, income, VAT, custom duty.	loss accounts. 4.6 Explain meaning and example of different taxes of financial management.		
UNIT NO.5 Material Management	5.1 Inventory management- Inventory -concept, classification, functions and objectives. 5.2 ABC analysis -concept and necessity, graphical presentation, advantages and limitations. 5.3 Economic order quantity- Concept EOQ, graphical representation, determination of EOQ, buffer stock, advantages and limitations. 5.4 Purchasing -objectives, functions of purchase department, purchasing procedure 5.5 Modern techniques of material management -Material resource planning (MRP)-input to MRP, benefits, functions. -Enterprise resource planning (ERP)-list of ERP module, advantages, disadvantages.	5.1 Understand the concept inventory and its importance in industry. Classification, function and objective of inventory management. 5.2 Explain meaning of ABC analysis, needs, steps and limitations of ABC analysis. 5.3 Understand the meaning of EOQ, its graphical representation. Calculation of EOQ. Know the buffer stock. Study of advantages and limitations of EOQ. 5.4 Understand entire purchasing procedure, objectives and functions of purchasing department. 5.5 Explain advance technique of material management in modern industry like MRP, ERP etc.	06	12
UNIT NO.6 Sales/Marketing management & Project management	6.1 Sales management -definition, function of sales department, duties of sales manager. 6.2 Marketing -definition, functions, 6.3 Marketing management -definition, functions. 6.3.1 Market research -definition, objectives and scope. 6.3.2 Advertising -definition, agency and types. 6.3.3 Market - concept, types. 6.4 Project management: Network analysis- Definition, list of network analysis technique, objectives and advantages. Terminology in network analysis- events, activity, path, network diagram, critical path, duration, dummy activity, construction of network diagram for project. CPM – Meaning of CPM and its characteristic, applications. Numerical on CPM. PERT-Meaning of PERT and its characteristics, applications, numerical on PERT, comparison of CPM & PERT.	6.1 Define sales management. State various functions of sales department. Explain duties of sales manager. 6.2 Define marketing. State the functions of marketing. 6.3 Define marketing management. State the functions of marketing management. 6.3.1 Define market research. State its objectives and scope. 6.3.2 Define advertising; also state its agency and types. 6.3.3 State the concept and types of Market. 6.4.1 Define network analysis. State its technique, objectives and advantages. 6.4.2 Explain the terminology used in network analysis with diagram. Construct the network diagram for given project activity. 6.4.3 Explain the meaning of CPM. State its important characteristics and applications. Solve numerical on CPM. 6.4.4 Explain the meaning of PERT. State its important characteristics and applications. Solve numerical on PERT. Compare CPM and PERT	06	12

Specification Table for question paper design:

Unit No.	Unit Title	Teaching Hours	Distribution of Marks			
			R Level	U Level	A Level	Total
1	Business Management and Management Processes.	06	04	04	04	12
2	Organizational Management	06	04	04	04	12

3	Human Resource and management	09	06	06	04	16
4	Financial Management	09	08	08	--	16
5	Material Management	06	04	04	04	12
6	Marketing Management & Project Management	06	04	04	04	12
Total		42	30	30	20	80

SUGGESTED STUDENT ACTIVITIES: A guest lecture by industry person or equivalent expert will be arranged for the students and students will submit the short report of the activity.

TEACHING METHODOLOGY:

Chalk Board, Discussions, Power Point Presentations, Videos and Expert Lectures.

i) Intellectual Skills:

- Understand functions and managerial skills required for various departments.
- Understand the principles of double entry book keeping system.
- Interpret transactions in journal, ledger and balance sheet.

SUGGESTED LEARNING RESOURCES:

REFERENCE BOOKS:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. O.P. Khanna	Industrial Engineering & Management.	Dhanpat Rai & Sons.
2	J. R. Batliboi	First Steps in Book Keeping.	
3	Dr. B. C. Punmia and K. K. Khandelwal	Project Planning and Control with CPM and PERT.	Laxmi Publication.

Library Related Activity: Go to library and *Find the book related to Management Success stories, / Business success story/ Entrepreneur biography etc. and write down the conclusion in your own wordings.*

CO-PO-PSO Mapping matrix:

CO's	PO1 Basic knowledge	PO2 Discipline knowledge	PO3 Experiments & Practice	PO4 Engineering Tools	PO5 The engineering & Society	PO6 Environment & Sustainability	PO7 Lifelong learning	PSO1	PSO2	PSO3
CO1. Overview of business and understand management process in organization.	1	3	1	1	2	1	3	-	1	2
CO2. Know types of business organization structures, organizational principals, departmentation and types of ownerships.	1	3	1	1	2	2	3	1	-	1
CO3. Identify different human resources and its management. Know different acts, wages, and incentives for execution of factory work.	1	3	1	1	2	2	3	-	2	1
CO4. Understand financial resources and its management.	2	3	1	1	2	2	3	-	-	2
CO5 Identify different sources of material and its storage management.	1	3	1	1	2	2	3	1	1	2
CO6 Understand marketing management, project management techniques.	2	3	1	1	2	2	3	1	2	3

3: High 2: Moderate and 1: Low Relationship

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE: ENVIRONMENTAL ENGINEERING****COURSE CODE: R18EE2301****COURSE CATEGORY: ALLIED****CREDIT: 03****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	TU/PR	Papers HRS	Th	TEST	PR	OR	TW	Total
1	1	-	-	-	-	@ 25	25	50

Rational: In this course, the student will understand the concept of Environmental engineering. This course will also help the student to learn various aspects of environment of electrical industries.

Outcomes: Students will be able to:

- CO1. Explain uses of resources, their over exploitation and importance for environment.
- CO2. Describe major ecosystem.
- CO3. Suggest measures for conservation of biodiversity.
- CO4. Identify measures for prevention of environmental pollution.
- CO5. Describe methods of water management.
- CO6. Identify effects of Climate Change, Global warming, Acid rain and Ozone layer.
- CO7. State important provisions of acts related to environment.

Unit	Learning Outcome	Contains of Unit	Hrs
1.Importance of Environmental Studies.	1. Define the term related to environmental studies. 2. State importance of awareness about environment.	1.1 Definition, Scope and Importance of the environmental studies. 1.2 Need for creating public awareness about environmental issues,3R's of environment i.e. Reduce Reuse and Recycle of resources.	2
2. Natural Resources: Renewable and Non-renewable resources	1. Define natural Resources. 2. Identify uses of natural resources, their exploitation. 3. Understand the use of natural resources for better condition of environment. 4. State the importance about Mineral resources. 5. Explain the concept of Food for all and understand the severity of food problem.	2.1 Definition -natural resources and associated problems. Forest Resources: General description of forest resources functions andbenefits of forest resources, effects on environment due to deforestation. 2.3 Water Resources-- Hydrosphere: Different sources of water, Use andoverexploitation of surface and ground water. 2.4 Mineral Resources: Categories of mineral resources, Basics of mining activities. 2.5 Food Resources: Food for all, Effects of modern agriculture, World foodproblem	7
3. Ecosystems	1. Define Ecosystem. 2. List the functions of Ecosystem. 3. Describe major eco systems in the world.	3.1 Concept of Ecosystem. 3.2 Structure and functions of ecosystem, energy flow in ecosystem. 3.3 Major ecosystems in the world.	5

4. Environmental Effects	1. Define Pollution. 2. Explain various types of pollutions. 3. List the e-waste components. 4. Write Do's and Don'ts for E waste.	4.1 Definition of pollution, pollutant, causes of pollution, types of pollution. 4.2 Air pollution– Definition, types of air pollutant, sources & effects of air pollutants. 4.3 Water Pollution: Definition of water pollution, Causes & sources of water pollution. 4.4 Noise Pollution: Definition, sources, effects, levels of noise. 4.5 E-WASTE - Their origin & control measures, Do's and Don'ts of E-waste, disposal of electric lamps, Fluorescent Tube-lights, cables, batteries, etc.	6
5. Social Issues and Environment	1. Define concept of Sustainability Development. 2. Describe methods of Water management. 3. Identify the effects of climate change, global warming, acid rain and ozone layer. 4. Explain about carbon credits.	5.1 Concept of sustainable development, Water conservation, watershed management. 5.2 Rain water harvesting: Definition, methods and benefits. 5.3 Climate change, global warming, acid rain, ozone layer depletion. 5.4 Concept of Carbon Credits and its advantages.	4
6. Environmental Protection	1. State importance of provision of act related to environment and its elements.	Brief description of the following acts and their provisions – 1. Environmental Protection Act, Air (Prevention and Control of Pollution) Act. 2. Water (Prevention and Control of Pollution) Act, 3. Wildlife Protection Act, Forest Conservation Act 4. Population Growth: Aspects, importance and effect on Environment. 5. Human Health and Human Rights 6. ISO 14001, 17025 (certified analytical test methods and related IS related to environment)	4

Term work:

A) Term work shall consist of the following assignments –

Unit	Assignment	Hrs.
1	Report on Importance and public awareness of Environmental Studies	02
2	Report on Use of natural resources and overexploitation of Resources	02
3	Assignment/Report on structure and functions of ecosystem	02
4	Group discussion on Environmental Pollution (Air pollution/Water pollution/Soil pollution/Noise pollution/E-waste)	02
5	Video Demonstration /Expert Lecture Report on Climate Change and Global warming	02
6	Write important provisions of Acts related to Environment/ Air (Prevention and Control of Pollution) Act/Water (Prevention and Control of Pollution) Act/ Wildlife Protection Act/ Forest Conservation Act	03

B) Video Demonstration to Renewable / Non-renewable (wind farm, hydropower station, thermal power station)/ resources of energy. Students can participate in Tree plantation activity under “ME and my Best friend my Tree”

Books:

Sr. No	Title of the Book	Author	Publication
1	Perspectives In Environmental Studies	Anubha Kaushik & C.P. Kaushik	New Age International Publishers
2	Air Pollution & Control Technologies	M.N.RAO & V.N.RAO	Tata McGraw Hills, New Delhi
3	Principals Of Environmental Science & Engineering	P.Venu Gopala Rao	Prentice Hall Of India Pvt. Ltd., New Delhi
4	Elements of Environmental Science & Engineering	P. Meenakshi	PHI Learning Pvt.Ltd., New Delhi

Library Related Activity: Go to library and *Find the book related to Environmental engineering /similar aspect and write a short note on it or prepare the wall Chart on it.*

Web sites for references:

www.neeri.res.in
www.bae.ncsu.edu
www.barc.gov.in/pubaware/index.html
www.mpcb.com

*Being a non-Theory course Specification table is Not applicable to this course.

CO-PO Mapping:

CO/PO	PO1: Basic and Discipline specific knowledge	PO2: Problem analysis	PO3: Design/development of solutions	PO4: Engineering Tools, Experimentation	PO5: Engineering practices for society,	PO6: Project Management	PO7: Life-long learning	PSO1	PSO2	PSO3
CO1. Explain uses of resources, their over exploitation and importance for environment.	2	1	-	-	1	2	2	2	1	-
CO2. Describe major ecosystem.	-	1	1	1	1	-	2	1	-	1
CO3. Suggest measures for conservation of biodiversity.	-	-	1	1	2	-	-	-	-	1
CO4. Identify measures for prevention of environmental pollution.	2	2	1	-	1	1	3	1	3	1
CO5. Describe methods of water management.	-	1	2	1	1	1	2	-	2	-
CO6. Identify effects of Climate Change, Global warming, Acid rain and Ozone layer.	1	-	-	1	1	-	1	-	-	2
CO7. State important provisions of acts related to environment.	2	1	-	-	-	-	1	-	1	1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE : BASIC ELECTRONICS (ELECTRICAL) COURSE CODE: R18EX2510****COURSE CATEGORY: ALLIED****CREDIT: 05****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	25	125

RATIONALE: A diploma holder in Electrical Engineering has to deal with Electronic components while controlling the Electrical systems & as equipments. In this course the student learn about the basics, working, and construction of the various semiconductor devices, rectifiers, filters, amplifiers, oscillators and electronic devices. Along with this they also learn about basic concepts of digital electronics.

COURSE OUTCOMES: After completion of this course the students will able to,

1. Use different logic gates and code conversion techniques.
2. Discuss different semiconductor devices and their applications.
3. Describe small signal and large signal amplifiers.
4. Explain working of filters and oscillators.
5. Demonstrate CRO, DMM and other electronic devices (like DSO, function generator, power supply etc.)

Course Details:

Unit	Major Learning Outcomes	Topics & subtopics	Hrs	Mk
1. Digital Electronics	1.Solve problems on number system 2.Describe logic gates with their symbol and truth tables 3.Build the given logic operations with the given types of gates	1.1.Number system : Binary, BCD, Decimal, Octal, hex, code Conversion Techniques 1.2. Logic gates-AND, NOT, NAND, NOR, EXOR, EX-NOR: symbol & truth table. Boolean expression, Building basic gates using universal gates. 1.3. Boolean algebra: Demorgan's Theorem, Realizing logic functions with gates.	04	12
2. Semiconductor Devices	1. Describe the construction and working principle of the semiconductor devices. 2.Describe characteristics and application of the semiconductor devices. 3. Compare different configurations of transistors 4.Describe specifications/feature	2.1.Construction, symbol, working principle, specification, applications, forward and reverse biasing and V-I characteristic of following semiconductor diodes: PN junction diode, Zener diode, zener diode voltage regulator 2.2.Construction, symbol, working principle, specification, applications of following photo devices : Photodiode, phototransistor, photovoltaic cells, Optocoupler 2.3 Bipolar junction transistor: Types:	08	16

	s of various semiconductor devices	PNP &NPN, Transistor configurations: CB, CE, CC, Comparison of all configurations 2.4 Constructional features, working, characteristics of JFET, MOSFET, SCR, UJT, Diac, Triac.		
3. Small Signal Amplifiers	<ol style="list-style-type: none"> 1. Explain input and output characteristics of transistor with suitable diagrams 2. Explain biasing methods of transistor 3. Explain the function of the given type of amplifier. 4. Compare the performance of the given type of amplifiers. 5. Draw frequency response of transistor amplifiers 	<ol style="list-style-type: none"> 1.1. Transistor CE configuration: circuit diagram, input and output characteristics. Different points of characteristics (Cut-off, Active and Saturation), input resistance, output resistance, current gain. 1.2. Different Biasing methods of transistor 1.3. Single Stage CE amplifier: Circuit diagram, Function of each component, Frequency response and bandwidth. 1.4. Multistage amplifiers - RC coupled, LC coupled. Transformer coupled & tuned amplifier: frequency response and bandwidth 	08	12
4. Large Signal Amplifiers	<ol style="list-style-type: none"> 1. State different types of amplifiers 2. Explain working of given type of amplifier with suitable circuit diagram. 3. Discuss advantages and disadvantages of given types amplifier. 4. Compare given types of amplifier 	<ol style="list-style-type: none"> 4.1. Classification of amplifiers on the basis of voltage & power amplification 4.2. Power amplifiers: Class A, Class B, Class AB, and Class C, Push pull amplifiers: Working, advantages, disadvantages. 4.3. Complementary symmetry push pulls amplifier- working, advantages, disadvantages. Emitter coupled DC differential amplifier. 4.4. Darlington amplifier- circuit & working. 	08	12
5. Rectifiers & Filters	<ol style="list-style-type: none"> 1. Explain given type of rectifier with relevant waveforms. 2. Discuss various parameters of rectifiers. 3. Compare given types of rectifiers. 4. Explain given type of filter. 5. Discuss advantages and disadvantages of given filters. 	<ol style="list-style-type: none"> 5.1. Types of Rectifiers: Half Wave, Full Wave Rectifier (bridge and center tapped): circuit operation, input & output waveforms for voltage and current. 5.2. Parameters of rectifier: Average or DC value of current and voltage, ripple factor, ripple frequency, PIV of diode, TUF and efficiency of rectifier. 5.3. Filters- series inductor, shunt capacitor, L section & π -type – circuit, working, advantages and disadvantages. 	10	16
6. Electronic Devices & Circuits	<ol style="list-style-type: none"> 5. Explain the given type of feedback 6. State Barkhausen's Criteria 7. Explain working of given type of 	<ol style="list-style-type: none"> 6.1. Types of feedback: Positive feedback, Negative feedback. Barkhausen's criterion 6.2. RC Oscillators-Phase shift oscillator, Wien Bridge oscillator. LC oscillators- Hartley, Colpitt's & 	10	12

	oscillator with suitable diagram 8. Compare given types of oscillators 9. Solve numericals on oscillators 10. Draw block diagram & describe working of given electronic devices 11. Compare analog and digital multimeter	crystal oscillators: circuit diagram & working. Simple numericals. 6.3. Electronic emissions- Methods of emission, practical emitters. Construction & operation of CRO, method of deflection. 6.4. DMM-Block diagram, applications, comparison with analog multimeter.		
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SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Digital Electronics	04	4	6	2	12
2	Semiconductor Devices	08	2	6	8	16
3	Small Signal Amplifier	08	2	8	2	12
4	Large Signal Amplifiers	08	4	6	2	12
5	Rectifiers & filters	10	4	8	4	16
6	Electronic Devices & Circuits	10	2	6	4	12
	Total	48	18	40	22	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point Presentation, Transparencies, Expert Lectures.

LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS

Minimum eight (08) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	1	Study of logic gates and verify their truth tables.	2
2	2	Study & characteristics plotting of junction diodes.	2
3	2	Characteristics of a phototransistor.	2
4	2	Plotting input & output characteristics of BJT CB configuration.	2
5	2	Build Zener diode voltage regulator circuit. Determination of its regulation characteristics.	2
6	2	Study & characteristics plotting of SCR	2
7	3	Plotting input & output characteristics of BJT CE configuration.	4
9	3	Study of single stage transistor amplifier, measurement of its gain & plotting of its frequency response curve.	2

10	3	Study of multistage transistor amplifier (RC coupled), measurement of its gain & plotting of its frequency response curve.	2
11	4	Emitter coupled differential amplifier – study of its operation for common mode & differential mode.	2
12	5	Building of half wave, full wave & bridge rectifier circuit with & without shunt capacitor filter.	4
13	6	Study of RC-phase shift oscillator	2
14	6	Study of Front panel of CRO & Measurement of amplitude frequency, phase shift of signals on CRO also testing of basic electronic components	2

LEARNING RESOURCES:**A) Books:**

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Millman & Halkies	Elements of Electronics.	Prentice Hall of India, New Delhi.
2	V.K.Mehta	Principles of Electronics.	S. Chand & Co. New Delhi
3	B.L.Theraja	Electrical Technology. (Volume IV)	S. Chand & Co. New Delhi.
4	Bell, Devid	Fundamental of Electronic Devices and Circuits	Oxford University Press New Delhi, 2015
5	Baru, V., Kaduskar, R., Gaikwad S.T.	Basic Electronic Engineering	Dreamtech Press, New Delhi, 2015
6	Boylestead, Robert, Neshelsky, Louis	Electronic Devices and Circuit: An Introduction	PHI Learning, New Delhi

B) Magazines:

1. Electronics for you. 2. Digital Electronics.

(C) Web sites for references:

www.en.wikipedia.org.
www.electronics-tutorials.com
www.indianscientificinstrument.com
www.alldatasheet.com

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	2	-	-	-	1
CO2	2	1	1	-	-	-	2
CO3	2	2	1	-	-	-	-
CO4	3	2	1	-	-	-	-
CO5	3	3	2	2	1	1	1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE : INDUSTRIAL ELECTRONICS****COURSE CODE: R18EX2511****COURSE CATEGORY: ALLIED****CREDIT: 05****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	-	25	125

1. RATIONALE:

A diploma holder of Electrical Engineering has to deal with electronic components as they are part of any electrical system. In this course the student will learn about the SCRs as controllers, rectifiers & filters, inverters, timers & counters, regulated power supply, motor speed control & basics of microcontroller. This course is developed in such a way that, students will be able to apply the knowledge of electronic to solve engineering problems.

2. COURSE OUTCOMES:

After completion of this course the students will able to,

1. Discuss applications of SCR, SCR triggering & commutation methods
2. Describe speed control methods of DC & AC-motors
3. Explain different types of inverters and their operation
4. Experiment various digital electronic circuits
5. Use fixed, variable voltage regulators and stabilizers
6. Memorize basic concepts of 8051 microcontroller

Course Details:

Unit	Major Learning Outcomes (in cognitive domain)	Topics & subtopics	Hrs	Mks
I. Silicon Controlled Rectifier	5. Explain working of given controlled rectifier with R and R-L load. 6. Describe given triggering method of SCR with suitable diagram. 7. Compare given commutation methods of SCR Discuss specifications of SCR. 8. Explain temperature control circuit of SCR.	1.1.SCR-Introduction to SCR, SCR as a controlled rectifier, Control rectifier half wave using R-L load. Control rectifier FWFC using R & R-L load.	08	16
		1.2.Different Triggering methods of SCR, using R, RC & UJT.		
		1.3.Commutation- Forced & natural commutation methods. Methods of commutation: Class A, Class B, Class C, Class D, Class E, Class F.		
		1.4.SCR Specifications, Temperature control circuit using SCR.		
II. Motor Speed Control	4. Discuss need of soft starters 5. Explain given speed control method of DC shunt motor	2.1.Motor Control- soft start circuit, Need of soft starters	06	12
		2.2.Speed control of D.C. Shunt motor: Armature voltage control and field current control		

	<p>6. Explain working of given type of converters with neat diagrams</p> <p>7. Explain given speed control method of induction motor</p>	<p>2.3.Single phase half wave converter, semi-converter, full wave bridge converter for separately excited DC drives with continuous conduction mode: circuit, operation & waveforms</p> <p>2.4.Speed control of Induction motors: Different techniques used to control speed of motors.</p>		
III. Inverters	<p>4. Categories various types of inverter</p> <p>5. Explain working of given type of inverter with suitable diagram & waveforms.</p> <p>6. Compare given two types of inverters.</p>	<p>6.1.Introduction, Classification of Inverters</p> <p>2.2.Single phase Half bridge VSI inverters & full bridge Inverters with R & RL load: Circuit operation & waveforms</p> <p>2.3.Current source Inverter-single phase capacitor commutated with R- Load circuit operation and waveforms. Comparison between VSI and CSI.</p> <p>2.4.PWM Inverters-Half Bridge and full bridge : operation & waveforms</p> <p>2.5.Series and parallel Inverters using SCR: Circuit, operation & waveforms</p>	07	12
IV. Timers & Counters	<p>1. Describe give type of timer circuit.</p> <p>2. Explain working of given type of multivibrator with suitable diagram & waveforms</p> <p>3. Describe flip flops with their symbol & truth tables</p> <p>4. Explain working of given counter with suitable diagrams and truth table.</p>	<p>4.1.Introduction to electronics timer: IC-555, Pin diagram, functional block diagram and working. Advantages of electronic timer over other conventional timers. Different types of timers using BJT & SCR.</p> <p>4.2.Multivibrators: Astable, Monostable, Schmitt trigger using IC-555</p> <p>4.3.Flip flops: SR, JK, T & D type, master slave FF their symbol, truth table and race around condition</p> <p>4.4.Counters: Asynchronous & Synchronous block diagram, truth table and timing diagram. Divide by N-Counter</p>	10	16
V. Voltage Regulators	<p>1. Write specifications of given type of voltage regulator.</p> <p>2. Draw functional block diagram and pin-out of given voltage regulator IC.</p>	<p>5.1.Transistorized series and shunt voltage regulator: Circuit operation</p> <p>5.2.Fixed voltage regulators using IC 78XX & 79XX : circuit,</p>	08	12

& Stabilizers	3. Describe need of stabilizer and basic principal of operation. 4. Explain working of given type of stabilizer with suitable circuit diagram.	operation & waveforms		
		5.3. Variable voltage regulator using IC 723, Specifications, pin-out diagram, functional block diagram		
		5.4. A.C. Voltage Stabilizer-Need of stabilizer, basic principal of operation (buck & boost operation)		
		5.5. Types of stabilizer- relay type stabilizer, static or solid state stabilizer & servo controlled stabilizer : circuit & operation		
VI. Micro controller	1. Compare microprocessor & microcontroller 2. Discuss various types of memory 3. Draw architecture and pin-out diagram of 8051 microcontroller 4. Explain working of given blocks of 8051 architecture 5. Describe working of given pins of 8051- IC.	6.1. Comparison of Microprocessor, Microcontroller. Overview of 8051 family	09	12
		6.2. Terminology: - RISC, CISC Processors, Harvard and Von Neumann Architectures		
		6.3. Memory types:- PROM, EPROM, EEPROM, FLASH & NVRAM		
		6.4. 8051 pin description. Clock and reset logic, Block diagram of 8051 and description.		
		6.5. Register Bank and PSW, Internal and external memory organization, SFR's – Hardware addresses		

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

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
I	Silicon Controlled Rectifier	08	4	8	4	16
II	Motor Speed Control	06	4	6	2	12
III	Inverters	07	2	8	2	12
IV	Timers & Counters	10	2	8	6	16
V	Voltage regulators & Stabilizers	08	2	6	4	12
VI	Microcontroller	09	2	8	2	12
	Total	48	16	44	20	80

Legends: R = Remembrance; U = Understanding; A = Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

5. TEACHING METHODOLOGY: Chalk-Board, Group Discussion, Power Point Presentation, Videos, Expert Lectures.

6. LIST OF PRACTICALS / ASSIGNMENTS / EXPERIMENTS.

Minimum eight (08) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	I	SCR firing circuits	2
2	I	Controlled Rectifiers	2
3	II	Half wave Converter/semi-converter/full wave bridge converter	4
4	III	Series or parallel Inverter	2
5	IV	Astable/ Monostablemultivibrator using IC 555	2
6	IV	Study of Flip-flops	4
7	IV	Asynchronous or Synchronous counters	2
8	IV	Schmitt trigger using IC 555	2
9	IV	Timers using BJT/SCR	2
10	V	78XX & 79XX as voltage regulator	2
11	V	Transistorized series or shunt voltage regulator	2
12	V	IC 723 as voltage regulator	2
13	VI	Simple assembly language program on 8051 microcontroller	2

7. LEARNING RESOURCES:

A) Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Millman& Halkies	Elements of Electronics	Prentice Hall of India, New Delhi.
2	V.K.Mehta	Principles of Electronics	S. Chand & Co., New Delhi
3	P.S. Bhimbra	Power Electronics	Dhanpat Rai& Co., New Delhi
4	M.D.Singh K.B.Khanchandani	Power Electronics	Tata McGraw Hill Companies
5	M. A. Mazidi and J. G. Mazidi	The 8051 Microcontroller and Embedded Systems	Pearson Education Asia
6	Ajay V. Deshmukh	Microcontrollers –Theory and Applications	Tata McGraw Hill Companies
7	Anand Kumar	Fundamentals of Digital Circuit	PHI Learning, New Delhi

C) Magazines: Electronics for you.

D) Web sites for references:

www.en.wikipedia.org
www.electronics-tutorials.com
www.indianscientificinstrument.com
www.alldatasheet.com

8. CO-PO MAPPING :

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	2	2	3	1	-	-	2
CO2	3	3	1	1	-	-	2
CO3	2	2	1	1	-	-	2
CO4	2	2	2	1	-	-	2
CO5	3	3	1	1	-	-	2
CO6	2	2	1	1	-	-	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE: TOTAL QUALITY MANAGEMENT****COURSE CODE: R18ME2204****COURSE CATEGORY: ALLIED****CREDIT: 03****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS	TH	TEST	PR	OR	TW	TOTAL
1	2	--	--	--	--	@25	25	50

Rationale: Indian organizations are facing a challenge from the inflow of MNCs ever since the Government implemented the policies of linearization, privatization & globalization. In the light of this, there is a dire need of new ideas, approaches and techniques for attaining a competitive edge. The course aims at exposing various aspects of TQM like cost of quality, QC tools, Kaizen, quality circles, team work for quality, customer satisfaction, benchmarking, quality culture, quality standards and quality audit.

Course Outcomes: The students will be able to

1. Know about detail clauses of ISO 9000:2000 series
2. Know about the TQMEX model, Japanese 5 – S practice, Deming cycle, Juran’s trilogy, Kaizen etc.
3. Understand the concept of six sigma, total waste elimination, incoming material control.
4. Know old as well as new tool for quality improvement.

Course Details:

UNIT	NAME OF THE TOPIC	HRS
1	ISO 9000 : System, Management system, Quality management system, What is ISO 9000 series of standards? Structure, scope and approach of ISO 9000 (2000) series standards, 8 Quality management principles. ISO 9000:2000, Types of audit, Benefits and stages of Audits. Advantages and disadvantages of ISO 9000. Registration of ISO 9000, Validity of registration, Organizing the documentation. ISO 9001: ISO 9001:2000, Quality management systems – Requirements for quality assurance, Advantages of ISO 9001 (2000) , Reversed ISO 9001:2000 standard characteristic, Comparison of ISO 9001 (2000) and ISO 9001 (1994). Ten tips of moving to ISO 9001 (2000). ISO 14000 & ISO14001, Comparison of ISO14000 and ISO 9000, Why ISO 14001.	3
2	TQM : TQM – Definition, Aim, and guide line principles, salient features. Difference between ISO & TQM. The TQMEX model, Japanese 5-S practice, 5 pillars of TQM, Core concept of TQM- Quality for profit, Right first time. Acceptance Quality Level. Quality Gurus: Philip crossby, A.V. Feigenbaum, Ishikawa,	3

	<p>Shigeo shingo, Deming's 14 point methodology, Juran's quality trilogy.</p> <p>Kaizen :</p> <p>Concept of Kaizen, Kaizen v/s innovation, Kaizen and management process oriented and result oriented management. Company wide quality control (CWQC). Kaizen the practice. Deming cycle- PPCA cycle, PDCA cycle, SDCA cycle, Quality Control Circles. Types of Kaizen- Management, Group and Induction Oriented.</p>	
3	<p>Six Sigma:</p> <p>Introduction, concept, Quality approaches models, Belts in six sigma, six sigma cost and savings, eliminate waste (DMAIC), six sigma in manufacturing and six sigma in service industry. Zero defect programme.</p> <p>Quality Challenge facing Industry, Total Quality & Internationalism, Role of Govt. 9 M's affecting Quality. 4 Jobs of Quality Control. Role of Statistics in QC</p>	2
4	<p>Quality of Product Design and Development: Introduction, quality of design, Product development, FMEA, FMECA.</p> <p>Tools for Quality Improvement :</p> <p>Quality improvement, Methods of quality improvement, Break through sequence, Tally sheet, Graphs, Histograms, stratification, Scatter diagram, Pareto diagram, frequency distribution, flow chart, Brainstorming, 5 W & 1 H. New Q. Tools : Flow diagrams, Flow chart, Cause and effect diagram, Relations diagram, Tree diagram, Matrix flow diagram, Matrix data analysis diagram, Arrow diagram, Applications of new tools.</p>	3
5	<p>Incoming Material Control :</p> <p>Need, Principles of vendor relations in Quality, Pattern for incoming material control routine: - Purchase analysis, Vendor selection & order placement. Material receipt & material examination, material disposal. Vendor relations, Vendor ratings and Vendor quality ratings.</p> <p>Control Charts & Acceptance Sampling :</p> <p>Use of X & R chart, p chart. np Chart, c Chart for Quality Control. Sampling inspection, OC curve and terms in OC curve, uses of OC curve, IS 2500 for selection of sampling plans</p>	2
6	<p>Total waste Elimination:</p> <p>What is waste? Classes of wastages, Sources of waste, Waste identification, Steps of waste elimination, TWE methods.</p> <p>Achieving Total Commitment to Quality :</p> <p>Introduction, Total commitment to quality, Activities for achieving total commitment to quality, Quality education and training for total commitment to quality, Quality mindedness, Participative approaches for total commitment to quality, Other key approaches, Communication, motivation for development of TQM.</p>	3

Teaching Methodology: Discussions, Chalk-Board, Transparencies.

Term Work:

Skills to be developed:

- **Intellectual Skills :**
- Understand TQM Methodolgy.
- Report writing on ISO 9000, ISO 9001.
- Enhance learning to learn skills.

ii) Motor Skills :

- Preparation of power point presentation / Transperancies.

Assignments:

Twelve assignments consisting of at least one on each topic are to be completed

Professional Practices:

At least two topics from the syllabus have to be selected by group of student and they are supposed to give seminar / presentation.

One visit to a relevant industry and student will submit a reportof the visit as a part of term work.

Learning Resources:

Books:

SR.NO.	AUTHOR	TITLE	PUBLISHER
1	Dr. K. C. Arora	Total Quality Management	S.K. Kataria & Sons Pub., New Delhi.
2	Juran and Gryna	Quality Planning & Analysis	Tata McGraw Hill Publications, New Delhi.
3	Tapan P. Bagchi	ISO 9000	Wheeler Publications.
4	R.K. Jain	Engineering Metrology	Khanna Publications, New Delhi.
5	Poornima M. Charantimath	Total Quality Management	Pearson Education Pub., New Delhi.

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE : MARKETING MANAGEMENT****COURSE CODE: R18EE2302****COURSE CATEGORY: ALLIED****CREDIT: 03****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
01	02	-	-	-	-	@25	25	50

Rationale:

An engineer of any branch may be required to deal with marketing activity related with his field. This course covers the basic techniques used in the marketing management generally related with any field of application

Course Outcomes:

The student should be able to

1. Understand & apply the principles of market research & analysis
2. Summarize functions of marketing department& marketing network.
3. State the aspects of international marketing.
4. Conduct a market survey& write a report of market survey.
5. Use the various methods of Digital Marketing.

Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HOURS
1.	Introduction Marketing Management, process & functions. Developing marketing strategies. Marketing environment	1 a Identify the functions & processes of marketing	01
2.	Market Research & Sales forecasting Need of market research, Methods of data collection, sales forecasting, consumer behavior.	2.a Understanding the consumer requirement 2.b Interpretation of data that is collected.	03
3.	Market Planning Market positioning, market targeting, marketing strategy, product policy, branding, pricing & pricing strategy, Advertising, Case study	3.a Selection of suitable method of marketing by case study by surveying by considering these factors.	03
4.	Sales management International marketing- Setting objectives& deciding policies, development of sales force, sales organization Liberalization, need of International Marketing, process & Exim policy of Govt. of India.	4.a Report writing about the market survey conducted	04

5.	Digital Marketing Email -Marketing: Introduction, Using Email marketing Software, Building email list by quantity and quality, crafting email analyzing and tracking email marketing strategy. Internet Marketing: Basic Search engine optimization and search engine optimization techniques. Affiliate marketing: Introduction, Setting of an affiliate program, Gaining affiliates, tracking and reporting of affiliates, Affiliate plans, becoming an affiliate.	5.a Select and elaborate various methods of Digital Marketing.	05
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SUGGESTED EXERCISES/PRACTICALS

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	1	About My Self/ Marketing yourself.	02
2.	1,2	Preparation of Mind Map for any selected topic by the student.	02
3.	3	SWOT Analysis.	02
4.	4	Self /Personal evaluation.	02
5.	1,2,3,4	Team building Activity.	02
6.	1,2,3,4,5	A group of 4 to 5 students have to complete the following assignments. i. Select an existing /hypothetical product related with their discipline ii. Carry any market survey by preparing suitable questionnaire iii. Prepare & submit the report of above activities.	14

SPECIAL INSTRUCTIONAL STRATEGIES : Arrange the guest lecture on marketing management by the expert.

SUGGESTED LEARNING RESOURCES

C) Books

Sr. No.	Title of Book	Author	Publication (with year)
1.	Marketing Management 11 th Edition	Kotler Philip	Pearson Education India
2.	A Handbook on Marketing Management	Dr. V.O. Vorkey	Everest Publishers, Pune
3.	Email, Internet , Affiliate Marketing	-	The internet Marketing Academy.

Library Related Activity: *Find the book related to Marketing success story/ Motivation/ Business success story/Entrepreneur biography etc. and write down the conclusion in your own wordings.*

D) Websites

1. https://www.tutorialspoint.com/marketing_management/

2. <https://www.studocu.com/en/document/university-of-connecticut/intro-to-marketing-management/lecture-notes/lecture-notes-complete-revision-introduction-to-marketing-management/686989/view>
3. <https://www.slideshare.net/>
4. WWW.Bookboon.com

CO's - PO's mapping:

Course Outcome	Program Outcomes							PSO		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1: Understand & apply the principles of market research & analysis	1	2	-	3	2	3	3	1	-	-
CO2: Summarize functions of marketing department & marketing network	2	-	3	-	3	2	1	2	1	-
CO3: State the aspects of international marketing.	1	3	-	2	-	1	2	1	-	2
CO4: Conduct a market survey & write a report of market survey.	2	2	2	-	3	2	2	1	-	1
CO5: Use the various methods of Digital Marketing.	1	2	-	3	2	3	3	2	1	3

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE: ENTREPRENEURSHIP DEVELOPMENT COURSE CODE: R18EE2208****COURSE CATEGORY: ALLIED****CREDIT: 03****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
1	2	-	-	-	-	@25	25	50

@ Internal Examination

Rationale:

This course consists of topics related to the development of entrepreneurial skills and other details such as selection of product lines, site selection, financial aspects, personnel management, quality control and creative thinking. The course includes case studies in the related field. The course emphasizes the development of enterprising qualities among young engineers.

Course Outcomes:

CO1. Explain concept of and Difference between Entrepreneur and Intrapreneur.

CO2 Explain concept of, challenges in and theories of motivations with analysis of selected business idea.

CO3 Develop the ability of Creativeness **and** Innovation in Business Development.

CO4 Identify various business opportunities

CO5 Generate & use awareness about government and non-government agencies for promotion and development with enterprise management.

CO6 Prepare business plan for enterprise

Course Details:

UNIT	NAME OF THE TOPIC	LEARNING OUTCOME	HRS
UNIT NO.1	1.1 Introduction : Definition of entrepreneur, Concept of entrepreneur and Entrepreneurship, Importance of entrepreneur. Types of entrepreneur: Innovative, Imitative, Fabian, Drone and according to type of business. Difference between Entrepreneur and Entrepreneur. 1.2 Entrepreneurial Competencies: - Characteristics of an entrepreneur, qualities of an entrepreneur, competencies of entrepreneur. 1.3 Women Entrepreneur: Definition,	1. Explain concept of entrepreneur and entrepreneurship. 2. State characteristics and qualities of. entrepreneur 3. Difference between Entrepreneur and Intrapreneur. 4. Explain Women entrepreneurship with examples. 5. Discuss causes of limited growth of Women entrepreneurship.	03

	characteristics of women entrepreneur. Causes of limited growth in India, remedies for limited women Entrepreneurship development.		
UNIT NO.2	2.1 Motivation : Definition and concept of motivation, types of motivation: affiliation, power, and achievement motivation. Need and importance of achievement motivation. Challenges of motivation. Motivating factors. Theories of motivation: a) Maslow Hierarchy theory, b) Mc Gregory X-Y theory.	1. Explain concept of motivation and types of motivation. 2. Explain challenges of motivations. 3. Explain theories of motivations.	02
UNIT NO.3	3.1 Creativity and Innovation : Definition and concept of Innovation. Definition and concept of Creativity. Characteristics of creative people. Discussion of various examples with respect to creativity and innovation.	1. Explain concept of Innovation and Creativity. 2. Discuss characteristics of creative people. 3. Discuss various examples of Innovation and Creativity.	02
UNIT NO.4	4.1 Business Opportunity Search and Scanning: Opportunities available in different sectors such as manufacturing, services and trading. Classification of opportunities on the following: - Natural resource based, Demand based, Local industrial based, Service sector based, Export based, Skill based, Off-farm based. 4.2 Business Idea : Search for business idea, sources of business idea, ways of generating ideas, Ideas processing & selection (factors affecting product idea). SWOT Analysis. 4.3 Sources of Business Idea : Market survey & techniques, prospective consumers, development in other nation, study of project profile, government organization, trade fair and exhibitions. Checklists for information collection.	1. Discuss the Business Opportunities. 2. Describe classification of opportunities. 3. Explain search and generation of business idea. 4. Discuss Sources of Business Idea.	03
UNIT NO.5	5.1 Government and Non-Government Agencies for Promotion and Development: Importance of funds, types of funds. Various schemes of assistance of Government, Government policies and incentives. Registration with various Government agencies, definition of SSI and Ancillary.	1. Discuss Government and Non-Government Agencies associated with entrepreneurship. 2. State importance of funds and government fund schemes. 3. Explain SSI and Ancillary.	02
UNIT NO.6	6.1 Business Plan Preparation : Project identification, project formulation, feasibility analysis, Estimation of cost of production, Cost volume profit relationship at different levels, Interpretation of financial statements, Institutionalized and Non-	1. Explain concept of Business Plan. 2. Explain project formulation and analysis. 3. State sources of capital. 4. Calculate cost of production.	02

	institutionalized sources of working capital, Funds flow statements, Loan application form for appraisal. Project report preparation.	5. Describe cost volume profit relationship. 6. Calculate cost of production. 7. Discuss loan application form for appraisal.	
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SUGGESTED EXERCISES/PRACTICALS:

S. No.	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx. Hrs. Required
1.	I	Biography of any entrepreneur	02
2.	I	Self Disclosure Exercise (Who am I?)	02
3.	II	Self rating questionnaire.	02
4.	III	Thematic Appreciation Test (TAT)	02
5.	III	Ring Toss Exercise	02
6.	III	Tower Building Exercise	02
7.	II	Convince and Crown	02
8.	III	Creativity and Problem solving	02
Professional exercises			
9.	IV	Walking through Market [Experience sharing after activity]	04
10.	V, VI	Business plan preparation	04
11.	I, V, VI	Interview of a successful entrepreneur	02
12.	I	Interview / Biography of a successful women entrepreneur	02
Total			28

MAJOR EQUIPMENT/INSTRUMENT REQUIRED:

Sr. No.	Equipment Name With Broad Specifications	Exp. Sr. No.
1.	LCD Projector	ALL
2.	Rings, Pegs, one Line Marker	5 each
3.	Work Table	5,6
4.	Wooden Blocks, Sticks	6

TEACHING METHODOLOGY:

Chalk Board, Discussions, Power Point Presentations, Videos, Expert Lectures and Visits.

i) Intellectual Skills:

- Identify various opportunities in market.
- Identify individual's entrepreneurial competencies.
- Interpret risk to be taken during a task.
- Interpret SWOT of individual.
- Prepare a report of business plan.
- Enhance/Improve presentation and writing skills.

ii) Motor Skills:

- Presentation Skills
- Use of multi media

SUGGESTED LEARNING RESOURCES:

E) REFERENCE BOOKS:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	Vasant Desai	Dynamics Of Entrepreneurial Development And Management.	Himalaya Publishing House, 1997, Reprint-1999.
2.	Dilip M. Sarwate	Entrepreneurial Development Concept and Practices	Everest Publishing House, 1996
3.	Gupta Srinivasan	Entrepreneurial Development	Sultan Chand & Sons, 1993.
4.	D. D. Mali	Training of Entrepreneurship and Self Employment.	Mittal Publications, 1999.

Library Related Activity: Find the book related to Motivation/ Business success story/ Entrepreneur biography etc. and write down the conclusion in your own wordings.

Mapping matrix of CO's, PO's and PSO's:

CO's	PO1 Basic knowledge Discipline specific knowledge	PO2 Problem analysis	PO3 Design/ development of solutions	PO4 Engineering Tools, Experimentation and testing	PO5 Engineering practices for society, sustainability & environment	PO6 Project Management	PO7 Life long learning	PSO1: Electrical Engg. Skills and Lab Skills for Testing and Maintenance.	PSO2: Estimate and interpret data related to Electrical Engg. System	PSO3: Apply Electrical Engg. Knowledge to work professionally in team, or lead team.
CO1. Explain concept of and Difference between Entrepreneur and Intrapreneur.	1	1	-	1	-	2	2	-	1	2
CO2 Explain concept of, challenges in and theories of motivations with analysis of selected business idea.	1	2	1	1	1	2	2	1	1	1
CO3 Develop the ability of Creativeness and Innovation in Business Development.	1	-	2	1	1	2	3	-	-	1
CO4 Identify various business opportunities	1	-	-	-	-	3	2	3	-	1
CO5 Generate & use awareness about government and non-government agencies for promotion and development with enterprise management.	1	1	1	-	-	2	2	-	-	2
CO6 Prepare business plan for enterprise	-	1	1	1	2	2	3	-	1	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course: Electrical Engineering Material and Appliances****Course code: R18EE3301****Course Category: Core****Credit : 07****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
3	4	03	80	20	-	-	50	150

RATIONALE: An Electrical Engineering diploma passed student learns through this course knowledge of Electrical Engineering Materials for performing various duties such as wiring contractor, installation supervisor, Insulation inspection for installations, equipment, instruments. Also diploma holder in Electrical Engineering will be involved in installation, operation, and maintenance and testing. This subject covers things which are needed in everyday application. Knowledge of various types of domestic appliances will be useful for maintenance, fault finding and testing of appliances.

COURSE OUTCOMES: The student will be able to -

1. Understand the properties, select the conducting and special purpose materials for appropriate applications.
2. Understand the properties, select the insulating materials for appropriate applications.
3. Understand the properties, select the magnetic materials for appropriate applications.
4. Understand the construction, working and fault detection of various types of commonly used domestic appliances.
5. Understand the construction, working and fault detection of various types of commonly used motor operated appliances.
6. Understand the construction, working and fault detection of special domestic appliances.

COURSE DETAILS:

Unit No.	Unit Learning outcome	Course Content	Hrs	Mks
1. Conducting materials	1. Classify low resistivity and high resistivity materials. 2. Understand and remember properties and applications of various conducting materials. 3. Select proper material for appropriate application.	1.1 Resistivity and factors affecting resistivity. Temperature coefficient of resistance. Properties of conductors: Mechanical properties, Electrical properties, economic factors, Characteristics of good conductor material. 1.2 Commonly used conductor materials used for overhead lines, conductor material used for underground cables, electrical machines windings: Properties and electrical uses of Low and High resistivity materials. Low resistivity materials and alloys: Copper, Aluminium and steel, ACSR conductors. Copper alloys- Brass, Bronze, cadmium & beryllium. Mercury, silver, zinc, lead, nickel, selenium, tin 1.3 High resistivity alloys: Tungsten, Carbon, Nichrome, Manganin, Eureka, platinum, Constantan. Superconductivity: theory of superconductivity, superconductor materials,	10	12

		<p>applications.</p> <p>1.4 Special purpose materials: Bimetal, Soldering materials, fuse materials, thermocouple materials, Contact materials, Applications of special purpose material.</p>		
2. Dielectric and Insulating materials.	<p>1. Select the dielectric and insulating materials according to their properties and applications of various Dielectric materials.</p> <p>2. Choose the insulation for application according to temperature range, environment conditions and physical conditions</p>	<p>2.1 Dielectric strength, factors affecting the dielectric strength, Dielectric loss, factors affecting dielectric loss, Dielectric constant.</p> <p>2.2 Applications of dielectrics: Impregnated paper capacitor, Electrolytic capacitors</p> <p>2.3 Properties of insulating materials:</p> <p>1.Electrical Properties: Volume resistivity, surface resistance, dielectric loss, dielectric constant. Concept of Breakdown Voltage Strength, Factors affecting Breakdown voltage of an Insulating Material & Methods to determine Breakdown voltage.</p> <p>2.Visual properties: Appearance, colour, crystallinity</p> <p>3.Mechanical properties: Viscosity, Porosity, Solubility</p> <p>4.Thermal properties: Thermal stability, Melting point, Flash point, Volatility, Thermal conductivity, Thermal expansion, Heat resistance</p> <p>5. Physical properties: compressive strength, abrasive resistance.</p> <p>6. Chemical properties: Solubility, Chemical resistance, Resistance to external chemical effects, chemical changes in the material, Hygroscopicity, Ageing.</p> <p>2.4 Classification of insulating materials: Thermal classification- Classification according to permissible temperature rise, effect of overheating on the life of electrical insulation, Physical classification (solid, liquid and gaseous). Classification on structure of materials as cellulose, fibrous, organic inorganic, natural or synthesis. Factors affecting the failure of insulating materials.</p>	08	16
3. Insulating materials and Magnetic Materials	<p>1. Choose the plastic insulation for application according to temperature range, environment conditions and physical conditions.</p> <p>2. Understand and remember</p>	<p>3.1 Classification of insulating materials:</p> <p>3.1.1 Solid – Fibrous, Ceramic, Mica, Glass, Rubber, Resins - Natural resins: Amber, wood, shellac. Synthetic resins: Thermo setting materials: Bakelite, silicon resins, epoxy resins, phenol formaldehyde, amino resin with their properties and application.</p> <p>Thermo plastic materials: PVC (Polyvinyl chloride), Perspex, polythene, Fibre glass reinforced plastic, enamel, Prespahn[feldspar] and Latheroid , bitumen, XLPE- Cross Link Poly Ethylene with their properties and</p>	08	12

	<p>properties and applications of various types of magnetic materials used in electrical systems.</p> <p>3. Select proper material for appropriate application.</p> <p>4. Compare between hard and soft magnetic material.</p>	<p>applications.</p> <p>3.1.2 Liquid – Minerals, Synthetic, Special</p> <p>3.1.3 Gaseous – Air, Hydrogen, Nitrogen, sulphur hexafluoride.</p> <p>3.2 Insulating Varnishes: General properties and applications of insulating varnishes, electrical properties required, types of varnishes, applications.</p> <p>3.3 Coolents used in Electrical machinery: Necessity, type, properties and applications (Air, hydrogen, Nitrogen, SF₆)</p> <p>3.4 Mineral oils: Properties of good insulating oils, Use of oil in transformer.</p> <p>Properties and applications of Carbon tetrachloride, pyranol.</p> <p>3.5 Classification of magnetic materials: Diamagnetic, Paramagnetic and Ferromagnetic materials. Magnetisation characteristics, hysteresis, hysteresis loss, Magnetostriction, Loss of magnetism, Hysteresis loop for different ferromagnetic materials.</p> <p>3.5.1 Soft magnetic materials: Properties and applications</p> <p>Ferromagnetic materials:</p> <p>High silicon alloy steel and low silicon alloy steel, cold rolled grain oriented and non oriented steel, Nickel iron alloy, soft ferrites.</p> <p>3.5.2 Hard magnetic materials: Properties and applications.</p> <p>Tungsten steel, chrome steel, cobalt steel, Alnico, Hard ferrites.</p> <p>Permanent magnets: Alnico, Hard ferrites</p> <p>Applications of magnetic materials.</p>		
4. Construction, Working and Faults finding in Electrical Domestic appliances	<p>1. Repair electrical appliance.</p> <p>2. Select appropriate appliance from wide range.</p> <p>3. Handle & maintain electrical appliance.</p>	<p>4.1 Construction, Working, possible faults & their location. Maintenance of commonly used appliances e.g., steam iron, storage water heater, electric toaster & hair dryer etc. (some of the appliances to be studied in practical)</p> <p>4.2 Calculation of rating of a water heater.</p> <p>4.3 Standard specifications of appliances available in the market.</p> <p>4.4 Purpose of using appliances, components common to all appliances – various insulating materials, switches, timers, heating elements (properties & materials used for heating elements), thermostats.</p> <p>4.5 Bells- Types, construction & operation.</p> <p>4.6 Construction & working of Room Cooler, and OTG [Oven Toaster Griller].</p>	08	16
5. Electric Fans and Motors used in	<p>1. Identify appliance motors.</p> <p>2. Locate electrical faults with different</p>	<p>5.1, General construction of appliance motors, Types of bushings and bearings.</p> <p>5.2 Necessity of earthing of the appliances.</p> <p>How a person is saved from getting an electric shock by providing earthing.</p>	08	12

appliances	methods. 3. Calculate no. of fan	5.3 Use of megger, multi meter and series test lamp for detecting various types of faults in the appliances. 5.4 Fans: Types, construction and working of table and ceiling fans, Exhaust fan, Tower Fan. Standard specifications and methods of speed control. Air movement at various places. Calculations of no. of fans at given location.		
6. Special Domestic Appliances	1. Operate special appliance. 2. Select appropriate special appliance from wide range.	6.1: Microwave oven, Washing Machine, and Emergency lighting system, Solar based house lighting system and fuzzy controller refrigerator- Construction, operation. 6.2 Uninterrupted Power Supply (UPS) and calculation of Battery capacity.	06	12

SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Conducting Materials	10	4	6	2	12
2	Dielectric and Insulating materials	08	2	6	8	16
3	Insulating materials and Magnetic Materials	08	2	8	2	12
4	Construction, Working and Faults finding in Electrical Domestic appliances	08	4	6	2	16
5	Electric Fans and Motors used in appliances	08	4	8	4	12
6	Special Domestic Appliances	06	2	6	4	12
	Total	48	18	40	22	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point Presentation Transparency.

LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS :

Minimum twenty (20) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1.	1	Collect the different type of conducting materials. Making a comparison chart of A) Low resistivity materials B) High resistivity materials.	02

2.	1	Measure conductor resistance of cables using Kelvin's double bridge.	02
3.	1	Use the Wheatstone's bridge to measure resistance of a conductor bundle (to determine per unit length resistance).	02
4.	2	Collect the different types of insulating materials. Make a chart on thermal classification.	02
5.	2	Use the Megger to measure insulation resistance of cables.	02
6.	2	Select insulating materials for specific applications from given samples(at least five).	02
7.	2	Dielectric strength test of one insulating oil sample.	02
8.	3	Collect the different type of Magnetic materials. Making a comparison chart of A) Ferromagnetic materials B) Hard Magnetic materials.	02
9.	4	Dismantling & assembly of Room heater to understand the construction, working, fault finding & maintenance of appliance and corresponding reports of it.	04
10.	4	Dismantling & assembly of the Immersion heater to understand the construction, working, fault finding & maintenance of appliance and corresponding reports of it.	04
11.	4	Dismantling & assembly of the Electric Bell to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
12.	4	Dismantling & assembly of the Simple & Automatic Toaster to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
13.	4	Dismantling & assembly of the Geyser to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
14.	4	Dismantling & assembly of the Simple & Automatic iron to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
15.	4	Dismantling & assembly of the Electric Oven/Microwave oven to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
16.	4	Dismantling & assembly of the Vacuum cleaner to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
17.	5	Dismantling & assembly of the Electric Fan to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
18.	5	Calculations of no. of Electric fans at given location and prepare the accessories required for these fans.	02

19.	5	Test / measure earthing system resistance of a building.	02
20.	6	Dismantling & assembly of the Washing machine to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
21.	6	Dismantling & assembly of the Refrigerator to understand the construction, working, fault finding & maintenance and corresponding reports of it.	04
22.	6	Trace the circuit of Emergency light. List components used in it. List the faults occurred in emergency light and remedies on these faults.	02
23.	6	Trace the circuit of Emergency light. List components used in it. List the faults occurred in UPS and remedies on these faults.	02
24.	5	Trace the circuit of Emergency light. List components used in it. List the faults occurred in Solar based lighting system and remedies on these faults.	02
25.		Prepare switch board containing five switch five socket arrangements (with fuse, indicator, internal wiring etc.).	04

STUDENT'S ACTIVITY:

1. The students have to collect data sheets of any one type of conducting, insulating and magnetic materials and prepare the comparison Chart pertaining to their specifications.
2. A group of 3 to 5 students should collect the information brochure of any one electrical appliance from market and prepare a comparative statement and should present it as a part of Term work.
3. Trace the connection diagram of control circuit of any equipment in the electrical laboratory.

LEARNING RESOURCES:

A) Books:

Sr. no.	Title of the Book	Author	Publisher
1.	Electrical engineering materials	N. Alagappan	TTTI, Madras
2.	Electrical engineering materials	M.L.Gupta	Dhanpatrai and Sons
3	Study of Electric Appliances	K.B.Bhatia	Khanna Pub., New Delhi
4	Basic Shop Practice	Anwani, Hans	

B) Magazines: IEEE Journal. Power line

C) Web sites for references: www.dlsweb.rmit.edu.au
www.researchgate.net

D) CO-PO MAPPING:

CO \ PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	g Tools, Experimentation and g practices for society, sustainability and environment	Project Management	Life-long learning	
1. Select the properties and applications of different conducting materials and special purpose materials.	3	2	-	-	2	-	1
2. Select the properties and applications of different insulating materials.	3	2	-	-	2	-	1
3. Select the properties and applications of different insulating materials and magnetic materials.	3	3	-	-	2	-	1
4. Understand the construction, working and fault detection of various types of commonly used domestic appliances.	3	2	-	2	2	-	1
5. Understand the construction, working and fault detection of various types of commonly used motor operated appliances.	3	2	-	2	2	-	1
6. Understand the construction, working and fault detection of special domestic appliances.	3	2	-	2	2	-	1

COURSE: MECHANICAL ENGINEERING
COURSE CATEGORY: CORE

COURSE CODE: R18ME 3302
CREDIT: 05

Teaching and Examination Scheme:

Teaching Scheme		Examination Scheme						
TH	PR	PAPER HRS.	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	--	-	25	125

RATIONALE:

A diploma holder in Electrical Engineering has to deal with Mechanical system and its components while controlling the Electrical systems & its equipments. In this course the student will learn about the basics, construction and working of the various types of refrigeration and Air-conditioning, power producing devices, hydraulic and pneumatic ,material science and its properties, shear force and bending moment diagram and power transmission.

COURSE OUTCOMES:

1. Know the concept & working of refrigeration and air conditioning system.
2. Apply testing methods for mechanical properties of metal.
3. Understand the fundamentals of fluid mechanics and fluid flow.
4. Draw SFD and BMD diagram and know heat treatment & power metallurgy processes.
5. Demonstrate two strokes and four strokes I.C. Engine.
6. Use of various hydraulic and pneumatic systems.

COURSE DETAILS:

Unit	Topics & Subtopics	Major Learning Outcomes (in cognitive domain)	Hrs.	Mks
1. Refrigeration and Air Conditioning	<p>1.1. Refrigeration: Principle of refrigeration, definition of refrigeration, necessity and applications of refrigeration, unit of refrigeration, energy efficiency ratio, coefficient of performance (COE), reversed Carnot cycle.</p> <p>1.2. Vapour Compression Cycle: Principle, working of vapour compression cycle, simple vapour compression refrigeration (VCR) system, layout of components and representation of VCR cycle on P-H and T-S diagram, refrigerants & desirable properties of it.</p> <p>1.3. Air Conditioning: Definition, need, applications, Psychrometric - Composition of air, Dry bulb and wet bulb temperature, dew point temperatures, Humidity ratio, relative humidity, degree of saturation, enthalpy of moist air.</p>	<p>1. Explain the principle of refrigeration.</p> <p>2. Write applications and need of refrigeration system.</p> <p>3. Describe the unit of refrigeration.</p> <p>4. Describe energy efficiency ratio, COE & reverse Carnot cycle.</p> <p>5. Explain principle and working of vapour compression cycle.</p> <p>6. Draw diagram of simple vapour compression system and show various components.</p> <p>7. Describe P-H & T-S diagram for simple vapour compression system.</p> <p>8. Define refrigerants and its desirable properties.</p> <p>9. Write need of air conditioning with its applications.</p> <p>10. Explain various</p>	10	16

	Psychometric Chart-various lines.	compositions of air and different psychometric lines.		
2. Mechanical Properties and Testing of Materials	<p>2.1 Mechanical Properties of Metal: Elasticity, ductility, malleability, brittleness, toughness, hardness, formability & weld ability.</p> <p>2.2 Testing of Material: Stress strain curve, elastic limit, plastic limit, yield point, ultimate stress & Hook's law. Destructive, non-destructive testing, tensile, compressive, fatigue, impact & hardness test, magnetic crack detection, ultrasonic, radiographic tests.</p> <p>2.3 Ferrous and its Alloys: Classification of plain carbon steel. Steel alloy-nickel, chrome, tungsten & silicon steel.</p> <p>2.4 Non Ferrous & its Alloys: List non ferrous metal. Non ferrous alloy-Brass & Bronze</p>	<p>1. Define the following terms, Elasticity, ductility, malleability, brittleness, toughness, hardness, formability & weld ability.</p> <p>2. Draw stress strain diagram and show various elements of it.</p> <p>3. Explain the Hook's law.</p> <p>4. Differentiate between destructive and non destructive testing.</p> <p>5. Describe the following testing, tensile, compressive, impact, hardness test, magnetic crack detection, ultrasonic, radiographic tests.</p> <p>6. Classify plain carbon steels and explain steels alloys.</p> <p>7. Describe brass and bronze non ferrous alloys.</p>	06	12
3. Fluid Mechanics	<p>3.1 Introduction to Fluid Mechanics: Define hydrostatics, hydro kinematics & hydrodynamics, its examples.</p> <p>3.2 Hydrostatics: Properties of liquid, viscosity, surface tension, compressibility, vapour pressure etc.</p> <p>3.3 Pressure of Liquid: Concept, pressure head of liquid, vacuum & absolute pressure.</p> <p>3.4 Measurement of Pressure: Simple manometer-tube manometer.</p> <p>3.5 Fundamentals of Fluid Flow: Types of fluid flow, rate of discharge, Bernoulli's theorem, its application, venturimeter, orifice meter and pilot tube. Concept of hydroelectric power plant, hydraulic turbines.</p>	<p>1. Define hydrostatics, hydro kinematics & hydrodynamics, its examples.</p> <p>2. List the properties of fluids.</p> <p>3. Describe viscosity surface tension, compressibility, vapour pressure.</p> <p>4. Explain concept of pressure head of liquid, vacuum & absolute pressure.</p> <p>5. Explain simple manometer-tube manometer with diagram.</p> <p>6. State different types of fluid flow.</p> <p>7. Describe Bernoulli's theorem, its applications.</p> <p>8. Explain the venturimeter, orifice meter and pilot tube.</p> <p>9. Concept of hydroelectric power plant, hydraulic turbines.</p>	08	12

4. Heat Treatments , Power Metallurgy & Shear Force & Bending Moment	4.1 Heat Treatments Processes: Types of heat treatments, need of heat treatments, annealing, normalizing & hardening with diagram. 4.2 Power Metallurgy: Importance & limitations, processes, electrical applications. 4.3 Shear Force & Bending Moment: Concept of shear force and bending moment diagram, torsion, simple problems.	1. List different heat treatment processes. 2. Describe various purposes of heat treatments. 3. Explain annealing, normalizing & hardening with diagram. 4. Explain powder metallurgy and its main steps of manufacturing. 5. State and explain concept of shear force and bending moment diagram. 6. Simple numerical on shear force and bending moment diagram, torsion.	08	12
5. I.C. Engine	5.1 Internal Combustion Engines: Classification, Construction & working, terminology, 2-stroke & 4-stroke engine, 4-stroke petrol engine working, 4-stroke diesel engine working, Otto & diesel cycle with P-V & T-S diagram, maintenance & faults. 5.2 Testing of I.C. Engine: Indicated power & measurement, break power, frictional power, mechanical efficiency of I.C. engine, calculation of IHP, BHP & FHP, and heat balance sheet.	1. Classify I.C. engines. 2. Explain construction and working of 2 strokes & 4 stroke engine. 3. Differentiate between 2 strokes and 4 strokes engine. 4. Describe Otto & diesel cycle with P-V, T-S diagram. 5. Explain indicated, break & frictional power and its calculations. 6. Describe mechanical efficiency and meaning of balance sheet.	10	16
6. Hydraulic, Pneumatic & Welding	6.1. Hydraulic System: Introduction, applications, construction & working of hydraulic system, basic components of hydraulic system, purpose of components, symbols, simple circuit diagram. 6.2. Pneumatic System: Introduction, applications, construction & working of pneumatic system, basic components of pneumatic system, purpose of components, symbols, simple circuit diagram. 6.3. Welding Processes: Classification, working principle & set up of gas, arc, and resistance welding. Difference.	1. Explain construction and working of hydraulic system with neat sketch. 2. List and explain various components of hydraulic system along with its symbols. Draw and describe simple circuit diagram of hydraulic system and state purpose of each component. 3. Describe construction and working of pneumatic system with its various components and symbols. 4. Classify and explain working principle, set up of gas, arc & resistance welding.	06	12
Total			48	80

SUGGESTED SPECIFICATION TABLE:

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Refrigeration and Air Conditioning	10	4	6	6	16
2	Mechanical Properties and Testing of Materials	06	2	6	4	12
3	Fluid Mechanics	08	2	6	4	12
4	Heat Treatments, Power Metallurgy & Shear Force & Bending Moment	08	4	6	2	12
5	I.C. Engine	10	4	6	6	16
6	Hydraulic, Pneumatic and Welding	06	2	6	4	12
	Total	48	18	36	26	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point Presentation, Expert lectures.

LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS:

Minimum eight (08) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	1	Trial on Vapour compression cycle test rig.	2
2	1	Trial on Air-conditioning test rig.	2
3	2	Determine harness of material by BHN test.	2
4	2	Determine toughness of material by IZOD impact test.	2
5	3	Determination of coefficient of discharge by venturimeter.	2
6	3	Determination of coefficient of discharge by Orifice meter.	2
7	3	Study of pressure measuring devices.	2
8	3	Trial on hydraulic turbine.	2
9	4	Trial on Diesel engine test rig./Find IHP,BHP &FHP of I.C. engine.	2
10	6	Study of Industrial hydraulic components.	2
11	6	Study of Industrial pneumatic components.	2
12	6	Demonstrate of Industrial hydraulic/pneumatic system.	2
13	6	Study of simple hydraulic and pneumatic circuit.	2

LEARNING RESOURCES:**B) Books:**

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	C. P. Arora	Refrigeration & Air Conditioning	Tata McGraw Hill Publications, New Delhi.
2	R.K. Rajput	A Textbook of Refrigeration & Air Conditioning	S.K. Kataria & Sons Publishers, New Delhi.
3	V.D.Kodgire	Material science and Metallurgy	Everest Publication, Pune.
4	R.K.Bansal	Fluid Mechanics	Khanna Publication, New Delhi.
5	Ramamrutham	Strength of Material	Dhanpatrai & Company, New Delhi
6	V.Ganeshan	I.C.Engine	McGraw Hill Publications, New Delhi.
7	S.R. Majumdar	Hydraulic & Pneumatic systems	McGraw Hill Publications, New Delhi.

(B) Web sites for references:

<https://www.youtube.com/watch?v=cobFAMZDS0o>

<https://www.youtube.com/watch?v=h5wQoA15OnQ>

<https://www.youtube.com/watch?v=sfjK1GZ2W9A>

https://www.youtube.com/watch?v=qbyL--6q7_4

<https://www.youtube.com/watch?v=fTAUq6G9apg>

<https://www.youtube.com/watch?v=rlK7JIAz9WY>

Mapping Matrix of CO's, PO's and PSO'S:

CO's	PO1 Basic knowledge Discipline specific	PO2 Problem analysis	PO3 Design/	PO4 Engineering Tools, Experimentation	PO5 Engineering practices for society	PO6 Professionalism	PO7 Lifelong learning	PSO1 Applying fundamentals of mechanical engineering and	PSO2 Communicating effectively to work as a team member	PSO3 Pursuing higher studies and
CO1	1	0	0	1	1	0	2	1	1	2
CO2	1	1	0	2	1	0	1	1	1	2
CO3	1	1	0	1	1	0	2	1	1	2
CO4	1	1	0	1	0	0	1	1	1	2
CO5	1	1	0	1	1	0	1	1	1	2
CO6	1	1	0	1	0	0	1	1	1	2

3: High 2: Moderate and 1: Low Relationship

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course: DC Circuits and DC Machines****Course code : R18EE3303****Course Category: Core****Credits : 05****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	50@	-	25	175

RATIONAL: In this course the student will understand the concept of electric circuits. This course will also help the students to learn various types of electrical circuits.

COURSE OUTCOMES: After completion of this course the students will be able to,

1. Know the concept of laws applicable to electrical circuits.
2. Calculate various circuit parameters by applying laws and theorems.
3. Understand the theorem applicable to dc circuits.
4. Know and understand the construction, working of DC generator.
5. Understand the operation and controls related to DC motor.
6. Operate and choose starter and speed control technique for DC motor.

Course Details:

Unit	Learning Outcomes	Topics & subtopics	Hrs	Mks
1. Fundamentals of Electrical Engg.	<ol style="list-style-type: none"> 1. Describe ohms law Fleming's right hand rule, Fleming's left hand rule, Right hand grip rule 2. Solve numerical on electrical work, power and energy. 3. Define- Electric field, electric field intensity, electric flux density. 4. Mathematical expression and combination of capacitor. 	<ol style="list-style-type: none"> 1. Fundamentals of Electrical Engineering – <ol style="list-style-type: none"> 1.1. Concept of Current, Voltage. 1.2. Ohms law. 1.3. Dot & Cross convention for current flow. 1.4. Fleming's right hand rule. 1.5. Fleming's left hand rule. 1.6. Right hand grip rule [cork screw rule]. 1.7. Right hand grip rule for solenoid. 2. Concept of electrical work, power, energy with simple Numerical. 3. Electrostatics – <ol style="list-style-type: none"> 3.1. Laws of electrostatics. 3.2. Unit of charge. 3.3. Electric field. 3.4. Electric field intensity. 3.5. Electric flux density. 3.6. Equipotential surfaces. 4. Capacitor- <ol style="list-style-type: none"> 4.1. Mathematical expression of capacitor. 4.2. Charging and discharging of capacitor. 4.3. Series & parallel combinations of capacitor. 	08	12

2. DC Circuits	<ol style="list-style-type: none"> Describe Kirchhoff's law, loop & nodal analysis. Define Ideal & Practical sources Solve numerical on conversions (Voltage & Current). Solve numerical on Star – Delta conversion. 	<ol style="list-style-type: none"> D.C. Circuits – <ol style="list-style-type: none"> Network Terminology Kirchhoff's laws Loop & Nodal analysis Cramer's rule method. Ideal & practical voltage & current sources. Conversion of voltage & current sources. Delta to star & star to delta conversion. (Numerical based on these conversions) 	08	12
3. Network Analysis	<ol style="list-style-type: none"> Study of type of Theorems & Solve numerical on Mesh analysis. Solve numerical on Node analysis. Solve numerical on Superposition theorem & thevenin's theorem. State and explain thevenin's theorem. State and explain norton's theorem. Numerical based on maximum power transfer theorem. 	<ol style="list-style-type: none"> Mesh analysis Node analysis Superposition theorem Thevenin's theorem Norton's theorem Maximum power transfer theorem. 	08	16
4. Fundamentals of DC Machines	<ol style="list-style-type: none"> Explain constructional parts of D.C. Machine. Derive EMF equation of DC generator and explain types of D.C Generator Explain armature reaction with neat diagram. Solve numerical on Remedies to reduce armature reaction and improve commutation 	<ol style="list-style-type: none"> D.C. machine- <ol style="list-style-type: none"> Construction & Working principle. D.C. Generators – <ol style="list-style-type: none"> Construction & Working principle. EMF equation Types of D.C Generator. Armature reaction & commutation in DC generator. Remedies to reduce armature reaction and improve commutation (Numerical) 	08	16

5. DC Motors	<ol style="list-style-type: none"> 1. Explain concept of back EMF in dc motor and derive torque equation of DC motor. 2. Draw and explain characteristics of different types of DC motor. 3. What is armature reaction & commutation in DC Motor. 4. Describe the losses in DC machine, Deduce the condition for maximum efficiency of a D.C Machine. 	<ol style="list-style-type: none"> 1. D.C. Motors – <ol style="list-style-type: none"> 1.1. Operation of D.C Motor. 1.2. Torque equation 1.3. Concept of back EMF. (Numerical) 2. Types of D.C Motors & Characteristics of DC Motors. 3. Armature reaction & commutation in DC Motor. 4. Losses & efficiency calculations of DC Generator & Motor (Numerical) 	08	12
6. Speed Control of DC Motors	<ol style="list-style-type: none"> 1. Explain Construction and Working of Starters of DC motor and explain need of starter. 2. State and explain speed control method for D.C. shunt motors. 3. Give steps to carry out test on DC Motors. 4. Compare a lap winding and wave winding used in construction of DC motor. 	<ol style="list-style-type: none"> 1. Starters for DC Motors – <ol style="list-style-type: none"> 1.1. Types, Construction and Working of starters. 1.2. Necessity of starters. 2. Speed control methods for DC Shunt motors- <ol style="list-style-type: none"> 2.1. Flux control method. 2.2. Armature resistance control method. 3. Tests on DC Generators & Motors. 4. Design of Lap & Wave winding for DC machines 	08	12

SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY):

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Fundamental of electrical engineering	08	4	4	4	12
2	Dc circuits	08	2	6	4	12
3	Network analysis	08	4	6	6	16
4	Fundamental of Dc machines	08	4	6	6	16
5	Dc motors	08	4	4	4	12
6	Speed Control of D. C. Motors	08	2	4	6	12
	Total	48	20	30	30	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point Presentation, Transparency, Expert Lectures.

LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS

Minimum ten (10) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	1	To verify Ohm's law.	
2	2	To verify Kirchoff's law (KVL & KCL)	2
3	2	To verify the laws of Resistances in series and parallel.	2
4	2	Verification of Thevenin's theorem and Norton's theorem.	2
5	2	Verification of Superposition Theorem.	2
6	2	Identify and constructional details of various types of D.C machine.	2
7	3	Internal and external, characteristics of DC shunt generator.	4
9	3	Magnetization characteristics of DC shunt generator.	2
10	3	Study of DC shunt motor starter and reversal of direction of rotation of dc shunt motor.	2
11	4	Speed control of D.C. shunt motor.	2
12	5	Load characteristics of D.C. shunt motor	4
13	6	Load test on D.C. series motor.	2

LEARNING RESOURCES:

C) Books:

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Schaum Series	Network Analysis	McGraw Hill
2	B.L. Theraja	Electrical technology vol –I and vol-II	S.Chand Publishing
3	B.H. Deshmukh	Electrical Engineering	Nirali Prakashan
4	B.P. Patil, A.S. Zope	Electrical Measurement and Network Theory	Vrinda Publication

E) Magazines:

1. Electricals for you. 2. Digital Electricals.

E) Web sites for references:

www.en.wikipedia.org.

www.electricals-tutorials.com

www.indianscientificinstrument.com

CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	2	1	--	--	2	--
CO2	2	3	2	--	2	--	--
CO3	1	2	3	--	--	--	--
CO4		2	2	3	--	--	1
CO5	2	--	1	--	--	--	2
CO6	--	3	2	3	--	2	3

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course : AC Fundamental and AC circuits****Course code : R18EE3304****Course Category: Core****Credits : 06****Teaching and Examination scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
4	2	3	80	20	50	-	25	175

RATIONALE: :

In this course the student will understand the concepts of Electric Circuit. The basic aim of the subject is that the student must learn the basic concepts, rules and laws of electric and magnetic circuits and practical's thereof. This subject facilitates the understanding of principles of and working of machines, instruments and equipments.

COURSE OUTCOMES: After completion of this course the students will be able to,

1. Understand the concept of electromagnetism and learn basic rules and laws.
2. Apply the knowledge of basic laws for understanding an AC generator and concepts of sinusoidal EMF.
3. Apply the knowledge of various properties of conductors and combination of the circuit elements in a network form using phasor diagram.
4. Apply the combination of circuit elements in parallel.
5. Differentiate between AC circuits based on the phases connections and type of load use.
6. Understand the theorems applicable to ac circuits.

COURSE DETAILS:

Unit	Learning Outcomes	Topics & subtopics	Hrs	Mks
Unit no.1 Electromagnetic induction.	1.a Describe how to produce magnetic field by current carrying conductor. 1.b Solve numerical on energy stored in magnetic field. 1.c Describe electromagnetic induction laws, lenz's law, and self and mutual inductance of coil describe magnetization curve and hysteresis loop. 1.d Solve numerical on eddy current losses.	Electromagnetism- 1.1 Concept of magnetic field produced by current carrying conductor and solenoid. 1.2 Energy stored in magnetic field 1.3 Electromagnetic induction relation between electricity and magnetism, 1.4 Faraday's laws of electromagnetic induction, lenz law. self and mutual inductance of coil. 1.5 Eddy current loss	08	12
Unit no.2 Single phase ac system	1.Show equivalent circuit diagram for resistor, inductor and capacitor and define impedance and reactance. 2.Describe simple one loop ac generator with	2.1 Single phase ac circuit element R, L, C and concept of impedance and reactance 2.2 Simple one loop ac circuit generator with explanation of generation of	10	16

	<p>explanation of generation of sinusoidal EMF</p> <p>3. Represent sinusoidal ac quantity by a wave diagram and mathematical expressions</p>	<p>sinusoidal EMF Kirchhoff's laws</p> <p>2.3 Representation of a sinusoidal ac quantity by a wave diagram and mathematical expressions.</p> <p>2.4 Basic definitions of cycle, frequency, Time period, amplitude, form factor, peak factor, RMS value, average value.</p>		
Unit no.3 Ac series circuits	<p>1.Explain concept of phase and phase difference and draw the phasor diagram for voltage and current.</p> <p>2.Derive the expression for R-L, R-C, R-L-C, series circuit</p> <p>3.What is mean by power factor and explain lagging and leading condition.</p> <p>4.solve numerical on impedance triangle, active power apparent power, power triangle, phasor diagram</p>	<p>3.1 Concept of phase & phase difference & phase diagram for voltage and current</p> <p>3.2 Performance of series combination of RL RC & RLC Circuit on single phase ac supply</p> <p>3.3 Concept of power factor, lagging and leading condition. Resonance in series circuit</p> <p>3.4 Impedance triangle, active power, reactive power and apparent power, power triangle, phasor diagram. Solve numerical on power triangle.</p>	1 2	12
Unit no.4 Ac parallel circuit	<p>1.derive the expression for R-L,R-C,R-L-C parallel circuit on single phase ac supply.</p> <p>2. Describe admittance, inductance and susceptance.</p> <p>3.define parallel resonance and quality factor.</p>	<p>4.1 Performance of parallel combination of RL, RC & RLC Circuit on single phase ac supply.</p> <p>4.2 Concept of admittance, conductance, and susceptance</p> <p>4.3 Concept of parallel resonance, quality factor</p> <p>4.4 Based Numerical</p>	1 0	12
Unit no.5 : three phase ac system	<p>1. explain the concept of generation of three phase voltage with neat sketch and phasor diagram</p> <p>2. compare star connection and delta connection and numerical relationship between line voltage and phase voltage and line current and phase current for star and delta connected load.</p>	<p>5.1 Three phase ac circuit's advantage of polyphase circuit over single phase circuit</p> <p>5.2 generation of three phase MF, Phase sequence, polarity, types of three phase connections</p> <p>5.3 Concept of balanced and unbalanced load, line, phase quantities and power in three phase system in balanced star and delta connected load.</p> <p>5.4 Interrelation between star and delta connected load.</p>	1 2	16

Unit no.6 Ac Network Theory	1.show using an example of source 2.state and explain Norton's theorem with neat circuit diagram 3.solve numerical on the mesh analysis 4.Solve numerical on the node analysis	6.1 Source transformation- 6.2 Mesh analysis 6.3 Node analysis. 6.4 Norton's theorem 6.5 Explain T and PI network 6.6 concept of transient, concept of initial condition, and final condition of switching circuits consisting R,L and C. 6.7 Solve numerical based on theorem	1	12
			2	

SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Electromagnetic Induction	08	4	6	2	12
2	Single phase AC System	10	6	8	2	16
3	AC Series circuits	12	4	4	4	12
4	AC parallel circuits	10	2	6	4	12
5	Three phase AC System	12	2	8	6	16
6	AC Network Theory	12	2	4	4	12
	Total	64	20	36	22	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point Presentation, Transparency, Expert Lectures.

LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS; Minimum ten (10) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. Required
1	1	To plot a B-H curve for a ferromagnetic material and identify important parameters	2
2	2	To determine the variations in values of inductance of variable air-gap inductor for different air-gap lengths.	2
3	3	To verify the laws of Capacitors in series & parallel	2
4	3	To determine the relation between voltage, current and power for R-L series circuit	2
5	4	To determine the relation between voltage, current and power for R-C series circuit	2
6	4	To determine the relation between voltage, current and power of R-L-C series circuit and conditions for resonance.	2
7	5	To determine the relationship between Line values and phase values of voltage, current & power for a three phase balanced Star connected load.	2

8	5	To determine the relationship between Line values and phase values of voltage, current & power for a three phase balanced Delta connected load.	2
9	4	To determine the relation between voltage, current and power for R –L in series with C in parallel circuit and conditions for resonance.	2
10	6	To find out the parameters for T network	2
11	6	To find out the parameters for pi network.	2
12	6	Verification of Norton's Theorem.	2

LEARNING RESOURCES:**D) Books:**

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Schaum Series	Network Analysis	McGraw Hill
2	B.L.Theraja	Electrical Technology Vol.-I	S. Chand Publishing
3	B.L.Theraja	Electrical Technology Vol.-II	S . Chand Publishing.
4	B.H.Deshmukh	Electrical Engineering	NiraliPrakashan
5	B.P. Patil, A.S.Zope	Electrical Measurement & Network Theory	Vrinda Publication

(B)Magazines:

1. Electronics for you. 2. Digit.

(C) Web sites for references www.en.wikipedia.org.
www.indianscientificinstrument.com
www.alldatasheet.com

4.CO-PO MAPPING

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	3	2	1	--	--	2
CO2	3	3	2	1	--	--	2
CO3	3	3	2	1	--	--	2
CO4	3	3	2	1	--	--	2
CO5	3	3	2	1	--	--	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name: Electrical Measurement and Instrumentation****Course code: R18EE3305****Course Category: Core****Credit : 06****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
4	2	3	80	20	50	--	25	175

Rationale: Every part of engineering (design, construction, operation, installation, maintenance, testing) needs feedback that can be gained only through measuring the unknown quantities. This course will help a Diploma holder in Electrical Engineering to learn the basic principle, construction, operation & application of electrical measuring instruments. Also an electrical engineer has to deal with various types of instruments to measure various quantities like temperature, pressure etc. In this course the student will learn about operating principle, construction, operation, application & selection of various types of instruments used in Industries.

Course Outcomes: Student will be able to

1. Distinguish the various characteristics, different torques and torque producing methods of instruments.
2. Measure different electrical quantities using appropriate instrument/ meter.
3. Balance the bridge for measurement of electrical parameters like resistance, inductance and capacitance.
4. Select correct transducer to measure temperature, liquid level, displacement, vibration, speed.
5. Select appropriate non destructive test to identify flaws or defects in particular object.
6. Use the signal conditioning system and data acquisition system in measurement system.

Course Details:

Unit No.	Unit Learning outcome	Course Content	Hrs	Mk
1. Fundamentals of Measuring Instruments	1. Understand the various electrical effects. 2. Describe various characteristics and errors. 3. Identify various torques developed in an analog instrument	1.1 Necessity of measurement. 1.2 Classification of measuring instruments based on various effects of electric current. 1.3 Characteristics of instruments: accuracy, sensitivity, precision, resolution, least count, drift, dead zone. 1.4 Types of errors :instrument, environmental, temperature, gross, ratio/phase angle error 1.5 General construction of Electrical Instruments. Different torques in analog instruments: deflecting torque, controlling torque and damping torque. Methods of developing deflecting torque, controlling torque and damping torques. Supporting Mechanism required for instruments.	10	12

2.Measurement of Voltage, current, power, energy using analog instruments	<ol style="list-style-type: none"> 1. Understand the construction of different types of instruments 2. Choose the appropriate measuring instruments for measurement of particular quantity. 3. Measure the voltage, current, active power, reactive power and energy. 	<p>2.1 Construction, working principle & operation of Permanent Magnet Moving Coil (PMMC) instrument, Moving Iron Attraction type and Repulsion type instrument, Dynamometer type instrument, Electromagnetic induction type Instruments.</p> <p>2.2 Extension of range of Ammeter by using Shunts and Voltmeter by using Multipliers,</p> <p>2.3 Construction and working of Current Transformer and Potential Transformer, CT/PT Errors. Extension of range of Ammeter by using CT and Voltmeter by using PT.</p> <p>Measurement of single phase power using instrument transformer.</p> <p>2.4 Construction, working principle & operation of Dynamometer type Wattmeter. Digital wattmeter (Block diagram).</p> <p>Measurement of Active Power in Three phase balanced and unbalanced load using One wattmeter, Two wattmeter and Three wattmeter method. Study of variation of wattmeter reading with change in power factor.</p> <p>2.4 Measurement of reactive power using one wattmeter meter.</p> <p>2.5 Energy meter – Induction type (Single phase & Three phase) Construction, working principle & operation. Electronic energy meter (Block diagram and functions of blocks) Calibration of single phase Electronic energy meter.</p> <p>2.6 Block diagram and functions and applications of Net metering</p>	10	16
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3.Measurement of circuit parameters and other instruments to measure power factor, frequency etc.	<ol style="list-style-type: none"> 1. Understand the construction of different types of instruments 2. Choose the appropriate measuring instruments for measurement of particular quantity. 3. Measure the resistance, inductance and capacitance using bridges. 4. Measure the quantities of power factor, frequency, earth resistance. 	<p>3.1 Measurement of resistance Classification of resistance with ranges, Low resistance measurement by Kelvin's Double Bridge(KDB) circuit diagram, working principle & operation, Medium resistance measurement by Wheatstone's Bridge Circuit diagram, working principle & operation. High resistance measurement by Megger and Ohm meter with ranges, Construction, working and applications.</p> <p>3.2 AC Bridges: Measurement of Inductance using Maxwell's Inductance bridge Circuit diagram, working principle & operation, Measurement of Capacitance by Desauty's bridge Circuit diagram, working principle & operation. Circuit diagram, working principle & operation of LCR Meter.</p> <p>3.3 Other Measuring Instruments – Construction and working of following Earth Tester for Measurement of earth resistance. Single phase power factor meter, Weston synchroscope, rotating type phase sequence Indicator, frequency meter – Electric Resonance Type, Digital frequency meter, Block diagram and functions and applications of Multimeter.</p>	12	12
4.Transducers	<ol style="list-style-type: none"> 1. Differentiate between transducers used for measurement 2. Measure quantities of temperature, displacement, speed, acceleration. 	<p>4.1 Transducers : Definition, types of transducers</p> <p>4.2 Transducers for Temperature measurement: Bimetallic, liquid filled type, thermocouple, RTD, Thermister, Optical and Total radiation Pyrometers, Liquid level Measurement, Vibration Measurement, Acceleration Measurement, Displacement Measurement, Speed Measurement: Magnetic Pick up and photoelectric Pick up methods.</p>	12	16

5.Non Destructive Test (NDT)	<ol style="list-style-type: none"> 1. Understand various methods of NDT. 2. Select appropriate test for detecting the flaws in the material. 	5.1 Non – Destructive Testing [NDT] – Difference between Destructive and Non Destructive Testing, Advantages and limitations of NDT. 5.2 Methods of NDT - Visual, Magnetic particle, Eddy current, Ultrasonic, Radiography [X-ray & Gamma ray] 5.3 Instruments to detect the radioactivity 5.4 Use of radioisotopes for measurements of Density, Thickness, Liquid level, Flow, Homogeneity of mixture, Leakage detection.	10	12
6. Signal conditioning and Data acquisition system	<ol style="list-style-type: none"> 1. Read block diagram of signal conditioning system. 2. Describe parts of signal conditioning system and their applications. 3. Application of signal conditioning in measurement. 	6.1 Signal conditioning: Concept of signal Conditioning, 6.2 Block diagram of AC and DC signal Conditioning and it's working. 6.3 OP-AMP – 741, Signal Conditioning using OPAMP, Working and Construction 6.4 Types of Filters like Low pass High pass Band pass and band stop filter and study of their Frequency Response. 6.5 Use of Signal Conditioning Circuits for Instrumentation System 6.6 Generalised Data acquisition system: Block diagram and explanation, Types: Single channel, multichannel only block diagram. 6.7 Analog to digital and digital to analog Converter (only working principle)	10	12

Suggested Specification Table with Hours and Marks(Theory):

Unit No.	Teaching Hours	Distribution of Theory Mark			
		R Level	U Level	A Level	Total Marks
1	10	03	05	04	12
2	10	04	06	06	16
3	12	02	05	05	12
4	12	04	06	06	16
5	10	04	04	04	12
6	10	02	06	04	12

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Teaching Methodology: Chalk Board, Discussions, Power Point Presentation

Students activity :

1. The students have to collect Manufacturers literature / Brochures of any one type of Instruments used for Measurement of Temperature / Liquid Level / Biomedical and prepare the comparison Chart pertaining to their specifications.

List of Practicals:

Minimum Ten (10) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr.No	Unit	Practical Exercises	Appro.
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	No.	(Outcomes in Psychomotor Domain)	Hrs. required
1.	2	Measurement of Active Power in three phase load by using two-wattmeter method for balanced and unbalanced condition.	2
2.	2	Measurement of Reactive power in three phase load using one wattmeter method.	2
3.	2	Measurement of Single phase power using Instrument transformer C.T. & P.T.	2
4.	2	Calibration of Single phase Electronic Energy meter at different power factors.	2
5.	3	Measurement of low resistance using Kelvin's double bridge (KDB).	2
6.	3	Measurement of Capacitance by using Desauty's bridge.	2
7.	4	Calibration of bimetallic thermometer and expansion thermometer.	2
8.	4	Calibration of RTD and Thermister.	2
9.	4	Calibration of thermocouple.	2
10.	4	Measurement of dielectric Liquid level using capacitor method.	2
11.	4	Measurement of Displacement using LVDT.	2
12.	6	Understand the concept signal conditioning system	2

Learning Resources:

Books:

Sr. No.	Author	Title	Publishers
1.	Jones	Instrument Technology Vol.1,2,	Pitman Publications
2.	R.K.Jain	Mechanical Measurements & Instrumentation	S.Chand & Co.
3.	A.K.Sawhney	Electrical Measurements and Instrumentation	Dhanpat Rai and Co.
4.	Golding E.W.	Electrical Measurements & Measuring Instruments	Pitman Publishing

Website

www.omega.com

www.automaticelectricals.com

Co- PO Mapping :

CO	PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and environment	Project Management	Life-long learning
	Distinguish the various characteristics, different torques and torque producing methods of instruments.		2		3	2		1
	Measure the different electrical quantities using appropriate instrument/ meter.	2	3		2	2		
	Balance the bridges for measurement of electrical parameters like resistance, inductance and capacitance.	2		1	2	2		1
	Select correct transducer to measure temperature, liquid level, displacement, vibration, speed.	2	2	2		3		
	Select appropriate non destructive test to identify flaws or defects in particular object.				2	2		
	Use the signal conditioning system and data acquisition system in measurement system.	2	2		2	2		

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**COURSE: ELECTRICAL POWER GENERATION****COURSE CODE: R18EE3306****Course Category: Core****Credits: 05****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
3	2	3	80	20	--	--	50	150

Rationale - An electrical engineer working in the field of project engineering and utilities should possess adequate knowledge of various methods of power generation and its economics.

Course Outcomes: The student should be able to:

- CO1 Classify and explain various conventional and non-conventional energy sources for electric power generation.
- CO2 Select suitable site for different power stations
- CO3 Calculate load factor, diversity factor & plant capacity factor.
- CO4 Interpret and plot load curves and load duration curves.
- CO5 Draw functional block diagram of given power plant.
- CO6 Explain the functioning of components used in various generating stations.

Unit	Learning Outcomes	Contains of Unit	Hrs	Marks
1. Generalised concept of power conversion system.	<ol style="list-style-type: none"> Define renewable and non-renewable energy sources. Calculation of various quantities related to Power plant like load factor, diversity factor etc. Explain the terms related to power generating plants. State the functions and need of Cogeneration, captive power generation. 	1.1 Concept of energy conversion generation of Electrical Energy. 1.2 Types of fuels and various energy sources for Electricity Generation. Representation of energy conversion system by using block diagram. 1.3 Power station and load curves. 1.4 Electrical power generation economics. 1.5 Concept of Captive power Generation and Co-generation their applications, advantages and disadvantages, types of captive power plants.	08	12
2. Thermal Power Plants	<ol style="list-style-type: none"> Draw a flow chart of the various processes in the thermal power plant. Draw neat sketch of various components in steam power plant. Comparison and merits and demerits of the various process of thermal power generation. List out major steam power plants in Maharashtra with installed capacity. 	2.1 Introduction, Block Diagram and Working, Efficiency of the Steam power plant, Merits and Demerits, Site selection, Comparison of Fuels for thermal power stations like Coal, Diesel and Gas, MHD Power Plant 2.2 Constituents of Steam Power plant – Fuels and Fuel handling, Furnace-boiler, Draught system, Air-preheater, Feed water, Economiser, Super heater, Steam turbine-governor, condensers, Turbo-alternators-Exciter, Ash Handling, Electrostatic precipitator.	09	16
3. Nuclear Power plant	<ol style="list-style-type: none"> Draw the schematics block diagram of the nuclear power plant. Explain chain reaction taking place in the nuclear reactor. Write safety measures for protection against malfunction of the nuclear power plant. Write merits and demerits of the process of power generation List names of the major nuclear power plants in the India. 	3.1 Introduction, Nuclear physics Nuclear materials, Isotopes, Half-life, Fusion, Fission processes. 3.2 Working, principle Site Selection Types of reactors, Merits and Demerits, Safety arrangements, application	08	12

4. Hydro Power Plant.	<ol style="list-style-type: none"> 1. Explain the working principle of hydro power plants for both conventional and non conventional methods. 2. Draw block diagrams for the various systems of the various power plants. 3. Draw the components involved in the power generation process. 4. State advantages and disadvantages of the methods of power generation by using hydro energy. 	<p>Concept, Block Diagram, Working, Advantages & Disadvantages Of the following</p> <p>4.1 Hydro power plant –Hydroelectric power plant types Large storage power plant, Micro, Small, Run-off river plant, Pumped storage plant.</p> <p>4.2 Site selection on Availability of water, nature of the soil and construction of Dam, Types of Water Turbines.</p> <p>4.2Non-Conventional hydro Energy Sources like Ocean, Wave and Tidal power plant.</p>	07	12
5. Solar Energy Power Plant	<ol style="list-style-type: none"> 1. Write down the importance of the Solar Energy for electricity generation. 2. Define various definitions related to solar Radiations. 3. Draw the block diagram of both types of solar power plants. 4. Discriminate the differences of Solar Thermal and PV plants 5. Select the site for solar power plant. 	<p>5.1 Importance of solar energy, Solar radiations, Spectral distribution of radiations, Schematic representation of distribution of solar energy as direct, diffused and total radiation. Site selection for the Solar plants.</p> <p>5.2 Solar Collectors, Classification of collectors, Construction, working, applications and comparison of Flat plate and Concentric type solar collectors.</p> <p>5.3 Schematic diagram of Solar thermal power plant, Types, Construction, Working, Advantages, Disadvantages of Solar thermal power Plant.</p> <p>5.4 Solar PV System – Principle of Working, applications of Series parallel connections of PV cells and it necessity, Construction of Solar PV array, module and panel. Types of Solar Cells and its efficiency, block diagram of PV Generation Plant.</p>	09	16
6. Wind Power Plant	<ol style="list-style-type: none"> 1. Write down the importance of the wind Energy for electricity generation. 2. Define various definitions related to wind Radiations. 3. Draw the block diagram of types of wind power turbines. 4. Select the site for wind power plant. 5. Stat the necessity of the diesel power plant. 6. Draw the block diagram of Diesel power plant. 7. Explain the importance of the components used in the diesel power plant. 8. State the need and principle of operation of Fuel cell. 9. Suggest the types of Battery for specific operation in Power plant. 	<p>6.1 Concept of the power in the wind, maximum power, coefficient, Advantages and limitations of Wind Energy. Types of Generators – Induction, Synchronous, and their comparison.</p> <p>6.1.2 Site selection for the Wind power plant. Block Diagram of Wind power plant system with functioning of each block</p> <p>6.1.3 Types of wind turbines, horizontal and vertical axis wind turbine, schematic representation of different parts and their functions.</p> <p>6.2 Diesel power plant: Concept, Block Diagram, Working, Advantages & Limitations.</p> <p>6.3 Fuel cells- principle of operation, construction, advantage and limitations.</p> <p>6.4Revision of Batteries – Different types of batteries used for bulk energy storage</p>	07	12

Specification table with contact hours and marks for theory:

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Mark			
			Remember Level	Understand Level	Apply Level	Total Marks
1	Generalised concept of power conversion system.	08	04	04	04	12
2	Thermal Power Plants	09	06	06	04	16
3	Nuclear Power plant	08	04	06	02	12
4	Hydro Power Plant.	07	04	04	04	12

5	Solar Energy Power Plant	09	05	06	05	16
6	Wind Power Plant	07	04	04	04	12
	Total	48	27	30	23	80

Legends: R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point /Videos Presentation, Expert Lectures.

Term work:

A] The drawing sheets of A2 size any four of the following –

Sr. No.	Unit	Name of the Drawing sheet	Hrs.
1	02	The schematic diagram of Thermal and Gas power plant with accessories	06
2	03	The schematic diagram of Nuclear power plant with types of reactors	06
3	04	The schematic block diagram for Hydro/Tidal / Wave/MHD/Geothermal Power plant	06
4	05	The schematic diagram of solar power plant	06
5	06	The schematic diagram of wind power plant	06

B] Professional Practice: Students should visit to Electricity generation Power Plant and prepare a visit report as a part of above Term Work.

Books:

Sr.No	Author	Title	Publisher
1	V. K. Mehta	Principles Of Power System,	S. Chand and company, N.Delhi
2	B. R. Gupta	Generation Of Electrical Energy	TMH Publication
3	M.V.Deshpande	Electrical Energy Generation And Transmission,	TMH Publication
4	Soni, Gupta,Bhatnagar	A Text Book On Power System Engineering.	D. Rai and company Delhi.
5	J.B. Gupta	A Course In Electrical Power	TMH Publication
6.	S.Hasan Saeed, D.K. Sharma	Non Conventional Energy Resources	S.K. Kataria and Sons 2015
7	J.B. Gupta	Generation and economic considerations	S.K. Kataria and Sons 2012 Second Edition

Web Sites:

1. <https://www.mahagenco.in/>
2. https://www.eia.gov/energyexplained/index.cfm?page=electricity_generating
3. <https://www.nuclear-power.net/nuclear-power-plant/>

Library Related Activity: Go to library and *Find the hand book of Electrical Engineering and write down the small ESSAY of the unit of your choice from that book also write down the conclusion in your own wordings.*

CO-PO Mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1: Classify and explain various conventional and non-conventional energy sources for electric power generation.	2	2	2	2	-	3	-	1	-	1
CO2: Select suitable site for different power stations.	1	3	3	1	-	2	2	-	1	2
CO3: Calculate load factor, diversity factor & plant capacity factor.	3	3	1	-	2	2	1	3	-	1
CO4: Interpret and plot load curves and load duration curves.	2	-	2	-	3	1	-	-	2	1
CO5: Draw functional block diagram of given power plant.	-	2	1	3	2	-	1	-	1	3
CO6: Explain the functioning of components used in various generating stations.	-	3	2	-	1	1	-	3	1	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name: LT & HT Switch Gear****Course code : R18EE3307****Course Category: Core****Credits: 05****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
L	T	P	Paper HRS	Theory	Test	Practical	Oral	Term Work	Total
3	-	2	03	80	20	-	50	25	175

Rationale: Today's industry having both LT & HT equipments. Most of the equipments are protected for better performance & higher life. An Electrical Diploma holder is supposed to work smoothly with Switchgears. This course will provide that sufficient knowledge to a student of electrical engineering about **LT & HT Switch Gear**

Course Outcomes:

Student will be able to

1. Select & Troubleshoot Contactor.
2. Select Relay for specific application.
3. Select & Handle HRC Fuse, Switch & ELCB.
4. Select Reactive power compensation methods.
5. Identify & Handle Circuit Breaker.
6. Design control circuit for various applications.

Course Details:

Unit	Unit Learning Outcome	Course Contents	Hours	Marks
1 Classification of Switchgear based on Voltage level.	1.1 Typical L.T. & H.T distribution system in an industry	1.1 Introduction to low tension Switchgear & its components. Typical L.T. & H.T distribution system in an industry. Power Control Centre [PCC], Motor Control Centre [MCC], Power & Motor Control Centre [PMCC], Motor feeder & Switchboard 1.2 Power & Control contactors: Broad definition, construction & operation, comparison with switching devices with respect to current & mechanical life. Utilization categories as per IEC 60947-1, applications, arc extinction mechanism, selection of contactors, performance test, Pick up & drop off voltage measurement. Capacitor Duty Contactors, Vacuum Contactors. Troubleshooting – probable causes & possible solutions	12	16

2. Relay	2.1 Classification and selection of relay	2.1 Relays. Classification, Overload relay- Thermal, Magnetic & Electronic: construction, operation & characteristics (IS 13947, PART -4) International Codes for relays [ANSI/IEC Standards]. Working of Over-current and Earth fault relay and its current and time settings. 2.2 Requirements of thermal relay. Setting of overload relay. Connection diagrams of relays (with &/or without C T)	08	12
3 Fuse & Switches	3.1 Selection of Fuse and Switch	3.1 Fuses, Switches & Combination Units: HRC fuses[LT and HT], definition, construction & operation. Various terms associated with fuses. Selection of fuses. 3.2 Switches – various types, specifications & applications, automatic changeover switch. Switches used in high explosive area. 3.3 ELCB types (Number of Poles and Current Sensitivity) and Selection	08	12
4 Circuit Breaker	4.1 Operate Circuit Breaker	4.1 Air Circuit Breaker, MCCB and MCB: Definition & necessity of circuit breakers. Arc Phenomenon. Arc extinction method in L.T.C.B., Construction & Operation of L.T.C.B, comparison & selection. 4.2 kVAR Compensation by capacitor banks- Methods. Automatic power factor improvement unit	08	12
5 HT Switchgear	5.1 Selection of e Circuit Breaker	5.1 Classification of Circuit Breaker with respect to arc extinguishing methods. 5.1.1 Operation, Maintenance. and Applications of following HT Switchgear. Vacuum circuit breaker and SF6 circuit breaker, Oil Circuit Breaker 5.1.2 Ring-Main Switches 5.2 Breaker Rating: - Rated Voltage, Rated Frequency. Rated Symmetrical Braking Capacity, Rated asymmetrical. Braking Capacity, Rated making capacity, rated short time current of - 1 seconds & 3 seconds, Rated operating duty cycles. (Simple Numerical)	12	16

6 Protective System	6.1 Components and function of protective system	6.1 Functions of protective system. 6.1.1 Normal & abnormal conditions. 6.1.2 Types of faults & their causes. 6.1.3 Short circuit calculations(Symmetrical faults only) 6.1.4 Use of current limiting reactors & their arrangements 6.2 Control & metering circuits- Difference between power circuit & control & metering circuits, diagrams for power circuit & control & metering circuits 6.3 Components used in control & metering circuits Indicating meters used for different measurement 6.4 CT & it's connections in control circuits. Rotary switches, [selector switches] Push buttons, Timers, Indicators Limit switches, Hardware used in control panels.	8	12
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Suggested Specification Table with Hours and Marks(Theory):

Unit No.	Teaching Hours	Distribution of Theory Mark			
		R Level	U Level	A Level	Total Marks
1	12	04	06	06	16
2	08	04	04	04	12
3	08	04	06	02	12
4	08	04	04	04	12
5	12	04	06	06	16
6	08	04	06	02	12

Term Work:

All experiments are to be performed from the following list.

Sr. No.	Practical	Unit No.	Hours
01	Study of contactors	1	02
02	Performance test of a contactor	1	02
03	Testing of MCB	4	02
04	Study of ACB	5	02
05	Connections of CTs for ammeter change over switch.	5	02
06	Setting a Thermal timer & measuring its operational time.	2	02
07	Testing of ELCB	4	02
08	Study of Limit Switches.	4	02

Professional Practice:

Students should visit a given locations. They should collect all the necessary information, brochures regarding Switchgear

01	Student should visit a Switchgear training centre and prepare the visit report for the same as a part of the Term work.	2	04
02	Student should collect the data sheets for various L.T. and HT switchgears components and make Comparative statement and present as a report as a part of the term work	2	04
03	Collect data and draw single line diagram of HT metering kiosk.	2	04

Learning Resources:

Sr. No.	Title of the Book	Author	Publisher
1	Electrical Control of Machines	Rexford K.B	Delmar Pub.
2	Handbook of Motor Control System	EswarU.S	TMH Pub lication.
3	Switchgear and Protection	S. Rao	Khanna Publications

Websites:1. www.electrical4u.com 2. www.electrical easy.com

CO- PO Mapping

CO \ PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and environment	Project Management	Life-long learning
Select & Troubleshoot Contactor.	1	-	-	3	2	-	1
Select Relay for specific application.	2	3	-	2	2	-	-
Select & Handle HRC Fuse, Switch & ELCB.	2	-	1	2	2	-	1
Select Reactive power compensation methods	2	2	2	-	3	-	1
Identify & Handle Circuit Breaker.				2	2		
Design control circuit for various application	2	2		2	2		1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name : Transformers****Course Code: R18EE3308****Course Category: Core****Credits: 06****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
4	2	03	80	20	50	-	50	200

Rational: In every field of Electrical Engineering such as utilization, transmission & distribution of electrical energy the transformers are needed. The knowledge about Transformers is essential for an Electrical Engineer. In this course the student will acquire knowledge about the working principle of Transformers, their construction, performance characteristics, operation, tests, special features & applications.

Course Outcomes:

The student should be able to

1. Classify transformers and explain working principle, construction and necessity of them.
2. Differentiate ideal and practical transformers, draw phasor diagram and equivalent circuit.
3. Design core and windings of single phase transformer and calculate efficiency.
4. Perform tests, calculate various quantities related to performance of operating transformers in parallel and use tap changer transformer.
5. Explain working of three phase transformers, their connections and apply remedies to protect the transformers from the faults.
6. Explain working of special transformers, their applications and select insulation used in transformers.

Course Details:

Unit No.	Learning Outcome	Contents	Hrs	Marks
1. Introduction, Construction & Working Principle of the Transformer	1. Understand the concept of the electromagnetic induction, self & mutually induced emf. 2. To know the classifications, construction & working principle of the transformer/s.	1.1 Concept of Electromagnetic Induction. Self Induced EMF & Mutually Induced EMF. 1.2 Constructional details of transformer and transformer mountings, Working principle of Transformer, Necessity of Transformer. 1.3 General classification of transformer.	08	12
2. Emf equation, Ideal & Practical Transformers, Equivalent Circuit	1. To derive emf equation 2. To understand ideal & practical transformers 3. To know performance of the transformers at no-load & at load. 4. To draw phasor diagrams of the transformers at lagging, leading & unity p.f. 5. To develop equivalent circuit.	2.1 EMF Equation of transformer & derivation, voltage & current ratios. 2.2 Concept of No load & on load of transformer. Rating of transformer 2.3 Ideal transformer – on load, no load, with phasor diagram, Practical Transformer on load, no load, with phasor diagram. 2.4 Equivalent Circuit of Transformer (Development from Equivalent circuit diagram of Ideal Transformer).	10	16

3. Losses, Efficiencies & Voltage Regulation of Transformer, Design of 1-phase Transformer	1. To find out losses 2. To know the methods to reduce the losses. 3. To calculate the efficiencies 4. To understand voltage regulation 5. To find voltage regulation 6. To design core & winding of the 1-phase transformer	3.1 Losses in Transformer – Copper losses, Hysteresis losses, Eddy current losses, measures to reduce these losses. 3.2 Efficiency of transformer. All day Efficiency.(Numerical). Voltage Regulation, Degree of loading. 3.3 Design of single phase Transformer – core design, winding Design	08	12
4. Transformers : Tests, Parallel Operation & Tap Changer	1. To develop circuit diagrams for tests 2. To perform tests & find out performance of the transformer. 3. To understand essential conditions for parallel operation of two 1- phase transformers & load sharing by them. 4. To know necessity of tap changing transformer, types, construction & operation.	4.1 Tests on transformer – 1] Direct loading 2] O.C. & S.C. 3] Back to back test & 4] polarity test. 4.2 Conditions for satisfactory Parallel operation of two 1- phase transformer, Load Sharing , % Impedance. 4.3 Tap changing transformer – (Numerical) Need of tap changing. Process of tap changing. Types of tap changers: ON load tap changer type[OLTC] & open circuit tap changer [OCTC]	10	16
5. 3-phase Transformers , their parallel operation & Protection of Power Transformers	1. To understand 3-phase transformer connections 2. To know open delta & Scott connections 3. To know vector groups for various types of connections 4. To know faults in transformers: types, causes, effects & remedies. 5. To understand essential conditions for parallel operation of two 3- phase transformers & load sharing by them.	5.1 Three phase transformer - Three 1-phase transformer banks, 3-phase transformer. 5.2 Three phase transformer connections: Y-Y, D-D, D-Y, Y-D, Open delta (V-V), Scott connection, Vector Groups. 5.3 Protection of Power Transformers – Types of faults, causes, effects and remedies. Over current and earth fault protection, Buchholz relay, winding temperature protection, percentage differential protection, problem arising and their solution, pilot wire current calculation and CT ratio. 5.4 Parallel operation of 3 phase transformers: Conditions for Parallel operations [significance of Vector Group], load sharing, % Impedance.	10	12

6.Special Purpose Transformers & Insulations used in transformers.	1. To understand circuit diagrams, construction, operation & applications of the special purpose transformers. 2. To know necessity & properties insulations used in transformers.	6.1 Special purpose transformers- Auto transformer, Oil filled transformer, Cast resin Transformer, Amorphous core transformer [Star Duty Transformer], Ferrite core transformer, Welding Transformer, Isolation Transformer, Instrument Transformers, furnace transformer. Reactors, Earthing transformer, Control Transformer 6.2 Insulations used in transformers. Like oil, resins etc.	10	12
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Teaching Methodology: Chalk Board, Discussions, Power Point Presentation

Term work:

A] Skills to be developed:

- i) Intellectual Skills: 1. Identify 2 Discrimination 3 Selection 4 Interpretation 4 Understanding
ii) Motor Skills: 1. Proper Connection 2 Measurement 3. Draw Graph 4 Observe the result and compare

List of Practical:

Minimum 10 experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Approx. Hrs. required
01	4	Polarity tests of 1-phase transformer using A.C. & D.C. supplies.	2
02	2	Verification of transformation ratio of 1-phase transformer.	2
03	4	Load test of 1-phase Transformer.	2
04	4	O.C. / S.C. tests of 1-phase Transformer.	2
05	4	Back to Back test (Sumpner's Test) on 1-Phase transformers.	2
06	4	Parallel operation of 1-phase transformers.	2
07	5	Parallel operation of 3-phase transformers.	2
08	5	Study of 3-phase transformer connections.	2
09	3	Design of core for 1-phase transformer.	4
10	6	To determine the efficiency of 1-phase auto-transformer.	2
11	6	Scott connection of the transformers.	2
12	6	Open Delta Connection of Transformer.	2
13	5	Study of Buchholz's relay.	2

Professional Practice:

- Students should visit Transformer Manufacturing /Repairing Unit; write the visit report & submit it along with above Term-work.
- They should also collect the information brochures regarding transformers of various manufacturing Company as a part of Term work.
- An Expert lecture on the topic related with transformer manufacturing / repairing / maintenance & prepare a lecture report.

Learning Resources:

Sr. No.	Title of the Book	Author	Publisher
1	Electrical Technology	H.Cotton	Pitman Publications
2	Electrical Technology	B.H. Deshmukh	Nirali Publications, Pune

3	Performance & Design of A. C. Machines	M. G. Say	CBS Publications, New Delhi
4	Electrical Technology (Volume II)	B. L. Theraja	S. Chand & Co, New Delhi
5	Electrical Machines	Ashfaq Hussain	Dhanpat Rai & Co. Delhi.

Term work:

Skills to be developed:

- i) Intellectual Skills: * Identify * Discrimination * Selection * Interpretation * Understanding
 ii) Motor Skills: * Proper Connection * Measurement * Draw Graph * Observe the result & compare

List of Practical: Minimum 10 experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Unit No.	Practical Exercises (Outcomes in Psychomotor Domain)	Hours
01	4	Polarity tests of 1-phase transformer using A.C. & D.C. supplies .	2
02	2	Verification of transformation ratio of 1-phase transformer.	2
03	4	Load test of 1-phase Transformer.	2
04	4	O.C. / S.C. tests on 1-phase Transformer.	2
05	4	Back to Back test (Sumpner's Test) on 1-Phase transformers.	2
06	4	Parallel operation of 1-phase transformers.	2
07	5	Parallel operation of 3-phase transformers.	2
08	5	Study of 3-phase transformer connections.	2
09	3	Design of core for 1-phase transformer.	4
10	6	Load test on 1-phase auto-transformer.	2
11	6	Scott connection of the transformers.	2
12	6	Open Delta Connection of Transformers.	2
13	5	Study of Buchholz's relay.	2

Professional Practice:

1. Students should visit Transformer Manufacturing /Repairing Unit; write the visit report & submit it along with above Term-work.
2. They should also collect the information brochures regarding transformers of various manufacturing Company as a part of Term work.
3. An Expert lecture on the topic related with transformer manufacturing / repairing / maintenance & prepare a lecture report.

Teaching Methodology: Chalk Board, Discussions, Power Point Presentation

Learning Resources:**A) Books**

Sr. No.	Title of the Book	Author	Publisher
1	Electrical Technology	H.Cotton	Pitman Publications
2	Electrical Technology	B.H. Deshmukh	Nirali Publications, Pune
3	Performance & Design of A. C. Machines	M. G. Say	CBS Publications, New Delhi
4	Electrical Technology (Volume II)	B. L. Theraja	S. Chand & Co, New Delhi
5	Electrical Machines	Ashfaq Hussain	Dhanpat Rai & Co. New Delhi.

B) Web sites:www.electrical4u.comwww.electricaleasy.comwww.electronicshub.orgwww.electronics-tutorials.ws**Suggested Specification Table with Hours and Marks(Theory):**

Unit No.	Teaching Hours	Distribution of Theory Mark			
		R Level	U Level	A Level	Total Marks
1	08	02	06	04	12
2	12	02	06	08	16
3	08	02	04	06	12
4	12	02	06	08	16
5	08	02	04	06	12
6	08	02	06	04	12

MAPPING MATRIX OF CO's & PO's: 3: High 2: Moderate &1: Low Relationship

CO's	PO1 Basic knowledge	PO2 Discipline knowledge	PO3 Experiments & Practice	PO4 Engineering Tools	PO5 The engineer & Society	PO6 Environment & Sustainability	PO7 Ethics
C01	2	3	2	1	2	3	3
C02	1	3	3	1	3	2	2
C03	2	3	3	1	3	3	3
C04	2	3	3	1	3	3	2
C05	2	3	2	1	3	3	3
C06	2	3	2	1	3	3	3

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course: Transmission Distribution and Protection of Power System****Course Category: Applied****Course code: R18EE4301****Credits: 06****Teaching and Examination scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
4	2	3	80	20	--	25	50	175

Rationale: An electrical engineer working in the field of project engineering and utilities should possess adequate knowledge of various methods of power transmission and power distribution considering the economics of the system. In this course the student learn about the equipments involved in methods of transmission and distribution along with the protection of the power system.

Course Outcomes:

Student will be able to

1. Identify the HVAC, HVDC and EHVAC Power transmission systems.
2. Evaluate performance of short and medium transmission lines.
3. Select specific insulators, conductors, line supports, Cables, span and other parameters for erection of transmission line.
4. Classify the different types of distribution systems, tariff system and power factor improvement of the system and suggest appropriate system.
5. Suggest particular type of sub-stations, equipments, cables for particular application.
6. Suggest appropriate protection scheme for particular condition.

Course details:

Unit No.	Unit Learning outcome	Course Content	Hrs	Mks
1. Basics of Transmission	1. Read the transmission line. 2. Remember the voltages used for various stages. 3. Identify HVDC system. 4. Compare HVAC and HVDC. 5. Explain the necessity of EHVAC.	1.1 Single line diagram of electrical power system. Advantages of HV transmission System. 1.2 Comparison of single phase and three phase supply system, Comparison of 3 phase 3 wire and 3 phase 4 wire system used in Transmission and Distribution systems. 1.3 HVDC: Block Diagram, Functioning, Merits and Demerits, Comparison of HVAC and HVDC, 1.4 EHVAC: Introduction, Necessity, Limitations.	08	12
2. Performance of Transmission line	1. Derive the circuit parameters of short and medium transmission lines. 2. Calculate sending end voltage using derivations. 3. Understand the effects of R,L,C on transmission line.	2.1 Types of Transmission Lines – Short, Medium and Long Transmission Line. 2.2 Line Inductance of 3 phase overhead lines, Capacitance of transmission Line for 1 phase and 3 phase System (No Derivations) 2.3 Performance of short Transmission lines and medium transmission line (Numerical on Short and Medium Transmission line), Introduction to ABCD Constants. 2.4 Transposition of the lines used for Transmission. 2.5 Skin Effect, Proximity Effect, Ferranti effect. Corona effect, Factors affecting the Corona,	12	16

		Advantages and Disadvantages of Corona, Corona Power Loss, Methods of reducing Corona Effect.		
3. Transmission Line Components	1. Understand the construction and applications of different transmission line components. 2. Select appropriate Insulator, conductor and other accessories as per application.	3.1 Line Towers: Requirement of supporting system, Types of towers, Advantages, limitations and uses of each type. 3.2 Conductor material, Types of conductors, 3.3 Cross arms, Guys and Stays, Conductor Configuration, Spacing and clearance, Span Lengths, Sag, Sag Templates. 3.2 Line Insulators – Material, Types of Insulators, Failure of Insulators, Testing of Insulators, Distribution of potential over string of suspension insulator, Methods of Improving String Efficiency 3.3 Comparison of Overhead transmission system and Underground system. Underground Power cables – Need of Cable system, Types of various cables, construction, Selection Parameters, laying methods, Cable jointing.	10	12
4. A.C. Distribution	1. Understand the distribution system. 2. Implement proper method to improve power factor of electrical system. 3. Can understand different tariffs implemented.	4.1 Distribution – Components of Distribution. Classification of distributors Radial feeder, parallel feeders and Ring main distribution. Requirement of good distribution system, Design consideration for feeder. 4.2 AC Distribution – Introduction, AC Distribution Calculation, Cost comparison of distribution systems. 4.3 Impact of Power factor on voltage drop and Power factor Improvement methods. 4.4 Tariffs: Present tariff structures and incentives of various utilities like MSEDCL, Reliance and BEST.	10	12
5. Substations and Protection of Alternator	1. Remember various types of substations 2. Understand and select components used for substations. 3. Learn the different faults occurs in alternator.	5.1 Types of substations: a. According to Service- Transformer substation, Switching substation, power factor correction substation, Frequency changer substation, Converting substation. b. According to construction- Indoor, Outdoor, Underground substation, Pole mounted substation. Introduction to Gas Insulated Substation c. Components of substations, protection of substation using Isolators, Isolator with earth blade : constructional Details, operation and applications and Lightning Arrester, 5.2 PLCC – Need of PLCC, Different components of PLCC.	10	12

		5.3 Types of faults: OC, SC, Earth Fault. Symmetrical faults, unsymmetrical faults etc. 5.4 Protection of Alternator – Stator faults: Merz- Price protection, Balanced Earth fault protection, Stator Inter turn fault protection Rotor Faults: Rotor Earth fault protection, Loss of excitation protection, rotor temperature alarm, Automatic field suppression.		
6. Protection of Transmission lines	1. Learn the different faults occurs in transmission line, feeders and busbars. 1. Select the definite protection required for particular part	6.1 Protection system for Feeders and Transmission lines: Overload protection, Over current and Earth fault protection for transmission line. 6.2 Protection of Feeders – Using Definite and Inverse time over current protection, Time graded and current graded system of protection. 6.3 Protection of Bus bars – Introduction to Busbar arrangement, Causes of Bus zone faults,, Differential protection, Fault bus protection.	14	16

Suggested Specification Table with Hours and Marks(Theory):

Unit No.	Teaching Hours	Distribution of Theory Mark			
		R Level	U Level	A Level	Total Marks
1	08	04	06	02	12
2	12	04	06	04	16
3	10	04	06	02	12
4	10	04	06	02	12
5	10	04	06	02	12
6	14	04	08	04	16

Term Work:

The term work shall consist of the following assignments –

The drawing sheets of A1 size any three of the following.

Sr. No.	Sheet Name	Topic	Hrs.
1.	Types of insulators.	3	4
2.	Types of cables (cross sectional view) .	3	4
3.	Layouts of substations, pole mounted substation –elevation.	5	4
4.	Any two Layout of Protection scheme used for Protection of Alternator, Transmission Line, Power Transformer, Busbar and feeder .	6	4

Studentsactivity:

1. Students should visit to a Transmission / Distribution substation and prepare a visit report of it as a part of above Term Work.
2. Student will collect the data of different line components and compare that and make a report.

Learning Resources:

A) Books:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1.	V. K. Mehta	Principles of Power System	S. Chand and company, N. Delhi
2.	B. R. Gupta	Generation of electrical energy	TMH Publication,
3.	M.V.Deshpande	Electrical Energy generation and transmission	TMH Publication
4.	Soni,Gupta,Bhatnagar	4 A text book on power system engg	D. Rai and company Delhi
5.	J.B. Gupta	A course in Electrical Power	TMH Publication

B) Web Sites:

1. www.mahatransco.com
2. www.mahadiscom.com
3. www.youtube.com

CO	PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation and	Engineering practices for society, sustainability	Project Management	Life-long learning
Identify the HVAC, HVDC and EHVAC Power transmission systems.		1			3	2		1
Evaluate performance of short and medium transmission lines.		2	3		2	2		
Select specific insulators, conductors, line supports, Cables, span and other parameters for erection of transmission line.		2		1	2	2		1
Classify the different types of distribution systems, tariff system and power factor improvement of the system and suggest appropriate system.		2	2	2		3		1
Suggest particular type of sub-stations, equipments, cables for particular application.					2	2		
Suggest appropriate protection scheme for particular condition.		2	2		2	2		1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name : A.C. Motors & Generators****Course code : R18 EE 4302****Course Category: Applied****Credits: 06****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
L	T	P	Paper HRS	Theory	Test	Practical	Oral	Term Work	Total
4	0	2	3	80	20	50	- -	25	175

Rationale: A diploma holder in Electrical Engineering has to deal with A.C. Motors & Generators in his career for various aspects like operation, selection, maintenance. In this course student will acquire knowledge about construction, working principle, performance characteristics, operation & control of A C Motors, Alternators, Special purpose A.C. motors.

Course Outcomes: The student will be able to

1. Know the working principle , construction & operation of 3-phase induction motor, induction generator & know energy efficient motor.
2. Perform tests on 3 phase induction motor, to calculate parameters, draw the phasor diagram & circle diagram & analyze it.
3. Select & use starters for 3 phase induction motors & control the speeds of it.
4. Know the working principle, construction & operation of 3-phase alternators, develop winding diagram, perform tests, calculate voltage regulation & draw phasor diagrams.
5. Know operation of 3 phase alternators, synchronize alternator. Understand the effects of parameters on performance of alternator.
6. Know the working principle , construction, operation & applications of 1-phase induction motors, reluctance motor , hysteresis motor, universal motor, stepper motor, servo motor & perform tests on 1 phase induction motor & calculate parameters of it.

Course Details:

Unit	Learning Outcome	Contents	Hou rs	Mark s
1 3- Phase Inducti on Motor: Constr uction, Worki ng Princip le,	1. To know rotating magnetic field 2. To know types, construction & working principle of the 3-phase induction motor. 3. To know relationship between synchronous speed, number of poles & frequency. 4. To know the relationship between various quantities (like torques, rotor copper loss, power input, power output) 5. to draw power flow diagram 3-phase induction motor. 6. To know Energy Efficient Motors & Induction Generator.	1.1 Three phase Induction Motor- Introduction, production of Rotating Magnetic Field (RMF), conditions for production of RMF, Principle of working of 3 phase Induction Motor relation between speed, number of poles & frequency. 1.2 Constructional parts & features. Types of 3 phase Induction Motor, rotor frequency, rotor emf, rotor current and rotor p.f. under no-load condition & in running condition. 1.3 Factors determining torque, relation between full load torque, standstill torque, full load torque. Relation between rotor Cu loss, rotor output, and rotor input. Power flow diagram, efficiency (Numerical) 1.4 Energy Efficient Motors: latest	08	12

		standards [IE2, IE3] 1.5 <u>Induction Geneartor</u>		
2 Torque -slip charact eristics , equiva lent circuit Tests on 3- phase inducti on motor.	1. To know effect of slip on torque. 2. To know equivalent circuit & its parameters 3. To know methods of improving starting torque. 4. To draw phasor diagram of 3-phase induction motor. 5. To know the procedures of different tests & calculations of various quantities. 6. To draw circle diagram & to find various quantities from it.	2.1 Torque-Slip Characteristics, methods of improving starting torque in Slip Ring & Squirrel cage Induction Motor as generalized a Transformer. 2.2 Equivalent circuit & phasor diagram of three phase Induction, Motor 2.3 Determination of performance characteristics of 3-phase Induction Motor by load test, no load & blocked rotor tests. Determination of various quantities from circle diagram (Numerical)	12	16
3 Starter s, Speed Contro l & applica tions	1. To draw diagrams starters & to know their construction & working. 2. Suggest proper type of starter for 3 phase induction motor. 3. To know the control of speed of 3-phase induction motors by varying a) voltage, b) frequency, c) number of poles & d) rotor resistance & injecting emf 4. To know applications of induction motors	3.1 Necessity of starters for 3-phase induction motors. Study of direct on line starter, auto transformer starter & star-delta starter. 3.2 Methods of speed control of 3-phase induction motor with control of voltage, frequency, injecting emf & rotor resistance & including electronic control. 3.3 Applications of three phase Induction Motors.	08	12
4 Synchr onous Machi nes (Altern ators)	1. To understand synchronous generator 2. Construction & working principle of 3-phase alternator 3. To derive emf equation of alternator. 4. To know winding factors 5. To draw phasor diagrams of alternators at different loads & to find voltage regulation from it. 6. To effect of armature reactions on induced emf	4.1 Synchronous Machines – introduction, construction & working principle of alternator, EMF equation of alternator 4.2 Armature winding of 3 phase machines. pitch factor, distribution factor, synchronous reactance & phasor diagram of alternator. Voltage regulation (Numerical), armature reaction 4.3 Load test, open circuit & short circuit tests on 3 phase alternator.	12	16
5 Operat ion & paralle l operati on of 3- phase alterna tors	1. To know operation of alternators 2. To know the effect of change of excitation & input parameters on the performance of alternators 3. To know the conditions for parallel operation of 3-phase alternators 4. To know the concept of synchronization of 3-phase alternators	5.1 Alternator- operation of alternator, effect of change of excitation & input parameters on alternator performance, infinite bus-bar, parallel operation, power angle, synchronizing power, sharing of load.	08	12

6 1- Phase Motors	1. To know the classifications, construction, working principle, performance characteristics & applications 2. To draw diagrams of 1-phase motors. 3- To perform load test on 1-phase induction motor & to find performance of it.	6.1 Single phase motors: Introduction, classification, construction, principle of operation, performance characteristics, a applications. Load test, no load & blocked rotor tests on 1- phase Induction motor, circle diagram 6.2 Construction, working principle & applications of repulsion start induction run, capacitor start & capacitor run, two-value capacitor & shaded pole motors 6.3 Construction, working principle & applications of Single phase Synchronous motors: reluctance, hysteresis, universal motor, stepper motor & servomotor	08	12
Total			56	80

Teaching Method: Chalk Board, Power Point Presentation, Slides

Term Work:

Minimum ten (10) experiments are to be performed from the following list.

It is expected that the staff member should conduct one or two additional self designed experiments.

[All the experiments should be done as per IS wherever possible]

Sr. No.	Practical	Unit No.	Hours
01	Study of 3-phase induction motor starters.	3	2
02	Starting & reversing of direction of rotation of 3-phase induction motor.	1	2
03	Load test on 3-phase squirrel cage induction motor.	2	2
04	Slip measurement of 3-phase slip ring induction motor.	2	2
05	Speed - Torque characteristics of 3-phase slip ring induction motor.	2	2
06	No load & blocked rotor test on 3 phase Squirrel Cage Induction motor	2	2
07	Load test on 1 phase Induction motor	2	2
08	Starting & reversal of Single Phase induction motor & determination of no load power factor.	6	2
09	Load test on 3 phase Alternator.	4	2
10	O.C. / S.C. Tests on 3 phase Alternator.	4	2
11	Synchronization of two 3-phase alternators.	5	2
12	No load & blocked rotor test on 1- phase Induction motor	6	2

Professional Practice:

Students should visit a manufacturing/ repairing unit of induction motor/ alternator & write a report & submit it. They should also collect the information brochures regarding electrical motors/ alternators of various manufacturing company.

Learning Resources:**A) Books**

Sr. No.	Title of the Book	Author	Publisher
1	Performance & Design of A. C. Machines	M.G. Say	CBS Publications, NewDelhi
2	Electrical Technology (Volume II)	B.L.Theraja	S. Chand & Co, New Delhi
3	Electric Machines	S.K. Bhattacharya	TTTI, Chandigarh
4	Electrical Machines	Nagrath & Kothari	Tata McGraw Hill Co., New Delhi
5	Electrical Machines	Ashfaq Hussain	Dhanpat Rai & Co. Delhi.
6	Electrical Technology	H.Cotton	Pitman Publications

B) Websites:

www.electrical4u.com

www.electricaleasy.com

www.electronicshub.org

www.electronics-tutorials.ws

Suggested Specification Table with Hours and Marks (Theory):

Unit No.	Teaching Hours	Distribution of Theory Mark			
		R Level	U Level	A Level	Total Marks
1	08	02	04	06	12
2	12	02	06	08	16
3	08	02	04	06	12
4	12	02	08	06	16
5	08	02	04	06	12
6	08	02	06	04	12`

MAPPING MATRIX OF CO'S & PO'S:

CO's	PO1 Basic knowledge	PO2 Discipline knowledge	PO3 Experiments & Practice	PO4 Engineering Tools	PO5 The engineer & Society	PO6 Environment & Sustainability	PO7 Ethics
C01	1	3	2	1	2	3	3
C02	1	3	3	1	3	2	2
C03	2	3	3	1	3	3	3
C04	2	3	3	1	3	3	2
CO5	2	3	2	1	3	3	3
CO6	2	3	2	1	3	3	3

3: High 2: Moderate & 1: Low Relationship

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course :Electrical Design & Drawing****Course code : R18EE4303****Course Category: Applied****Credits : 04****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
-	4	-	-	-	-	50	25	75

RATIONALE :

This course deals with design of electrical machines and equipments. The aim is to provide the basic principles useful for simple design. After completing students will be able to design DC as well as AC machine along with skill of computer programming for design of electrical machines.

COURSE OBJECTIVE:

The students will be able to

1. Understand basics of design, specific loadings and factor affecting design.
2. Follow the procedure to estimate transformer design of various types.
3. Apply the procedure and steps to Calculate parameters in design of induction motors.
4. Carry out computer aided design for transformer
5. Compute parameters for design of design of induction motors using program

COURSE OUTCOMES:

1. Know the principles of design, effect of specific loadings.
2. Understands the details procedure of transformer cooling tubes design
3. Understand the step of single phase induction motor design.
4. Understand the step of three phase induction motor design.
5. Grade the sections of starters for squirrel cage induction motor.
6. Use of computer programming for design of transformer and induction motor

TERM WORK:

Unit	Major Learning Outcomes	Topic/Subtopic
1. CAD Tools.	<ol style="list-style-type: none"> 1. Identify the function of the given components of CAD classic screen. 2. Identify the given components of CAD screen. 3. Identify the given toolbar and commands. 	<ol style="list-style-type: none"> 3.1 components of CAD classic screen. 3.2 Menu bar and status bar. 3.3 CAD tool bar.

2. Simple drawings in CAD	1. Interpret the given line diagram using absolute method. 2. Interpret the given line diagram using coordinate and relative polar coordinate method. 3. Interpret the given 2D figure. 4. Interpret the given isometric drawing of electrical machine in CAD.	4.1 Absolute coordinate Method: commands :LIMITS,UNITS,LINE and ARC. 4.2 Relative coordinates Method: 4.3 Commands :LIMITS,UNITS,LINE and ARC 4.4 Relative polar coordinate method commands LIMITS,UNITS,LINE and ARC 4.5 2D Figures: commands: CIRCLE OFFSET,TRIM,FILLET, ARC ,POLYGON,ELLIPSE,COPY,MIRROR,ROTATE and CHAMFER.
3. Electrical Drawings in CAD	1. Interpret the given CAD Induction Motor	5.1 Application of electrical CAD software to :Draw construction of Induction motor

LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS :

Minimum eight (08) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	Draw starters for AC motor.	4
2	Design of three phase distribution transformer with cooling tubes	6
3	Design of single phase induction motor	6
4	Design of three phase squirrel cage induction motor and draw sectional view	6
5	Use computer design method to design three phase distribution transformer.	6
6	Use computer design method to design winding diagram for 3-phase A.C Machine with coil connection diagram with calculation report	6

Remaining 30 hours should be used for following professional activity.

A. Professional Practice:

1. Read at least 3 different electrical drawing other than those covered in practical above.
2. Collect specification of three phase transformers (distribution and power).
3. Collect specification of three phase induction motor and single phase induction motors
4. Information search on energy efficient motor design considerations.
5. Prepare list of materials with properties for amorphous core, new trends in winding material
6. Observe manufacturing and design procedure in induction motor and transformer manufacturing industries.

7. Collect leaflets, brochures, data sheets for transformer, induction motors.

B. Special instructional strategies(if any):

1. Show and get acquainted with computer software related to design.
2. Arrange a visit to manufacturing industries for transformer, induction motors.
3. Arrange expert's lectures of industries person in the area of electrical design of electrical machines and equipments.

❖ **LEARNING RESOURCES:**

A) Books:

SR. NO.	AUTHOR	TITLE	PUBLISHER
1	Bhattacharya S.K	Electric Engineering Drawing	TTTI, Chandigarh
2	Narang K.L	Electric Engineering Drawing	TMH, New Delhi.
3	A.K.Sawhney	Course in Electric Machine Design	Dhanpat Rai and Co. New Delhi.
4	Gladfelter	AutoCAD 2016	Johnwiley & Sons.india

B) Magazines:

1. Electricals for you.
2. Ieema journal.

(C) Web sites for references:

www.en.wikipedia.org.
www.electricals-tutorials.com
www.indianscientificinstrument.com
www.cs.toronto.edu/
www.electricals4u.com

CO-PO MAPPING:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	3	1	1	-	2	2	2	-
CO2	3	3	3	1	1	-	2	2	2	-
CO3	3	3	3	1	1	-	2	2	2	-
CO4	3	3	3	1	1	-	2	2	2	-
CO5	2	2	3	1	1	2	2	2	2	-
CO6	2	2	3	1	1	2	2	2	2	-

Course : UTILIZATION OF ELECTRICAL ENERGY**Course Code : R18EE 4304****Course Category : Applied****Credits: 03****Teaching and Examination Scheme**

Teaching Scheme		Examination Scheme					
L	P	Theory	Test	Practical	Oral	Term Work	Total
03	-	80	20	- -	- -	- -	100

Rationale: It is expected that the Diploma Holder in Electrical Engineering has to deal with number of electrical equipments in the industry from the various aspects like operation, maintenance, testing etc. For this he should have the basic knowledge about the construction & operation of this equipment. In this course the students will learn about the various modes by which electrical energy is utilized in industries through various equipment for heating, welding, material handling electrical equipments etc.

Course Outcomes: The student will be able to

1. Select electrical system & their components for automobile.
2. Select refrigerator unit, do maintenance & trouble shooting of domestic refrigerator & also select air conditioning unit & install ice manufacturing unit.
3. Do maintenance of cranes, hoists, gantry, lifts, platform truck & conveyors belts & apply safety & precautions measures for these equipments.
4. To calculate energy used, efficiency of the electric furnaces & the dimensions of the heating elements.
5. Select welding unit, equipment used & power supply for resistance & arc weldings.
6. Select battery for particular requirement, use of the super capacitor & fuel cell as a substitute for batteries & increase battery ratings.

Course Details:

Unit	Learning Outcomes	Contents	Hrs	Marks
1 Electrical Systems of Auto-mobile	1. To know electrical systems of automobiles & components used. 2. To draw circuit diagram using components. 3. To know construction, working & necessity of components used.	Electrical Systems of Automobiles: Electrical components used for 2 wheeler & 4 wheeler automobiles like batteries, magnetos, contact breakers, ignition coils, cut outs, voltage & current regulators, spark plugs, various types of lamps, alternators & dynamos. Connection diagrams of these components in typical two wheeler & four wheeler automobiles.	9	16
2 Refrigeration & Air Conditioning	1.To know the refrigeration, its elements, rating. 2.To know the construction, working, electric circuit, maintenance & trouble shooting of domestic refrigerator. 3.To know construction & working of water cooler. 4.To know air conditioning,	2.1 Refrigeration: Introduction, applications, elements of refrigeration systems, coefficient of performance, standard rating, simple vapour compression refrigeration system. Construction, working, electric circuit, maintenance & trouble shooting of domestic refrigerator. Water coolers. 2.2 Air Conditioning: Introduction, thermodynamics of human body, factors	6	12

	its system, classifications. 5.To know manufacturing of ice.	affecting human comfort. Air conditioning systems: Introduction, cycle, classifications & central system. Air conditioning of theatres, manufacturing of ice.		
3 Material Handling Electrical Equipments in Industries:	1.To know principle, general drive control, safety & precautions of cranes, hoists, gantry, lifts, platform truck & conveyors belts 2. To do maintenance of these equipments. 3. To operate these equipments.	3.1 Material Handling Electrical Equipments in Industries: Cranes, hoists, gantry: Principle, general drive control, safety & precautions. 3.2 Lifts: Principle, general diagram, control 3.3 Platform Truck: Principle, general diagram, control 3.4 Conveyors Belts: Principle, general diagram, control.	6	12
4 Electrical Heating & Melting:	1.To understand principle, advantages & disadvantages of electric heating & melting. 2.To know modes of transfer of heat, heating element materials & its design, process losses & reasons of failure of heating element. 3.To control temperature of resistance oven/furnaces. 4. To know principle, construction & operation of heating methods like resistance heating, salt bath heating, arc furnaces, induction heating, dielectric heating, high frequency eddy current heating. 5. To know high frequency power supply sources.	Electrical Heating & Melting: Introduction, advantages, disadvantages & applications, modes of transfer of heat, heating element materials & design, losses, efficiency (Numericals). Temperature control of resistance oven / furnaces, causes of failure of heating element, electric heating methods: resistance heating, salt bath heating & infra red heating, arc furnaces, power supply. Induction heating: direct core, indirect core, vertical core & coreless induction furnaces. High frequency power supply sources, high frequency eddy current heating Dielectric heating Principle. Choice of frequencies for induction & dielectric heating.	9	16
5 Electrical Welding	1. To understand principle & types of electric welding & requirement of good weld. 2. To know various electric welding processes, equipment used, operation, characteristics, advantages, disadvantages & applications. 3. To know power supply for resistance & arc welding.	5.1 Electrical Welding: Introduction, requirements of good weld. Advantages, disadvantages & applications. Types of electrical welding processes / equipment. Types, equipments, operation, characteristics, advantages, disadvantages & applications of electric resistance, electric arc, ultrasonic, electron beam & laser beam weldings. Power supply for resistance & arc weldings: Transformer & differential compound generator for weldings.	6	12
6 Batteries	1.To know types of cells, super capacitor & difference between primary cell & secondary cell.	6.1 Batteries: Types, comparison, construction, working, charging & discharging of lead acid battery, nickel cadmium cell, leclanche cell, nickel –	6	12

	2. To know construction & working of the cells. 3. To know maintenance of the batteries. 4. To know charging & discharging of the batteries.	iron cell. Types of connections, maintenance & applications of these batteries. 6.2 Super capacitor & fuel cell as substitutes for batteries.		
			42	80

Teaching Methodology: Chalk Board, PPT.

Professional Practices:

Visit to industry/ industry manufacturing heating / welding unit. Literature survey.

Learning Resources:

Sr. No.	Title of the Book	Author	Publisher
1	Utilization of Electrical Energy	Taylor E. O	TMH, edition
2	Art & Science of Utilization of Electrical Energy	Partab H	Dhanpat Rai & Co. Delhi
3	Electrical Power	Uppal S. P	S. Chand & Co, New Delhi
4	A Course in Electrical Power	Soni, Gupta & Bhatnagar	Dhanpat Rai & Co. Delhi.
5	Utilization of Electrical Power	R. K. Rajput	Laxmi Publications (P) Ltd. New Delhi
6	Electrical Technology- Vol I	Theraja B. L.	S. Chand & Company Ltd., New Delhi.
7	Refrigeration & Air Conditioning	V. M. Domkundwar	Dhanpatrai Publications, New Delhi
8	Refrigeration & Air Conditioning	C. P. Arora	Tata McGraw Hill Publications, New Delhi.

(B) Web sites for references:

www.electrical4u.com

www.electricaleasy.com

www.electronicshub.org

www.electronics-tutorials.ws

SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS (THEORY)

Unit No.	Teaching Hours	Distribution of Theory Marks			
		Remember Level	Understand Level	Apply Level	Total Marks
1	10	4	4	8	16
2	08	2	6	4	12
3	08	2	4	6	12
4	10	3	7	6	16
5	08	2	4	6	12
6	08	3	4	5	12

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

MAPPING MATRIX OF CO'S & PO'S:

3: High 2: Moderate & 1: Low Relationship

CO's	PO1 Basic knowledge	PO2 Discipline knowledge	PO3 Experiments & Practice	PO4 Engineering Tools	PO5 The engineer & Society	PO6 Environment & Sustainability	PO7 Ethics	PO8 Individual & team work	PO9 Communication	P10 Lifelong learning
C01	2	2	1	2	3	3	1	3	3	3
C02	2	2	1	3	2	3	1	2	3	3
C03	1	2	1	2	2	1	1	2	3	3
C04	1	3	1	1	2	1	1	1	3	3
C05	1	3	1	1	1	2	1	1	3	3
C06	1	3	1	1	1	2	1	1	3	3

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name: Electric Motor Control****Course code: R18EE4305****Course Category: Applied****Credits: 06****Teaching and Examination scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
04	02	3	80	20	--	50	25	175

Rationale: In the sophisticated industries, an electrical engineer is expected to work on the drives run by the electric motors, which have different working characteristics. Student has to deal with the electric as well as electronic control of AC and DC motors. In this course, the students will learn about the various types of the electrical drives and undergo the various methods of control through the electrical as well as electronic circuitry. Student will also learn about various components used for motor control and revise the various AC and DC motors characteristics.

Course Outcomes: The student should be able to -

1. Understand and suggest electric drives for various applications.
2. Chose proper types of Induction motors and suggest its control method for particular applications.
3. Understand the various methods of controlling the Induction motor & their starters and braking of the AC drives
4. Draw the circuit diagrams for conventional and electronic methods of starting & efficient braking of the DC drives.
5. Identify Select suggest and maintain control assembly/ panel and auxiliary devices.
6. Suggest Special type of Modern Drives with their applications and understand the safe working of Power supplies.

Course Contents:

Unit	Learning Objectives	Contains of Unit	Hours	Marks
1. Importance of Electric Drives	<ol style="list-style-type: none"> 1. Select the correct type of Electric Drive for given various types of loads. 2. Select the suitable & stable drive type according to need of the load to be driven. 3. Suggest the electric motor for particular applications. 4. Draw and explain the operation of electric motor in particular operating quadrant. 5. Draw and suggest type of motor according to the characteristics of the load to be drive. 6. Identify various types of Industrial loads and suggest suitable stable drive operation. 	<ol style="list-style-type: none"> 1. Types of Drives: Advantage of Electrical Drives over other drives. 2. Classification of Electric Drives. A. Group Drive B. Individual Drive. C. Multi-motor Drive with their advantages and limitations. 3. Factors governing selection of electric motors. 4. Four-quadrant operation of electric drives. 5. Speed-Torque characteristics of various types of electrical motors. 6. Types of industrial loads and Stability of electric motor driven drives. 	10	16
2. Conventional control of Induction motor	<ol style="list-style-type: none"> 1. Distinguish between type of characteristics of load to be driven by Induction motor and suggest proper starters for safe working. 2. Explain the effect of Starting current of the Electric Motors on various system components. 3. Distinguish between soft 	<ol style="list-style-type: none"> 1. Need of reduced voltage starting of Electric Motors. Methods of reducing voltages, their advantages & disadvantages. 2. Effects of starting current on power lines motor & load. 3. Induction motor starter: A. DOL Starter with thermal relay. B. Star delta starters – Manual, Semi-automatic and automatic types, 	09	12

	<p>stating methods and regular starting methods for induction motor with comparisons</p> <p>4. Draw and explain the methods applicable for soft starting methods of induction motors..</p> <p>5. Understand the function of remotely operated induction motor Starters.</p>	<p>their circuits and operations. <i>C.</i> Auto-transformer Starter. <i>D.</i> Rotor Resistance starter for SRIM.</p> <p>4. Soft starters for induction Motor, Operations and their advantages, limitations and applications.</p> <p>5. Remotely operated starters like Nano-Ganesh starter for Agriculture pumps.</p>		
3. Electronic Control of Induction motors.	<p>1. State need and importance of Electronic speed control of electric drive.</p> <p>2. Draw block diagram and explain about V/F method of control for Induction motor.</p> <p>3. Enlist pros and cons and explain about Variable Frequency drive with its block diagram.</p> <p>4. Explain and Suggest the proper type of Electronic Control method from vivid available options for the control of Induction with their circuit diagrams.</p> <p>5. Write down the step-by-step (systematic) procedure for suggested braking method to be carry out on induction motor by doing connections; perform various braking tests from drawn circuit diagram and plot the graph from noted obtained results.</p>	<p>1. Principle of Electronic speed control for AC motors.</p> <p>2. V/F control: - Block Diagram, Working and Applications.</p> <p>3. Variable Frequency drive: - Block diagram, Working and application.</p> <p>4. Voltage Source Inverter, Current Source Inverter, Cyclo-converter, Static Scherbius drives and Static Kramer drive for control of induction motor with their circuit diagrams, working and applications.</p> <p>5. Plugging & Dynamic braking of 3 phase induction motor.</p>	09	12
4. Conventional and Electronic Control of DC motors	<p>1. Explain the construction and working with sketch of specific starter with type of DC motor.</p> <p>2. Draw and explain the scheme of jogging of dc drive with neat control circuit diagrams.</p> <p>3. Select proper type of controlling scheme using Electronic components for DC drives.</p> <p>4. Suggest and demonstrate the skill for starting, controlling and braking methods for DC drives.</p>	<p>1. Current limit acceleration starters for shunt motor and series motor like a. 3-point starter b. 4-point starter. c. Drum controller respectively.</p> <p>2. Jogging/ Inching of DC Motors, their simple control circuits with forward and reverse control.</p> <p>3. Principle of Electronic control for controlling the speed of DC Motors: A. DC Motor Control through SCR single and three phase schemes with P.F. consideration. B. DC Motor Control through various types of Choppers.</p> <p>4. Electrical braking of DC motors: - a. Regenerative [Rheostatic braking] b. Plugging.</p>	10	16
5. Control assembly, panels and Auxiliaries.	<p>1. Compare Electromechanical and Electronic components used in various control and power circuits used for electric drives.</p> <p>2. State, select and identify various MCC components.</p> <p>3. Suggest and select proper IP level for particular MCC panel.</p> <p>4. Applying basic concepts in</p>	<p>1. Electromechanical and electronic components used in electric motor control unit.</p> <p>2. Study of Motor Control Centres and motor control circuit components like pilot lamps, push buttons, manually and automatically operated selector switches, actuators, contactors with their types, static and electromechanical relays, sensors,</p>	09	12

	<p>explaining the working and construction of advanced form of the electric drive related applications.</p> <p>5. Understand the importance of Electric drives in other branch of engineering.</p>	<p>bus-bars, MCB's etc. in MCC.</p> <p>3. Control panels and Ingress protection for control panel boxes.</p> <p>4. A. Electro-mechanical brakes – construction and working.</p> <p>B. Brake motor – construction and working, advantages, limitations and applications.</p> <p>C. Study of electromagnetic clutches – advantages and applications.</p> <p>5. Use of CNC method for control for Drives.</p>		
6. Modern Drives, applications and Power supply.	<p>1. Describe the use and applications of the modern types of electric motors as drive.</p> <p>2. Draw the correct labelled circuit diagram for Solar Powered Drive vehicle.</p> <p>3. Draw and explain the working and applications of special purposed drives like lifts and conveyors.</p> <p>4. Identify the problems arising in the normal working of drive due to power quality issues in supply.</p> <p>5. Suggest remedial measures and equipments to eliminate power failure in electric drives. and power supply for the drives.</p> <p>6. Suggest remedial methods and correct schemes for power factor improvement in electric drives.</p>	<p>1. Construction, working and applications of –</p> <p>a. BLDC Motors.</p> <p>b. Printed Circuit motors.</p> <p>c. Linear Induction Motor.</p> <p>2. Solar battery power drives – Circuit, working and applications.</p> <p>3. Control circuits for lifts and conveyors.</p> <p>4. Need and application of single phasing preventer, types, construction and working of Voltage Operated Single Phasing preventer and Current Operated Single Phasing preventer.</p> <p>5. Need of voltage stabilization and types of Voltage stabilizers for single and three-phase supply.</p> <p>6. Power factor Correction Methods in brief.</p>	09	12

Specification table with contact hours and marks for theory:

Unit No.	Teaching Hours	Distribution of Theory Mark			
		Remember Level	Understand Level	Apply Level	Total Marks
1	10	04	08	04	16
2	09	03	06	03	12
3	09	03	05	04	12
4	10	04	08	04	16
5	09	02	05	05	12
6	09	03	06	03	12

Term work:

A] List of the practical: Minimum 12 experiments are to be performed from the following list.

Sr. No	Unit	Practical	Hrs.
1	2	Identify, draw and write construction and working of Manual and Automatic Star-Delta starter.	02
2	2	To plot braking characteristics of AC motor by Dynamic Breaking Method	02
3	2	To plot braking characteristics of AC motor by Plugging Method.	02
4	3	To troubleshoot the given AC drive.	02
5	3	Check the functioning of the different components of the high power Electronic speed control devices for AC motor and write their specifications and ratings.	02
6	4	To troubleshoot the given DC drive.	02

7	4	Identify, draw and write construction and working of reduced voltage starters for DC Shunt and Series motors.	02
8	4	To plot braking characteristics of DC motor by Plugging	02
9	4	To plot braking characteristics of DC motor by Rheostatic method.	02
10	5	Draw, Study and write the construction and working of the Electromagnetic Brakes and clutches.	02
11	5	To Study the MCC/ Control panels installed in the lab for various types of AC /DC drives and prepare the list of components with specifications.	02
12	6	To Draw and write construction and working of the operation of Voltage operated single phasing preventer	02
13	6	To Draw and write construction and working of Current operated single phasing preventer.	
14	6	To study the various types of stepper motor.	02
15	6	To study the types, Construction, working & applications of BLDC Motor.	02

B] Student/group of student will visit the firm/unit where various types of drives are used such as paper printing mill, small scale industry or manufacturing unit and will prepare the visit report.

Library related Activity: Students will prepare the Power-point Presentation on any topic of their choice based on the curriculum by taking the help of the reference books, journals or magazines available in the library.

Books:

Sr. No.	Title of the Book	Author	Publication
1	Electrical Motor Control	Siskind C.	McGraw-Hill Publications.
2	Industrial Drives	Pillai	New Age International
3	Handbook of Electrical Motor Control Systems	U. S. Eswar	TMH
4	Electric Drives	VedamSubramanyam	Tata McGraw-Hill Education
5	Modern power electronics and AC drives	Bimal K. Bose	Elsevier
6	Electrical Drives	Ali Emadi	CRC Press
7	Fundamental of electric drives	Gopal K. Dubey	Alpha Science international
8	Electrical Motors and Control Systems	Frank D. Petruzella	McGraw-Hill Education
9	Electric Motor Control	Stephen L. Harman	Delmar CENGAGE Learning.
10.	Control of Machines	S K Bhattacharya, Brijinder Singh	New Age international publisher
11.	Industrial Electricity and Motor Controls	Rex Miller & mark Miller	McGraw-Hill

Learning Websites

- www.cesim.com/simulations
- www.scilab.org/scilab
- www.ni.com/multisim
- www.youtube.com/electric_circuits/AC-DCDRIVES
- www.dreamtechpress.com/ebooks/AC-DCDRIVES
- www.nptelvideos.in/electrical_engineering/AC-DCDRIVES
- [www.learnerstv.com/free-engineering/AC-DC DRIVES](http://www.learnerstv.com/free-engineering/AC-DC_DRIVES)
- www.orcad.com/resources/orcad-downloads
- www.electricaltechnology.org
- www.howstuffworks.com
- www.electrical4u.com

CO- PO PSO Mapping:

PO/PSO	PO1. Basic and Discipline specific knowledge:	PO2. Problem analysis:	PO3. Design/ development of solutions:	PO4. Engineering Tools, Experimentation and Testing:	PO5. Engineering practices for society, sustainability and environment:	PO6. Project Management:	PO7. Life-long learning:	PSO1: Electrical Engg.Skills and Lab Skills for Testing and Maintenance.	PSO2: Estimate and interpret data related to Electrical Engg. System	PSO3: Apply Electrical Engg. Knowledge to work professionally in team, or lead team.
COs										
CO1:Understand and suggest electric drives for various applications.	3	2	-	2	1	2	1	2	1	3
CO2: Chose proper types of Induction motors and suggest its control method for particular applications.	2	2	2	2	-	1	-	2	1	3
CO3: Understand the various methods of controlling the Induction motor & their starters and braking of the AC drives	2	1	1	3	2	-	2	2	3	2
CO4: Draw the circuit diagrams for conventional and electronic methods of starting & efficient braking of the DC drives.	-	2	3	3	-	3	-	1	-	2
CO5: Identify Select suggest and maintain control assembly/ panel and auxiliary devices.	1		3	2	2	1	3	2	2	3
CO6: Suggest Special type of Modern Drives with their applications and understand safe working of Power supplies.	1	2	1	3	2	1	3	1	2	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course :Electrical Estimation &Costing****Course code : R18EE4306****Course Category: Applied****Credits : 07****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
3	4	3	80	20	-	50	25	175

RATIONALE:

An Electrical Engineer has to go through various processes requiring estimation of materials & costing of the installation. In this course, he will learn about the methods of estimation as well as methods of earthing as per IS, which will be helpful for him to estimate the quantity of materials & different methods of costing of various installations . He also will learn about methods of different types of installations as per IS.

COURSE OUTCOMES: After completion of this course the students will able to,

1. Read, interpret & draw electrical wiring diagram.
2. Understand IE rule related to electrical wiring installations.
3. Estimate Domestic & Commercial electrical wiring installation.
4. Prepare estimate of industrial wiring installations.
5. Estimate overhead & underground distribution line installations.
6. Prepare quotation, contract & tender documents.

Course Details:

Unit	Learning Outcomes	Topics & subtopics	Hrs	Marks
1. Elements of Estimation & Costing	1. Describe different terms used in estimation and costing. 2. State the principle & purpose of estimation and costing. 3. Estimate detail plan. 4. Prepare the rate analysis for different items & terms.	1.1 Meaning of terms used in estimation & costing. 1.2 Principle & purpose of estimation & costing. 1.3 Approximate estimates. 1.5 Detailed estimates. 1.6Preparation of detailed specification, standard specification book. 1.7 Market rate for material & labour, standard schedules of rate 1.8Methods of employing labour & making payments. 1.9 Preparing rate analysis for items	08	12

2. Installation Component s and Wiring System.	<ol style="list-style-type: none"> 1. State & Explain general requirement of electrical installation. 2. Draw & interpret electrical drawing & symbols. 3. Identify different types of wires& wiring methods used in electrical installation. 4. Draw different diagram as per IS code-762-1963. 5. State & explain IE rule related to electrical installation for wiring and Electricity supply act-1948. 6. Describe different wiring material. 	<p>2.1 General requirement of electrical installation</p> <p>2.2 Reading & interpretation of electrical engineering drawings & symbols related to installation.</p> <p>2.3 Revision of wiring methods in various electrical installations with general requirements.</p> <p>2.4 Representation of different type of diagrams, such as schematic, circuit, wiring diagram and it's single line representation as per IS code-762-1963.</p> <p>2.5 IE rule related to electrical installation for wiring, including Electricity supply act-1948.</p> <p>2.6 Wiring Material:</p> <p>2.6.1 Selection of Fuse /MCB/MCCB, ELCB, Starter.</p> <p>2.6.2 Deciding the Cable route, length of wire, cable, conduit, Earth wire etc.</p>	06	12
3. Residential and Commercial Wiring Installation .	<ol style="list-style-type: none"> 1. Identify difference in residential and commercial installation. 2. Estimates the Residential Installation. 3. Estimates the Commercial installation. 4. Prepare material table for electrical installation. 5. Solve numerical on installation. 	<p>3.1 Concept of Residential and commercial Installations.</p> <p>3.2 Design of Residential installation-</p> <p>3.2.1 General guidelines for residential installation.</p> <p>3.2.2 Electrical plan layout</p> <p>3.2.3 Single line diagram</p> <p>3.2.4 Schematic, wiring diagram</p> <p>3.2.5 Distribution of load as per I.E rules.</p> <p>3.2.6 Selection of wires, rating for main switch, distribution board, and wiring accessories.</p> <p>3.3 Design of Commercial installation-</p> <p>3.3.1 General requirement & selection factors for commercial installation.</p> <p>3.3.2 Design of lighting and power circuits as per IE rule.</p> <p>3.3.3 Load calculation and drawing of single line diagram</p>	08	16

		3.3.4 Design of Cable and other accessories fittings and Mounting Arrangements 3.3.5 Positioning of main switch, distribution boards & switch boards. 3.3.6 Wiring diagram of individual switchboard. 3.4 Preparation of bill of material for Residential & Commercial electrical installation. 3.5 Numericals on installation		
4. Electrical Installation in Small Industries.	1. Understand the guidelines for industrial installation. 2. Load calculation for small industry/work shop 3. State important consideration regarding motor installation wiring. 4. Prepare layout and wiring diagram for motor installation in small industry/ workshop.	4.1 Guidelines for industrial installation. 4.2 Concept of Industrial Load. 4.3 Important design consideration regarding motor installation wiring- 4.3.1 Motor current 4.3.2 Selection & size of cable, conduit, fuse rating. 4.3.3 selection of starter, distribution board, main switch & other relevant materials. 4.4 Preparation of detailed estimates and costing of small industries/ workshop (Numericals)	08	16
5. Installation and Estimates of Service connection.	1. Describe about service connection. Solve numerical on O.H Lines. 2. Identify difference in O.H Lines and Underground cables. 3. Describe in detailed about Earthing.	5.1 Types of Service Connection. 5.1.1 O.H. Lines & cables installation & their costing (Numerical) 5.1.2 Underground Cable Service Connection. 5.2 Distinguish between O.H line & Underground line 5.3 Earthing- 5.3.1 Types of earthing as per IS 5.4.2 5.3.2 Estimation of cost of earthing of Installation 5.3.3 Requirement of Earthing installation for Distribution Substations, Residential and commercial installations.	09	12
6. Tender and Quotation	1. Understand Quotation & Tender terminology. 2. Prepare a	6.1 Definition of different terms such as earnest money, security deposit, warranty period, contract agreement, scope of work & related taxes such as service tax , VAT etc. 6.2 Quotation-	09	12

	quotation with the reference of requirement	6.2.1 Requisition, call of quotation, opening of quotation		
3.	To understand tendering procedure & filling tender.	6.2.2 comparative statement		
		6.2.3 purchase order.		
		6.2.4 Overhead charges.		
		6.2.5 Per point charges & fixed percentage costing.		
4.	Describe the procedure for submission and opening of E-Tender	6.3 Tender-		
		6.3.1 Procedure to prepare tender document.		
		6.3.2 Floating of tender		
		6.3.3 Terms & condition for filling the tender		
5.	Explain different tender document and tender notice	6.4 Administrative approval and technical Sanctions.		
		6.5 Order of supply.		
		6.6 Payment of bills.		
		6.7 Tender Document		
6.	Difference between quotation & tender	6.8 Tender Notice		
		6.9 Concept of E Tender & E-Tendering procedure		
		6.10 Difference between quotation & tender		

❖ **SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS**

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Elements of estimation & costing.	08	4	4	4	12
2	Installation components & wiring system	06	2	6	4	12
3	Residential & commercial wiring installation	09	4	6	6	16
4	Electrical installation in small industries	09	4	6	6	16
5	Installation & estimates of service connection	08	4	4	4	12
6	Tender & Quotation	08	2	4	6	12
	Total	48	20	30	30	80

- **Legends:** R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point Presentation, Transparency, Expert Lectures.

LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS

Minimum Eight (08) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

A) Intellectual Skills:

- Identify
- Discrimination
- Selection
- Interpretation
- Understanding

Sr. No	Unit No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Appro. Hrs. required
1	2	Revision of Symbols for electrical installations.	4
2	3	Domestic Installation	4
3	3	Commercial Installation	4
4	4	Industrial Installation	4
5	5	Cable Installation or O.H. Line Installation.	4
6	5	Types of Earthing	4
7	6	Case study I- To prepare quotation, call quotation, make comparative statement.	4
8	6	Case study II- Collect tender notice from newspaper, study tender document & fill tender form.	4

B) Professional Practice:

- A guest lecture of eminent electrical contractor be arranged and the student should submit the lecture report as part of term work.
- Student should collect the datasheets of various electrical components and accessories and use this data in their term work estimation.

LEARNING RESOURCES:**B) Books:**

Sr. No.	AUTHOR	TITLE	PUBLISHER
1	Arora bB.D.	Electrical Estimation and Costing	McGraw Hill
2	Dr. S. L. Uppal	Electrical Estimation & costing	S.Chand Publishing
3	Surjeet Singh	Electrical Estimation and Costing	Nirali Prakashan
4	K.B. Raina, S.K. Bhattacharya	Electrical Design; Estimation & costing	Vrinda Publication
5	N. Alaggapan, E.Ekamberam	Electrical Estimation and costing	Tata MaGrawHill, New Delhi.

C) Magazines: 1. Electricals for you. 2. Digital Electricals.**(C) Web sites for references:** 1. www.en.wikipedia.org. 2. www.electricals-tutorials.com
3. www.indianscientificinstrument.com 4. www.youtube.com/electricalwiringsystem**CO-PO MAPPING:**

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	3	3	3	2	3	3	2	3	2	3
CO2	2	3	3	3	2	1	2	2	1	2
CO3	3	3	3	2	1	1	1	3	3	2
CO4	3	3	3	2	1	1	1	3	3	2
CO5	3	3	3	2	1	2	1	3	3	3
CO6	2	2	3	1	1	1	1	2	1	1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course name: Installation, Maintenance and Repair****Course Code: R18EE4307****Course Category: Applied****Credits: 5****Teaching & Examination Scheme**

Teaching Scheme		Paper HRS	Examination Scheme					Total
TH	PR	3	TH	TT	PR	OR	TW	125
3	2		80	20	-	-	25	

Rationale: An electrical engineering is supposed to carry out process of installation of electrical equipments, their maintenance & repair. This activity is core of duty of electrical diploma engineer. As an entrepreneur also a person must have knowledge of this. This course will cover the basics of installation, maintenance & repair of electrical equipments.

Course Outcomes: Student will be able to

1. Locate the fault location places in electrical equipment.
2. Prepare preventive maintenance schedule for electrical equipments
3. Predict the cause of fault in electrical equipments
4. Assist Engineer in Installation, Maintenance & Repair & follow safety norms

Course Details:

Unit No.	Learning Outcome	Contents	Marks	Hours
1	a. Explain causes of faults b. Identify tools used for fault finding & repair	1.1 Electrical circuit faults 1.2 Electrical equipment faults 1.3 Mechanical faults in electrical equipment 1.4 Magnetic faults 1.5 Causes of faults 1.6 Tools, instruments & materials used for repair & fault finding 1.7 Fault location in electrical equipment e.g. Transformer, DC machines, 3 phase Induction motor, synchronous motors, overhead lines, circuit breaker, batteries, etc.	16	10
2	a. Explain methods of measuring insulation resistance b. Draw diagram for oil filtration plant	2.1 Need of insulation in electrical system 2.2 Measurement of Insulation Resistance by i) Polarization Index ii) Dielectric absorption iii) Megger 2.3 Causes of insulation failure 2.4 Insulation testing methods 2.5 Condition monitoring & dissolved gas analysis of insulating oils 2.6 Filtration of insulating oils	12	08
3	a. Enlist the dos & don'ts of electrical safety b. Explain working of fire extinguisher	3.1 Concept of electrical safety, electrical accidents, their causes & prevention 3.2 Factors deciding the severity of electrical shocks 3.3 Statutory regulations (Dos & Don'ts) of electrical safety 3.4 Permit to work system	12	08

		3.5 Types & uses of different fire extinguishers		
4	a. Prepare maintenance schedule for various equipments b. State methods of drying out c. Prepare troubleshooting chart for various equipments	4.1 Concept of maintenance, types of maintenance- routine, preventive & breakdown 4.3 Maintenance schedule(as per IS) for transformers, Induction motors, Synchronous motors, DC motors, LT & HT Overhead lines, General procedure of overhauling of motors 4.4 Drying out & varnish impregnation process 4.5 Troubleshooting charts for transformer, Induction motor, batteries	16	08
5	a. Describe the installation various electrical equipments b. Describe the installation of HT & LT OH lines	5.1 Installation of Induction motors & rotary machines- inspection on arrival, handling, inspection, storage, care during installation, foundation, leveling, mechanical precommissioning checks, commissioning 5.2 Installation Diesel-Generator (DG) set. 5.3 Installation of transformers- inspection on arrival, handling, storage, installation, foundation, filling transformer with oil, precommissioning checks, commissioning, etc. 5.4 Installation of High Tension & Low Tension Overhead Lines	12	07
6	a. Explain the installation of cables b. Describe the earthing installation	6.1 Installation of cables 6.2 Installation of switchgear 6.3 Earthing – types, methods, earth resistance & factors influencing, methods of improving earth resistance, Installation and maintenance of earthing 6.4 Provision of earthing as per IS 6.5 Precaution & guidelines for handling of heavy equipments 6.6 Equipments, tools & accessories for handling heavy equipments	12	07

Teaching Methodology: Chalk Board, Discussions, Power Point Presentation

Unit No.	Teaching Hours	Distribution of Theory Mark			
		Remember Level	Understand Level	Apply Level	Total Marks
1	10	03	05	04	16
2	8	02	05	05	12
3	8	04	06	06	12
4	8	04	06	06	16
5	7	04	04	04	12
6	7	02	06	04	12

Practical:

Sr. No	Name of Experiment	Unit No.	Hours required Approximately
1.	Study of earth tester and measurement of earth resistance	6	2
2	Measurement of Insulation resistance	2	2
3	Testing of transformer oil	2	2
4	Overhauling of any electrical equipment	1	4
5	Rewinding/ Winding of small transformer, choke or small motor	1	4
6	Location of fault (any two) i. Induction motor ii. DC motor iii. Transformer	1	4

Professional Practices:**Learning Resources:**

Books :

Sr. No	Author	Title	Publishers
1.	Charles I. Hubert	Preventive Maintenance of Electrical Equipments	McGraw Hill Company,
2.	Madhavi Gupta	Installation, Maintenance of & Repair of Electrical Machines & Equipments	Katson Books
3.	Ashfaq Husain	Electrical Machines	Dhanpat Rai & Co.

Website

1. www.omega.com
2. www.automaticalecyricals.com

CO PO MAPPING

CO	PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and environment	Project Management	Life-long learning
Locate the fault location places in electrical equipment.		1	3	--	3	--	--	1
Prepare preventive maintenance schedule for electrical equipments		1	3	--	--	--	--	2
Predict the cause of fault in electrical equipments		1	3	3	--	--	--	1
Assist Engineer in Installation, Maintenance & Repair & follow safety norms		--	--	--	3	2	2	--

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course name: Electrical Traction Systems****Course Code: R18EE4308****Course Category: Core****Credits: 6****Teaching & Examination Scheme:**

Teaching Scheme		Paper HRS	Examination Scheme				Total
TH	PR	3	TH	TT	PR	OR	
4	2		80	20	25	25	150

Rationale:

The development of the cities in India is taking place at a fast rate. The number of daily commuters in cities has become huge. To cope up with this, railway electrification, metros, monorail is playing important role. Apart from this at national level also railways are regarded as lifeline of country. The diploma student is required to know about the electric traction system. This course will cover current & future trends in traction system, auxiliary equipments, electric locomotives, control of traction motors. The diploma pass will be able to maintain traction system, auxiliary equipments, electric locomotives, traction motors.

Course Outcomes:

1. Distinguish different traction systems, latest trends in traction systems.
2. Differentiate services of traction system based on speed time curve.
3. Control different types of control motors.
4. Use various traction system auxiliaries.
5. Describe Feeding and Distribution System for Electric Traction System
6. Understand and Explain Traction motor control scheme.

Course Details:

Unit No.	Learning Outcome	Contents	Marks	Hours
1 Traction systems and latest trends	i) Explain the present scenario of Indian Railways- High speed traction, Metro ii) Detail the latest trends in traction. iii) Explain types of traction systems and their significance. iv) Explain the general arrangement of different types of Electric traction systems and their significance. v) Select a traction system for a given application.	1.1 Present scenario of Indian Railways – City transportation: Trams, trolleybus, metro, monorail; Intercity transportation: Railways, Electromagnetic levitation, bullet train 1.2 Latest trends in traction- Metro, monorail, Electromagnetic levitation Vehicle 1.3 Steam, diesel, diesel-electric, Battery operated electric traction systems 1.4 General arrangement of D.C., A.C. single phase, 3 phase 1.5 Comparison of traction system - Diesel- Electric and Electric train system	12	10

2 Mechanics of Train Movement	i) Draw the speed time curve related to different traction system. ii) Solve numerical based on speed time curve. iii) Calculate specific energy consumption. iv) State the factors affecting Specific energy consumption	2.1 Analysis of speed time curves for main line, suburban and urban services 2.2 Simplified speed time curves. 2.3 Relationship between principal quantities in speed time curves 2.4 Requirement of tractive effort 2.5 Specific energy consumption and Factors affecting it	12	10
3 Electric Locomotives and Auxiliary Equipment	i) Classify electric locomotive ii) Describe the function of auxiliaries in traction system iii) Describe the different current collecting methods in locomotives iv) Explain different control and auxiliary equipment used in the locomotive v) Describe the Power conversion and transmission systems vi) Explain Coach wiring and lighting devices	3.1 Important features of electric locomotives 3.2 Different types of locomotives 3.3 Current collecting equipment 3.4 Coach wiring and lighting devices 3.5 Power conversion and transmission systems 3.6 Control and auxiliary equipment	16	12
4 Traction Motors and Their Control	i) State the desirable features of traction motors. ii) Explain Significance of D.C. series motor over D.C. Shunt motor. iii) Explain working of various A.C. motors as traction motors. iv) Compare different traction motors.	4.1 Features of traction motors. 4.2 D.C. series motor as traction motor 4.3 A. C. Traction motors- single phase, Three phase, Linear Induction Motor 4.4 Comparison between different traction motors	16	12
5 Feeding and Distributio	Explain the distribution & feeder system pertaining to	Distribution systems pertaining to traction (distributions and feeders) 5.2 Traction sub-station	12	10

n System.	traction 5b. Classify traction substations 5c. Describe different methods of feeding the traction sub- station	requirements and selection 5.3 Method of feeding the traction sub- station		
6 Traction motor control	v) Apply various control methods applied to traction motors. vi) Explain different types of electric braking system	3.5 Series-parallel control 3.6 Open circuit, Shunt and bridge transition 3.7 Pulse Width Modulation control of induction motors 3.8 Types of electric braking system	12	10

Teaching Methodology: Chalk Board, Discussions, Power Point Presentation

Unit No.	Teaching Hours	Distribution of Theory Mark			
		Remember Level	Understand Level	Apply Level	Total Marks
1	10	03	05	04	12
2	10	02	05	05	12
3	12	04	06	06	16
4	12	04	06	06	16
5	10	04	04	04	12
6	10	02	06	04	12

Termwork:

The termwork shall consist of following:

Drawing any

Sr. No.	Unit No.	Practical Exercise	No. of hours required
1	I	Layout of DC locomotive & Diesel Locomotive	4
2	III	Current collecting equipment	4
3	III	Train lighting system & devices	4
4	V	Traction substation & methods of feeding the traction sustation	4
5	VI	Control & auxiliary equipment in traction	4

SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

- Prepare a report on current collector of bow and pantograph type current collector, showing complete arrangements of Pantograph its location and electric wiring system with locomotive.
- Prepare a report on the following locomotives:
 - D. C. locomotive
 - A. C. / D. C. locomotive
 - Diesel electric locomotive (Report to be written)
- Prepare a report after visiting a electric-traction substation

SPECIAL INSTRUCTIONAL STRATEGIES (if any)

- Arrange visit to nearby locomotive workshops.

SUGGESTED LEARNING RESOURCES

1. List of books

S. No	Title of Book	Author	Publication
1.	Modern Electric Traction	H. Partab	Dhanpat Rai and Sons, New Delhi
2.	Electric Traction	J. Upadhyay S. N. Mahendra	Allied Publishers Ltd., Dhanpat Rai and Sons, New Delhi
3.	Electric Traction	A.T. Dover	Mac millan, Dhanpat Rai and Sons, New Delhi
4.	Electric Traction Hand Book	R. B. Brooks.	Sir Isaac Pitman and sons ltd. London.

2. List of measure equipments

i) Models of different traction system and equipments

3. List of software learning websites

i) www.irreen.com (Indian Railways Institute of Electrical Engineering, Nasik Road)ii) www.wr.railnet.gov.in/bctweb/ELECTRICAL.htmiii) www.scrailway.gov.in**CO PO Mapping:**

CO	PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and environment	Project Management	Life-long learning
Distinguish different traction systems, latest trends in traction systems.		1	--	--	1	--	1	--
Differentiate services of traction system based on speed time curve.		1	--	1	1	1	--	--
Control different types of control motors.		--	1	1	2	--	1	1
Use various traction system auxiliaries.		--	--	--	2	--	--	1
Describe Feeding and Distribution System for Electric Traction System		2	3	1	--	3	2	2
Understand and Explain Traction motor control scheme		3	3	2	--	2	1	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name : Illumination Engineering****Course code : R18 EE 4309****Course Category: Applied****Credits: 06****Teaching and Examination Scheme:**

Teaching Scheme			Examination Scheme						
L	T	P	Paper HRS	Theory	Test	Practical	Oral	Term Work	Total
2	0	4	--	--	--	--	50	50	100

Rationale: It is expected that the Diploma Holder in Electrical Engineering has to deal with number of electrical equipments in the Industry from the various aspects like design and testing etc. For this he should have the basic knowledge about the construction & operation of various illumination devices. In this course the students will learn about the various modes by which electrical energy is utilized in industries for illumination.

Course Outcomes: The student will be able to

1. Identify various illumination components.
2. Select Lamps & Lighting Scheme.
3. Select & Handle appropriate Illumination control.
4. Design Residential Illumination scheme.
5. Identify outdoor illumination scheme.
6. Identify appropriate Special Illumination scheme

Course Details:

Unit	Unit Learning Outcome	Course Contents	Hours	Marks
1 Fundamentals of Illumination	1a. Select illumination method. 1b. Assess illumination level.	1. Fundamentals of Illumination : Fundamentals of Illumination , Illumination terminology: Illumination, Light intensity, Lumen, Lux, Luminaries, Luminous Efficiency ,Laws of Illumination (Simple numerical) , scheme, Lux meter.Standard Illumination level required for various locations. Measurement of Illumination level for different locations. Characteristics of good Illumination Scheme. Advantages of good Illumination scheme. <u>r</u>	04	-
2 Lamps & Lighting Accessories	2a. Select appropriate lamp . 2b. Design lighting scheme. 2c. Calculate lighting	2. Lamps & Lighting Accessories : Types of Lights-- a. Visible light , b. Ultraviolet light , c. Infrared light 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,Xenon lamps. Sodium vapour lamp ,f.	06	-

		<p>Neon lamp , Neon Sign Tubes g. Halogen lamp ,h. CFL Lamps ,i. Metal halides lamp ,j. LED lamps k. Special purpose lamps Construction , working principle advantages and disadvantages of all lamps Selection of lamp for various application. Lighting schemes: selection of lamp, illumination efficiency , glare & power consumption , a. Direct & Indirect ,b. Semi direct & semi indirect c. General lighting scheme Lighting calculation methods :a. Watt /m² method, b. Lumens or light flux method ,c. Point to point method (Simple numerical)</p>		
3 Illumination Control and Control circuits	<p>3a. Control lights with appropriate method. 3b. Design control circuit of lamps.</p>	<p>Illumination Control and Control circuits: Purpose of lighting control , Electronic methods of illumination control, Working principle and operation of : Dimmer - Resistance type dimmer, Dimmer Transformer - 1) Auto transformer dimmer 2) Two winding transformer dimmer , Electronic Dimmer : working principle and operation , a. Thyristor operated dimmer ,b. Triac operated dimmer , Control of Enhance Lighting , Methods used for light control. Control circuits for lamps :Three point method & four point method , Polar curve : its meaning and applications for designing the lamps</p>	04	-
4 Illumination for Interior Applications	<p>4a. Design illumination scheme for interior application.</p>	<p>Illumination for Interior Applications: Standards for various situations in Interior Illumination, Std illumination level as per IS for various location. Methods for Designing illumination schemes , Design considerations for Interior location of Residential ,Commercial, Industrial premises . Design</p>	06	-

		Illumination scheme for different Interior locations of Residential, Commercial, Industrial unit. (Numerical on above sub topics)		
5 Illumination for Outdoor or Applications	5a. Design illumination scheme for outdoor application.	Illumination for Outdoor Applications: General requirements for lighting schemes , Specific requirements for above schemes, Factory Lighting , Street Lighting , Garden lighting Flood Lighting , Railway platform Lighting , Lighting for Advertisement/Hoardings , Sports Stadium Lighting , Simple numerical based on design of simple schemes	04	-
6 Lighting for special applications	6a. Design illumination scheme for general application.	Lighting for special applications: Lighting schemes and general requirements for : Agricultural & Horticultural applications , Health Care Centers and Hospitals , decorative lighting , stage lighting, Aquariums & Shipyards.	4	-
Total			28	-

Term Work:

All experiments are to be performed from the following list.

Sr. No.	Practical	Unit No.	Hours
01	Study of Filament lamp, Fluorescent lamp.	2	02
02	Study of Mercury Vapour, Sodium Vapour & Halogen Lamp.	2	02
03	Study of CFL & LED Lamp.	2	02
04	Study of Arc Lamp.	2	02
05	Study the different lighting accessories	5	02
06	Study of light control methods.	2	02
07	To measure illumination by Lux meter of given installation.	1	02
08	Estimate and compare the luminous efficiency of incandescent, filament lamp.	2	02
09	Compare performance of magnetic with electronic ballast. Estimate energy saving with electronic ballast.	2	02
10	To investigate the relationship between light intensity and the distance from light source.	1	02
11	Study of Street lighting.	5	02
12	Study of Stage lighting.	6	02
13	Study of Sport Stadium lighting.	5	03
14	Design of Illumination scheme for Residential Installation	4	02
15	Design of Illumination scheme for Commercial Installation/ Theatre/Auditorium.	4	03
16	Design Illumination scheme for Flood Lighting.	4	02
17	Study of energy efficient equipment	4	02
18	Study of biological implication of artificial illumination.	-	02
19	Design Illumination scheme for Industrial Lighting.	4	02

Professional Practice:

Students should visit a given locations. They should collect all the necessary information, brochures regarding illumination.

01	Prepare a report on Market survey for various lamps along with cost per unit.	2	04
02	Prepare a report on Market survey for various lighting accessories	2	04
03	Preparation of the comparative statement for lighting accessories by conducting survey and data collection from at least five companies	2	04
04	Write a report on illumination scheme used in industry by visiting small or medium industry.	6	04
05	Write a report on illumination scheme used in a mall & suggest remedial measures to save energy.(e.g use of LED, use of solar system ,use of foot-step generator)	4	04
06	Write a report on illumination scheme used in residential complexes & suggest remedial measures to save energy.(e.g use of LED, use of solar system)	4	04
		-	64

Learning Resources:

B) Books

Sr. No.	Title of the Book	Author	Publisher
1	Utilisation of Electrical Power	N.V.Suryanarayana	Wiley Eastern Limited
2	Applied illumination engineering	Jack I. Lindsey	The Fairmont Press Inc
3	Lighting Engineering & applied calculations	R.H. Simons & Robert Bean	Architectural Press(ISBN0750650516)

C) Websites: 1. www.electrical4u.com 2. [www. Electrical easy.com](http://www.Electrical easy.com)

CO- PO Mapping

CO	PO	Basic and Discipline specific knowledge	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation and Testing	Engineering practices for society, sustainability and environment	Project Management	Life-long learning
Identify various illumination components		1			3	2		1
Select Lamps & Lighting Scheme.		2	3		2	2		
Select & Handle appropriate Illumination control.		2		1	2	2		1
Design Residential Illumination scheme.		2	2	2		3		1
Identify outdoor illumination scheme.					2	2		
Identify appropriate Special Illumination scheme		2	2		2	2		1

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name: Industrial Training****Course Code: R18EE4310****Course Category: Applied****Credits: 06****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper	TH	TT	PR	OR	TW	Total
--	2	--	--	--	--	75	75	150

Rationale : In plant training is a learning opportunity for students. Students should therefore receive feedback on their performance so that they can grow professionally. This training will expose the trainee student to various departments in the industry. This training will make students to understand the industrial environment, discipline and punctuality. Students may also take special interest in any specific area of engineering and take it as a topic of Seminar and full /part of the project at last semester of diploma course. Overall professional development of diploma electrical engineers is the need of the day for enabling them to sustain in competitive global environment.

Course Outcomes:

Students will be able –

1. To enable exposure to the industrial environment, recognize the requirement of the industries and cope with the industrial scenario.
2. To study and learn different methods of maintenance, production, testing and different types of processes in industries.
3. To identify career paths taking into account their individual strengths and aptitude with preparation of report about the work experience in industry.
4. To communicate effectively through technical presentation.
5. To enhance the employability skills and start up skill to increases his ability to engage in lifelong learning.
6. To develop individual confidence to handle various engineering assignments and to expose themselves to acquire life skills to meet social challenges.

Activities to be carried out during industrial training:

1. Trainee students should visit various sections /departments in the industry .
2. Trainee student should observe and then make a list of processes, tools used for those processes, machinery and equipment used in the sections/departments of industry.
3. Trainee student should observe the routine maintenance procedures carried out, or any breakdown maintenance processes carried out for Electrical/Mechanical/Electro-mechanical components.
4. Trainee should study the pamphlets/ manuals available in the industry.
5. Observe and strictly follow all safety rules and regulations throughout the training
6. Prepare a report on the activities assigned to the trainee student during the training period.

Preparation of the report for the training : Followings are the guidelines for preparing the report of the industrial training after completion of the training.

- Details of the industry.

- Layout of the industry.
- Organizational structure.
- Major processes and their descriptions.
- Quality measure adopted during the processes.
- List of the equipments used in each section/department.
- Safety norms followed /implemented.

Any specific task allotted and performed by the trainee students during the training period.

Industries where in plant training can be undergone:

Hydro Power plant

Thermal Power Plant

Tidal Power Plant

Wind mills

solar power Plant

Substations – transmission or distribution.

State government undertaking

Public limited companies

Private limited companies

Individual ownership organizations

Power looms Paper mills

Cement Factories

Sugar factories

Textile industry / Textile machinery manufacturing / garment manufacturing /embroidery / textile printing and dying units.

Obligation on students:

1. To learn his/her subject field in Engineering or Technology conscientiously and diligently at his place of training.
2. To carry out all orders of his Employer and the Superior in the establishment.
3. To abide by the Rules and Regulations of the Industry/Establishment in all matters of Conduct and discipline.
4. The student shall maintain a report of his work during the period of his implant training (log sheet)
5. They are required to complete their in-plant training in a given period.
6. During this period, they shall be familiar with the understanding of the process and activities.
7. During this period, they shall be familiar with the understanding of the various motors used in the process.
8. The students can be asked to solve the problem related to electrical equipments/motors, that will make them think and make them try out some sort solutions.

Monitoring of Inplant Training :

1. The department Head will make the batches in group of students, The faculty will be in charge of supervising and monitoring the activity of the group.
2. The faculty and Industry supervisor will work out a suitable arrangement to review the progress of the work from time to time. The department Head should monitor the progress of in-plant training in association with industry authority.
3. Every student undergoing in-plant training in the respective branch of Engineering in any Establishment shall be treated as a trainee. The provision of any law with respect to labor will not apply to such a trainee
4. It shall not be obligatory on the part of the Employer / Industry to offer any stipend and other welfare amenities available, if any, to the students undergoing in-plant training. However, if the industry desirous to do so, it will be a privilege for the student.

FORMAT FOR PREPARATION OF TRAINING REPORT

(Four Weeks/Six Weeks/ Six Months)

ARRANGEMENT OF CONTENTS: The sequence in which the training report material should be arranged and bound as follows:

1. Cover Page
2. Inner Title Page (Same as cover page)
3. Certificate by Company/Industry/Institute (Optional)
4. Acknowledgement
5. About Company/industry/institute
6. Table of Contents
7. List of Tables
8. List of Figures
9. Abbreviations and Nomenclature (If any)
10. Chapters
11. References
12. Data Sheet (If any)
13. Appendices (If any)

CO/ PO mapping:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1	2	3	2	3	3	3	2	2	3	1
CO2	1	2	2	1	3	2	3	1	-	3
CO3	2	2	2	3	-	1	1	3	2	2
CO4	1	-	1	-	-	-	-	3	2	-
CO5	3	1	2	1	2	2	2	-	-	1
C06	-	1	2	3	1	3	3	2	1	3

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name: Project work and Seminar****Course code: R18EE4311****Course Category: Applied****Credits: 04****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper	TH	TT	PR	OR	TW	Total
--	4	--	--	--	--	50	100	150

Rationale:

An Engineer or technician has to work on various projects in profession or field work. The aim of project is to develop the ability of ‘learning to learn’ on its own, work in team. This would go a long way helping the students in keeping pace with future changes in technology and acquisition of Knowledge and skills as and when needed.

The scientific way of solving the problems and ability to apply it to find alternative solutions for the problems will help a technician in his 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. The involvement of student in the seminar course will help him to plan and prepare the related topic by searching information from various sources, interact with others, analyze the information, document the content and present.

Objectives:

The student will be able to -

1. Develop abilities to search information and Integrate the knowledge of engineering programme.
2. Develop the skill to identify the problem & define the problem statement.
3. Develop scientific attitude for stepwise solutions to the problems.
4. Develop attitude to work in team and act as leader of project.
5. Develop the capability and confidence for planning & execution skills.
6. Build multidisciplinary concept with time management and cost considerations.
7. Understand recent developments in engineering fields and prepare report and Develop presentation skills .

COURSE OUTCOMES:

The course content should be taught and learning imparted in such a manner that students are able to acquire required learning outcome in cognitive, psychomotor and affective domain to demonstrate some of course outcomes as applicable to project:

1. Participate effectively in group work
2. Collect, analyze and synthesize the data
3. Conduct a survey and investigate the activities
4. Make appropriate decision
5. Act as leader for group task
6. Develop cost consideration
7. Prepare technical reports

COURSEDETAILS:**For Project work**

Activity No	Activities
1	Formation of Group
2	Selection of Project: Individual/Group discussions
3	Define Problem statement for project work
5	Decide Strategies/Methodology to carry out project
6	Literature Survey/data survey
7	Submission of synopsis: by each group
8	Project activity plan-Defining activities, strategy, duration
9	Allocation of work responsibility to individual/team
10	Visits to Industries / Institutions / Market/field work/sites
11	Collection of Data /Survey/Analysis
12	Design of Components, preparation of drawing, estimates wherever required, printed circuits design, its checking,
13	Fabrication, Assembling, Model/Prototype development, Testing as per project requirements
14	Progressive presentation of work and recording in diary
15	Consolidation of work allotted to individual or team
16	Presentation of initial draft: pre submission draft
17	Final Project Report: Printed: Submission: soft & Hard copy
18	Group presentation of project work at the time of final evaluation

The activities mentioned above shall be monitored and guided by Project Guide every week during the contact hours provided for the same.

For seminar

Activity No	Activities
1	Briefing about selection for seminar topics in class: Discussion in class
2	Search seminar topics and approval of topic from guide from searched topics.
3	Collection of data and literature for seminar from internet/ visit/Journals/Books/EBooks
4	Preparation of synopsis of seminar topic: print draft copy
5	Submission of seminar synopsis to guide (Printed copy)
6	Guidance about preparation of document by guide
7	Preparation of document by students
8	Editing document
9	Submission of Seminar and presentation document: Hard copy & Soft copy of power point
10	Submission of diary
11	Seminar Presentation

The activities mentioned above shall be monitored and guided by the guide every week during the contact hours provided for the same.

The Project is also included with Seminar with the aim to develop certain set communication skills (preparation of report, writing survey report writing Lab. experiment results writing conclusions of the work done and physical phenomenon observed, participating in group discussions, verbally defending the project in the form of Seminar etc.)

AREA OF SELECTION FOR PROJECT :

These are only guidelines; any project related to Electrical Engineering depending upon the availability of projects may be included. Preference should be given to practical oriented projects according to the local needs.

Sr.No.	Areas For Selection
1	Illumination Engineering
2	Green building Codes,
3	Hybrid Vehicles
4	Variable Voltage Variable frequency drives
5	Traction new trends
6	EHV Transmission
7	Smart Grid Applications
8	Computer application in design of Electrical Machines
9	Energy Conservation, Energy Audits
10	Smart Metering, Electricity Theft Reduction
11	Power Quality
12	Renewable Energy
13	Any other topics related to Electrical Engineering

AREAS FOR SELECTION OF SEMINAR:

Sr.No.	Areas For Selection
1	Modern traction systems
2	Power system recent developments
3	Power quality
4	EHV & HVDC Transmission
5	Energy efficient machines/ New Trends in Machines/Electric Drives
6	New trends in switchgear
7	Energy conservation
8	Renewable energy
9	Energy Audit
10	Automation and Control of drives
11	Any other topic related to electrical engineering

GUIDELINES FOR PROJECT:

Individual project-

A student has to fabricate a simple electric/electronic gadget. He should understand the functioning of various parts. Some of the gadgets suggested are as follows:

- i) Solid state lamp dimmer
- ii) M.W. Radio Receiver
- iii) Simple electronic controller for temperature, liquid level, light intensity measurement.

The assignments similar to given below may be considered as individual project

- i) Wiring installation of a small room
- ii) Rewinding of a small single phase motor/transformer

Group Formation:

1. The department Head / Officer in Charge shall make sure that the project groups are formed within one week of the beginning of academic term and assign a faculty as project guide.
2. The students may be asked to work in groups of five students. The group size may be varied in accordance with the effective compliance of project work.
3. The group can decide the leader and distribute work and prepare the group management structure.

Finalization of Project Title:

1. The students are expected to take up a project with the guidance of a Project Guide from the institute/Industry Expert/Sponsored by industry, Institute, society, self.
2. Industrial project shall be encouraged.
3. The students can seek help from TPO/HOD/Guide/industry.
4. The group of students/Project guide/authority shall see the viability/ feasibility of project over the duration available with the students and capabilities and setup available.

Note:

1. The group / student shall prepare Project Diary with Name of Project, Name of Students in group, their attendance and progress and get assessed from guide from time to time during project hours.
2. The title of the project should be finalized within **two weeks** after the group formation and a synopsis of the project should be submitted to the guide.
3. An abstract (synopsis) not exceeding 100 words, indicating salient features of the work shall be submitted to guide.
4. Modify format suitably as per requirement of the project.

Project Execution:

5. Guide shall monitor the work and help the students from time to time.
6. The progress shall be presented before the guide every week during project hours.
7. The students shall design parts, prepare their drawing showing all details and manufacture within the institute / sponsoring industry / workshop in local areas.
8. The guide should maintain a record of progressive / continuous assessment of project work and observe the progress of each group member on weekly basis.
9. The same shall be kept ready for submission to the external examiner before the final examination.

Evaluation of Project:

10. The continuous evaluation of individual progress shall be followed
 11. External examiner and guide shall jointly evaluate the project.
 12. The project can be evaluated on site if it is difficult to bring or demonstrate the trials in the institute
 13. The attendance of the student shall carry 05 marks as follows
- | | |
|------------------------|------------|
| Below 75% | : 00 marks |
| b. 75 % and below 80 % | : 02 marks |
| c. 80 % and below 85 % | : 03 marks |
| d. 85 % and below 90 % | : 04 marks |
| e. 90 % and above | : 05 marks |

Project Report:

The student shall get the initial draft copy of the project approved from the Project Guide.

Structure: It shall be as follows

- Title page, Inner title page (white), Certificate, Certificate from Industry, Synopsis, Acknowledgment, Table of Contents, List of table & figures (optional), Introduction, Objectives of the Project, Methodology used, Design, Drawing of the part and assembly, Testing, Costing, Result, Conclusions & Scope for future, Merits, Demerits, Applications, Bibliography
- Annexure consists of various designed parts and assembly drawings, photographs, charts, statistical data
- CD of video clips /Power Point presentation

Each group has to submit two copies of project report to the deptt. And one soft and hard copy to the department apart from the individual copy.

The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.

GUIDELINES FOR SEMINAR:**1. Selection of topic for seminar:**

- a. The student shall search from various resources and get the topic approved.
- b. Topic of seminar shall be based on curriculum with new developments.
- c. Topic of seminar should not be from the project taken by the group or by individual.
- d. Selection of topic should be finalized in consultation with teacher guide allotted for the seminar.

2. Submission of Seminar Document:

- a. The student shall get the seminar draft approved from Guide and complete final document.
- b. 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.
- c. The structure of the seminar document shall be as per the following format: Certificate / Acknowledgement / Index / introduction / Detailed content / Conclusion / References.
- d. 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.

3. Evaluation of Seminar:

Evaluation of seminar will consist of Progressive Assessment,
And Presentation of the topic to deliver in power point presentation form.

Progressive Assessment:

1. Progressive assessment will be based on attendance, searching of various seminar topics, selection of title, collection of data from internet, Journals, Literatures, organization of data and preparation of document.

2. The student has to get seminar document assessed from guide regularly.
3. The attendance of the student shall carry 05 marks as follows
 - a. Below 75% : 00marks
 - b. 75 % and below 80 % : 02marks
 - c. 80 % and below 85 % : 03marks
 - d. 85 % and below 90 % : 04marks
 - e. 90 % and above : 05marks

Presentation of Seminar:

4. The time for presentation shall be 7 to 10 minutes per student
5. The question answer session time shall be 2 to 3 minutes per student
6. Evaluation of presentation of seminar will be carried out by a panel of teaching staff from institute based on the following point
 - a. Confidence and courage
 - b. Technical Knowledge acquired
 - c. Presentation skill
 - d. Use of presentation medium e.g. A/V aids, animation etc.

LEARNING RESOURCES:

Magazines, Journals, Papers: National & international Reference Books, Internet, Previous seminars, Text Books, Codes of Practices e. g. IS Codes, Video Cassettes, Audio Cassettes, Compact Discs, Charts, Transparencies, Software, Models, Industrial visits, expert lectures/workshops

MAPPING MATRIX OF PO /CO:

Course Outcomes	Programme Outcomes						
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	3	-	-	-	-	-	-
CO2	-	3	-	-	-	-	-
CO3	-	-	-	-	-	-	2
CO4	2	-	-	-	-	1	-
CO5	-	-	-	1	-	2	2
CO6	-	-	3	-	-	-	3
CO7	-	-	3	-	-	-	-

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name : Programmable Logic Controller & SCADA****Course code : R18EE5301****Course Category: Specialized****Credits: 05****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Paper Hrs	TH	TEST	PR	OR	TW	TOTAL
3	2	3	80	20	-	25	25	150

Rationale:

Today's industry is automation industry. Most of the equipment's are automated for better performance & higher productivity. It's using Programmable logic controllers for these purposes. An Electrical Diploma holder is supposed to work smoothly with PLC & SCADA system. This course will provide that sufficient knowledge to a student of electrical engineering about PLC & SCADA.

Course Outcomes: Student will be able to

1. Identify various component of PLC.
2. Develop logics using basics of gates.
3. Handle system component of PLC.
4. Interface a given I/O device with the appropriate PLC module.
5. Select system component of PLC.
6. Prepare a PLC ladder program for a given application
7. Prepare a simple SCADA application.

❖ Course Details:

Unit	Learning Outcomes	Topics & subtopics	Hrs	Mks
1. Introduction to Industrial Automation	1.a Explain significance of Automation, State advantages of automation 1.b Identify the automation system with its salient features for the given process. 1.c Explain with sketches the working of the industrial automation system. 1.d Describe the application areas of the given automation system. 1.e Differentiate Relay based & PLC based control system	1.1. Need and benefits of industrial automation, Importance of Automation, Advantages of Automation 1.2. Automation Hierarchy, basic components of automation system, description of each component 1.3. Types of automation system:-Fixed, programmable, Flexible, Comparison between Relay based and PLC based control systems. 1.4. Different systems for the Industrial automation : PLC, HMI, SCADA, DCS, Drives	06	12
2. Fundamentals of Logic gates & Programmable Logic Controllers	2a. Develop logic with gates and number systems. 2b. develop relay ladder schematic 2c. Draw generalized block diagram of PLC 2d. Draw simple block diagrams and functions of different input modules 2e. Know type and use of Memory	2.1 Binary concept. 2.2 AND, OR, NOT & EX-OR Functions- function application 2.3 Boolean algebra- Boolean instruction, function & its graphic symbol 2.4 Developing circuits from Boolean expression- 2.5 Hardware logic versus programmed logic- Relay ladder schematic, Ladder logic program. 2.6 Block diagram and working of PLC 2.7 PLC Advantages and Disadvantages 2.8 Types of PLC-Fixed and modular 2.9 Comparison between PC and PLC 2.10 Scan cycle of PLC 2.11 PLC specifications 2.12 PLC Modules-digital input modules & their ratings 2.13 Analog input models & ratings	10	16

	2f. Compare PC and PLC 2g. Develop block diagram of PLC power supply.	2.15 Memory: Types of memory and their functions 2.16 PLC Power supplies- block diagram and function of each block		
3 Developing fundamental PLC wiring diagrams & ladder logic programs	3a. connect input & output device. 3b. handling of various PLC components in safe manner. 3a. Know names of PLC Programming languages 3b. Understand Ladder diagram development 3c. Use of logic diagram for Industrial applications	3.1 I/O Section- Logical rack, Remote I/O rack, Allen Bradley addressing format, Discrete I/O module addressing 3.2 Discrete I/O module- block diagram, schematic for ac input module, typical input module wiring connection, ac discrete output module. 3.3 sourcing & sinking module circuit. 3.4 CPU- major components, simplified illustration, typical processor unit, electrostatic damage. 3.5 Program scan- data flow overview, scan cycle. 3.6 PLC Programming languages- ladder diagram, sequential function chart, instruction list, functional block diagram, structured text. 3.7 Programming examine instructions 3.8 Modes of operation 3.10 Industrial Process examples-Bottle filling plant, Diesel generator set control, Motor Control, Traffic light control, stepper motor control	08	12
4 Hydraulic and Pneumatic Systems	4a. Know fundamentals of hydraulic system and Pneumatics systems 4b. Familiarize with working of components used in both systems 4c. List control devices used for systems & know control process 4d. Applying control action in hydraulic and Pneumatic systems	4.1 Review of fundamentals and features of Pneumatics and Hydraulic systems 4.2 Components of hydraulics and Pneumatics systems with their working 4.3 Control devices of above Systems 4.4 Examples of Hydraulic Systems 4.5 Examples of Pneumatic Systems	08	12
5. Programming Timers& Counters	5a. Program timer & counter instruction . Describe with sketches the given timer & counter instruction 5 b Describe with sketches the given logical and comparison type instruction. 5.c develop a PLC ladder program for given industrial application	5.1 Timer instructions : On delay timer, off delay timer, retentive timer , cascading timer – basics, functions, relay schematic diagram. 5.2 Counter instructions: UP counter, DOWN counter, cascading counter- basics, functions, relay schematic diagram. Logical instruction, comparison instruction, data handling instruction, arithmetic instruction. 5.3 Combining counter & Timer functions	08	16
6. Supervisory control and Data acquisition system	1. Describe the function of the given element of SCADA. 2. Describe the steps to develop a simple SCADA screen for the given application 3. Explain with sketches the interfacing diagram for the given PLC with the SCADA system	6.1 Introduction to SCADA- 6.1.1 Architecture of SCADA 6.1.2 Block diagram 6.1.3 Benefits of SCADA 6.2 Interfacing SCADA system with PLC- 6.2.1 Typical connection diagram 6.2.2 Steps in creating SCADA screen for simple object steps for linking SCADA object (defining tags and items) with PLC ladder diagram. 6.3 Application of SCADA- 6.3.1 Traffic light control 6.3.2 Water distribution 6.3.3 Water bottle filling.	08	12

❖ SUGGESTED SPECIFICATION TABLE WITH HOURS AND MARKS

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
1	Introduction to Industrial Automation	06	4	4	4	12
2	Fundamentals of Logic gates & Programmable Logic Controllers	10	4	6	6	16
3	Developing fundamental PLC wiring diagrams & ladder logic programs	08	2	6	4	12
4	Hydraulic and Pneumatic Systems	08	4	4	4	12

Unit No.	Unit Title	Teaching Hours	Distribution of Theory Marks			
			R Level	U Level	A Level	Total Marks
5	Programming Timers& Counters	08	4	6	6	16
6	Supervisory control and Data acquisition system	08	4	4	4	12
	Total	48	22	30	38	80

- **Legends:** R = Remembrance; U= Understanding; A= Application and above levels (Revised Bloom's taxonomy)
- **Note:** This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.
- ❖ **TEACHING METHODOLOGY:** Chalk-Board, Discussion, Power Point Presentation, Transparency, Expert Lectures.

❖ **LIST OF PRACTICAL / ASSIGNMENTS / EXPERIMENTS**

Minimum ten (10) experiments are to be performed from the following list. It is expected that the staff member should conduct one or two additional self designed experiments.

Sr. No.	Practical(Outcomes in Psychomotor Domain)	Unit No.	Hours
01	Develop ladder diagrams for logic gates OR and, NOT, XOR	3	04
02	Interfacing of lamp & button with PLC for ON & OFF operation	2	02
03	Perform delayed operation of lamp by using push button	2	02
04	UP/DOWN counter with RESET operation	6	04
05	Develop ladder diagrams for traffic light control system	4	02
06	Combination of timer & counter for lamp ON/OFF operation	6	04
07	To study set & Reset operation of lamp	3	02
08	DOL Starter & star delta operation of lamp Draw power and control circuit diagrams for Semi-automatic & Fully Automatic Star-Delta Starter.	3	02
09	Programming compare operation for given conditions.	6	02
10	Programming compute operation for given conditions.	6	02
11	Observe SCADA/DCS operation in process plant and understand the block diagram with components used.		

Professional Practice:

- 1) Visit to industry applying Programmable logic controller for their operation.
- 2) Collect data from market- PLC brands and manufacturers. Information search on PLC specifications from leaflets, brochures and websites

Learning Resources:**A) Books:**

Sr. No.	Title of the Book	Author	Publishication
1	Programmable Logic Controller	Frank Petruzella	TMH Publication
2	Programmable Logic Controllers , principles and applications	Webb & Reiss	Prentice Hall India
3	Programmable Logic Controllers	John R. Hackworth & Frederick, Hackworth	Pearson
4	Electronics Instrumentation	H.S. Kalsi	Tata McGraw Hill
5	Introduction To PLC	Gary Dunning	Thompson Publications
6	PLC Principles and applications	John Webb	Pearson Publication

CO-PO Mapping

CO	PO	Basic and Discipline specific knowledge	Problem analysis	Design/ developme nt of solutions	Engineerin g Tools, Experimen tation and Testing	Engineerin g practices for society, sustainabil ity and environme nt	Project Manageme nt	Life-long learning
Identify various component of PLC.		1	1	3	3	2	1	2
Develop logics using basics of gates.		2	3	3	2	2	1	2
Handle system component of PLC.		2	2	1	2	2	1	12
Select I/P & O/P modules of PLC.		2	2	3	2	3	1	2
Select system component of PLC.		1	1	3	2	2	1	2
Prepare a PLC ladder program for a given application		2	2	3	2	2	1	2
Prepare a simple SCADA application.		1	3	3	2	2	1	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course name: Electrical Energy Audit & Conservation****Course Code: R18EE5302****Course Category: Specialized Courses****Credits: 5****Teaching & Examination Scheme**

Teaching Scheme			Examination Scheme				Total
TH	PR	Paper HRS	TH	TT	OR	TW	
3	2	3	80	20	25	25	150

Rationale:

In today's world of industrialization, use of energy has tremendously increased. To make the use of energy judiciously, energy audit is essential. The judicious use is energy conservation. Environments, Economy & Future Availability of Energy are taken care of through Energy Audit & Conservation.

Competency: To plan & conduct energy conservation & audit project under guidance of energy auditor & to prepare energy audit & conservation report for the industry/organization.

Course Outcomes:

Student will be able to

1. Identify the energy losses & wastage
2. Suggest energy conservation techniques in various sectors
3. Conduct energy audit & prepare energy conservation report for small scale industry
4. Identify the need of energy conservation

Course Details:

Unit No.	Learning Outcome	Contents	Marks	Hours
1 Elements of Energy Conservation & Policy of GOI	i)Identify need of energy conservation ii)State functions of state organizations iii)Assessment of present lighting system iv)Identify Energy Conservation techniques in lighting & suggest methods to improve Energy Conservation	1.1 Present energy scenario 1.2 Need of energy conservation 1.3 Concept of Energy Conservation 1.4 Energy Conservation Act 2003 1.5 Functions of Govt. organizations 1.6 Basics of illumination & procedure to assess lighting system 1.7 Energy Conservation Techniques e.g. using control gears, servo stabilizes	12	7
2 Energy Conservation in Induction Motors	i)Select Electric motor for suitable application ii)Energy conservation techniques	2.1 Selection of Motors for drives For different applications 2.2 Inverter fed Induction motor drives- Introduction, vector control, v/f control, advantages and limitations 2.3 Energy Conservation in Induction motor 2.4 Energy Conservation techniques for Induction motor e.g. power quality, motor survey 2.5 Energy efficient motor	16	9

3 Energy Conservation in transformers transmission and distribution And tariffs to reduce energy bill	i)Listing methods improving performance of Transformer ii)Suggest Energy Conservation opportunities to improve performance of Transformer iii)Scenario of losses in Transmission & Distribution iv)Identify Energy Conservation opportunities v)Suggest methods of Energy Conservation	3.1 Need of Energy Conservation in transformer 3.2 Methods to improve performance of transformer 3.3 Energy Conservation techniques for transformer 3.4Energy Efficient transformer(Numerical)3.1 Scenario in transmission & distribution 3.5 Types of losses in transmission & distribution 3.6 Energy Conservation techniques in transmission & distribution system related to technical losses 3.7 Reactive Power Management	12	8
4 Energy Conservation Equipments	i)List energy conservation equipments ii) Selection of Energy Conservation equipments	4.1 Energy Conservation equipments 4.2 Energy conservation equipments referred to lighting system e.g. centralized control equipments, occupancy sensors 4.3 Energy conservation equipments for electric motors e.g. soft starters, p.f. controller, static capacitor, star delta starter, Variable Frequency Drive 4.4 Energy Conservation in transmission & distribution, e.g. MD controller, kVAr controller 4.5 Energy Audit Instruments	16	9
5 Energy Management	i) List energy management method ii)Prepare planning of energy conservation	5.1 Effective Energy Management 5.2 Energy Policy 5.3 Tariff and Energy Conservation 5.4 Demand side Management 5.4.1 Scope & Evaluation 5.4.2 Load Management 5.4.3 Applications of load control	12	8
6 Elements of Energy Audit	i) Draw energy flow diagram ii) Analyze energy audit data	6.1 Energy flow diagrams 6.2 Energy Audit 6.3 ABC Analysis & Audit data analysis 6.4 Economic Analysis of energy conservation	12	7

Teaching methodology: Chalk board, Discussion, Power point presentation

Suggested specification table with hours & marks (Theory):

Unit No.	Teaching Hours	Distribution of Theory Mark			
		Remember Level	Understand Level	Apply Level	Total Marks
1	7	03	05	04	12
2	9	02	05	05	16
3	8	04	06	06	12
4	9	04	06	06	16
5	8	04	04	04	12
6	7	02	06	04	12

Term work:

The term work shall consist of following experiments

Sr. No.	Unit No.	Practical	No. of hours required
1	II	Verification of Energy saving in three phase induction motor by p. f. improvement	2
2	IV	Verification of energy saving by using starters	2
3	IV	Verification of load suitability of star and delta connected motor	2
4	IV	Energy Saving by electronic ballast over electromagnetic choke	2
5	VI	Draw Energy flow diagram for the industry	2
6	VI	Energy Audit Project for small industry /workshop/section in industry	6

Resources

1.

Sr. No	Author	Title	Publishers
1.	Wayne C Turner, Handbook	Energy Management Handbook	Wiley Press
2.	Austin Hughes,	Electric Motors and Drives	
3.	B G Desai, J S Rana, A V Dinesh, R Parman	Efficient use & management of Electricity in Industry,	Devki Energy Consultany Pvt Ltd.

2. Websites

- i. www.beeindia.com
- ii. www.pera.org
- iii. www.energymanagertraining.com

CO-PO Mapping

CO	PO	Basic and Discipline specific	Problem analysis	Design/ development of solutions	Engineering Tools, Experimentation	Engineering practices for society, environment	Project Management	Life-long learning
Identify the energy losses & wastage			3			3		3
Suggest energy conservation techniques in various sectors				2		3		3
Conduct energy audit & prepare energy conservation report for small scale industry		1			3		3	
Identify the need of energy conservation					3			

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name: Electrical Substation Engg. and Practices****Course code: R18 EE 5303****Course Category: Specialized****Credits: 05****Teaching and Examination scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
3	2	3	80	20	--	25	25	150

Rationale: After 2000 A.D several additions were done to 765 kV AC and 400kV AC conventional and SF₆ GIS have been commissioned. National Power Transmission Corporation has formed to look after this development. ± 500 kV HVDC Transmission system is also Established. These substations thus will control the power flow to various sub-transmission and distribution networks and will for, an integral part of India's national power grid.

The objective of *Electric Substations Engineering and Practices* is to provide an extensive overview of substations and to make them aware and satisfactorily able to handle the basic operations like Installation, Testing, Commissioning, operation, maintenance, of complete substation.

Course Outcomes: The student should be able to -

1. Understand the importance of the electrical substation and its role in smart grid.
2. Identify and choose the correct substation equipments according to the need.
3. Discriminate between types of substations.
4. Draw the busbar system and layout of substations.
5. State and explain the operation and applications of SF₆ and HVAC and HVDC Substations.
6. Prepare the maintenance schedule and carry out maintenance work of substation.

Course Details:

Unit	LEARNING OUTCOME	NAME OF THE TOPIC	Hrs	Mrks
1	1. Classify the types of substations. 2. Draw the substation layout with substation equipments.	Electrical Substations and Substation equipment: Classification, Function of Substation, substation layout, Essential features of substation, Protective systems in substation, Electrical Equipments Busbar CBs, Isolators, Earth switches, Power transformers, CTs and PTs, Lightning Arresters, Types of substations and Transformer substations with bus bar system Layout: Classification of Substations based on Configuration, Location(Indoor/Outdoor), based on application. Specifications of Substation.	08	12

2	<p>1. State and classify the requirement and types of busbar systems.</p> <p>2. State the importance of earthing systems.</p>	<p>Concept of Bus bar system and layout Configuration: Concept, requirement of bus bar system, technical requirements, single bus bar, sectionalized bus bar, double bus bar, duplicate bus bar, duplicate bus and transfer bus, ring bus, three switch bus bar system for through feeder, basis of comparison of feeder system.</p> <p>Substation earthing system and firefighting system: Functional requirements of earthing system, Description of earthing system, equipment earthing and neutral point earthing, Substation earthing system, dimensions of earthing conductors, step potential and touch potential, Earth mat and procedure to laying it, Resistance of earthing systems, values of soil resistivity, Fencing.</p> <p>Firefighting system description, Fire alarm systems, Fire detectors, Transformer water spray system, Precaution against starting of fire and protection against spreading of fire, Oil sump for transformers in substation.</p>	08	12
3	<p>1. Understand the design aspects of substations.</p> <p>2. List the material required/ used for various constructions in substations.</p> <p>3. select the types of busbars, connectors and clampers.</p>	<p>Principle of Substation design: Various terms and Definitions, Stresses on substation equipments, Clearance and Maintenance Zone, Developing substation layout.</p> <p>Substation structure: Structural form Material for construction of Structure, Galvanized steel structure, RCC structure, Dimensions and Main factors in Designing support structure.</p> <p>Bus bars, Connectors and Clampers: Forms of Bus bars, Configuration of Bus bars in outdoor Substations, Definitions and Ratings of Bus bars, Design aspects and Thermal Expansion, Method of Joining Clamps and Connectors, Oxidation Layers.</p> <p>Insulators: Types of Insulators used in substations and materials for insulators and various configuration according to applications, Leakage or creepage distance, corona rings or voltage grading rings, special features of HVAC insulator string and solid core insulators.</p>	10	16
4	<p>1. Select the proper protection used in substations.</p> <p>2. Draw the schematic arrangements Of power and control cables in the substations.</p>	<p>Insulation co-ordination and surge arrestors: Insulation levels of Equipments, Insulation co-ordination of substation, Terms and definitions related to insulation co-ordination of substations, lightning and switching over-voltages in substations and protection of substation equipments.</p> <p>Power and control cables: their laying and grounding, Electrical Noise, Pre-commissioning checks in the substation.</p> <p>Protection, control and Automation in substations: Control Room and Control Panel, Protective relaying in Substations, Power transformer protection, Bus zone protection, Carrier assisted distance protection, introduction to substation control PLC for relaying measurement and control.</p>	08	12

5	1. Draw the schematic of G.I., HVDC and HVAC substations.	HVAC and HVDC Substations: GI substation: Application, range ,ratings, demerits, configuration, single line diagram, basics of design aspects, Earthing switches, GI Cables, Hybrid substations. HVDC Substations:, Layout of HVDC Substation, AC Switchyard, AC harmonic filter Area, Converter transformer, Valve hall and control room, HVDC Yard, DC Smoothing Reactor, Operating modes of HVDC Transmission system, Auxiliary power, Protection and Controlling in HVDC substation. HVAC Substation: Busbars for outdoor yards, Corona rings and Corona Bells, Mechanical Stresses and factor of safety for support insulator, Shunt reactors, components of Reactive power, Electric Field at working level, corona, Audible noise, CBs.	10	16
6	1. State the various processes to carry out maintenance work on various equipments installed in HVAC and HVDC substations.	Maintenance at HVAC and HVDC Substations: Inspection, servicing and overhauling, difference between breakdown and preventive maintenance, schedule preparation, Preventive maintenance of substation, Maintenance of Power transformer, switchgear, ACBs, SF ₆ CBs, VCBs. Preventive maintenance of HVDC substations and equipments, Live line (hot Line) Maintenance. Skilled personnel requirement.	08	12

TEACHING METHODOLOGY: Chalk-Board, Discussion, Power Point Presentation, Expert Lectures.

Term work:

A] List of the A3 Size Drawing sheet with report will be submitted by student as a part of the term work.

B] Student will also visit the Distribution Substation/Generating Substation/GI Substation/HVDC substation and detail report will be submitted as a part of the Term work.

Sr. No	Unit	Description of the Drawing Sheet	Hrs.
1	01	Single line diagram of Different Bus-bar systems.	04
2	02	Diagrams of the Busbar connectors, Clamps i.e. all equipments of the substations.	04
3	03	Diagram of The Pole mounted substation.	04
4	05	Diagram of Protection for substation transformer like Buchholz's Relay etc.	04
5	06	Lay out of HVAC/HVDC ?GI substation.	04

LEARNING RESOURCES:

1. Books:

Sr. No.	Title of the Book	Author	Publication
1	Electric Power Substations Engineering	John D. McDonald	3 rd Edition (2012) CRC Press.
2	Electrical substation and engineering Practice.	S. Rao	Khanna Publication, 3 rd Edition 10 th Reprint 2013.
3	Electric Power Transmission System	Turan Gonen	CRC Press, Taylor and

	Engineering Analysis and Design		Francis group 2 nd Edition
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Specification table with contact hours and marks for theory:

Unit No.	Teaching Hours	Distribution of Theory Mark			
		Remember Level	Understand Level	Apply Level	Total Marks
1	08	03	05	04	12
2	08	03	05	04	12
3	10	04	06	06	16
4	08	03	05	04	12
5	10	04	08	04	16
6	08	03	06	03	12

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO2
CO1	3	2	1	3	2	2	1	2	1	3
CO2	2	3	2	1	2	1	2	-	1	2
CO3	3	1	-	2	1	2	-	3	-	1
CO4	-	2	3	3	-	1	-	2	2	-
CO5	1	-	-	-	1	-	3	-	3	1
CO6	-	1	1	3	3	2	2	1	2	2

DIPLOMA PROGRAMME: ELECTRICAL ENGINEERING**Course Name: Vehicular Electrical System****Course code: R18 EE 5304****Course Category: Specialised****Credits: 05****TEACHING AND EXAMINATION SCHEME:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
3	2	3	80	20	--	25	25	150

Rationale: The development of automobile with heat engines is the great achievements in modern technology. But due to air pollution, global warming and reduce in petroleum resources an interest is increasing continuously in the development of safe, clean and high efficient transportation. It has been well recognized that electric, hybrid electric and fuel cell powered drive train technologies are the most promising solution to the problem of transportation in the future.

The course deals with the fundamental theory and design of electric vehicles, hybrid electric vehicles and fuel cell vehicles. It includes electric vehicle design, hybrid electric vehicles configurations, electric propulsion systems, energy storage systems, fuel cells and their applications in vehicles.

Course Outcomes: The student should be able to –

1. Select appropriate motor suitable for particular vehicle.
2. Choose the proper energy storage system in electric vehicles.
3. Understand the fuel cell used electric vehicles.
4. Know the concept of Electrification used in aircraft, space station and sea undersea vehicles.

Course Contents:

Unit	Learning Objectives	Contains of Unit	Hours	Marks
1. Introduction to Electric and hybrid vehicles	Students will be able to 1. Understand the importance of electric vehicles. 2. Compare the conventional vehicles and electric vehicles.	1.1 Environment and socioeconomically importance: Air pollution, global warming, petroleum resources, importance of different transportation development 1.2 History: History of electrical vehicles, history of hybrid electrical vehicles, history of fuel cell vehicles 1.3 Comparison of conventional and electrical vehicle system. Recent development in electrical vehicles.	08	12
2. Electric and hybrid electric vehicles	1. Know the difference between electric vehicle and hybrid vehicle. 2. Draw the architecture of series hybrid and parallel hybrid electric vehicles.	2.1 Electric Vehicles: Configuration, performance, Tractive efforts in normal driving, energy consumption 2.2 Hybrid Electric vehicles: Concept of hybrid electric drive trains, Architectures-series hybrid and parallel hybrid electric vehicles.	08	12

3. Electric Propulsion system	<p>1. Understand the different types of motors used in electric vehicles.</p> <p>2. Choose the correct motor for particular operation.</p>	<p>3.1 DC motor drive : Principle of operation and performance, combined armature voltage and field control, chopper control of DC motors</p> <p>3.2 Induction motor Drives: Operation principles, steady state performance, constant volt/hertz control, power electronic control, voltage source inverter for field orientation control</p> <p>3.3 Permanent magnet brushless DC motor drives: Basic principles, construction and classifications, performance analysis and control of BLDC motors</p> <p>3.4 Switched Reluctance motor drives: Basic magnetic structure, torque production, SRM drive converter, modes of operation</p> <p>3.5 Conventional 14V electrical system architecture, increasing system voltage to 42V, Advanced voltage distribution systems, starters, alternators and integrated starter alternator system.</p> <p>3.6 Automobile steering systems.</p>	12	16
4. Fuel cell vehicles Fuel cell Hybrid electric drive train design	<p>1. Know the important properties required in fuel cell to work in vehicle.</p> <p>2. Draw the control circuit of fuel cell.</p>	<p>5.1 operating principle and properties of fuel cells.</p> <p>5.2 Electrode potential and current voltage curve, fuel and oxidant consumption</p> <p>5.3 Fuel cell technologies</p> <p>5.4 Important properties of fuel cells for vehicle</p> <p>5.5 Light duty and heavy duty vehicles</p> <p>5.6 Fuel supply, Nitrogen fuel cells</p> <p>5.7 Configuration</p> <p>5.8 Control strategy</p> <p>5.9 Parametric design</p>	12	16
5. Energy storage systems	<p>1. Understand the operation of energy storage devices used in electric vehicles.</p> <p>2. Know the hybridization of energy storage devices.</p>	<p>5.1 Electrochemical batteries: Electrochemical reaction, thermodynamic voltage, specific power, specific energy, energy efficiency, battery technologies</p> <p>5.2 Ultra capacitors : features, basic principles, performance, ultra capacitor technologies</p> <p>5.3 Ultra high speed flywheels: operation principle, power capacity, flywheel technologies</p> <p>5.4 hybridization of energy storage.</p>	10	12
6. Aircraft, Space power and sea and undersea vehicle system	<p>1. Understand the concept of aircraft electrification.</p> <p>2. Understand the concept of space station electrification.</p>	<p>6.1 Aircraft: Conventional electrical system, power generation, Aircraft electrical distribution</p> <p>6.2 International space station, spacecraft power system</p> <p>6.3 Undersea vehicles: Electrical distribution in sea and undersea vehicles, advanced loads and drives in sea and undersea vehicles.</p>	08	12

Term work:

A] List of the A3 Size Drawing sheet with report will be submitted by student as a part of the term work.

Sr. No	Description of the Drawing Sheet	Hrs.	Unit
1	Architectures- series hybrid and parallel hybrid electric vehicles.	02	02
2	chopper control of DC motors, , constant volt/hertz control, power electronic control, voltage source inverter for field orientation control, control of BLDC motors.	02	03
3	Control strategies of fuel cells.	02	04
4	Advanced Electrical drives in Aircraft, space station and sea undersea vehicles.	02	06
5	Battery charging, Capacitor charging circuits in vehicles.	02	05
6.	Auxiliary power unit in aircraft electrical system.	02	06

Books:

Sr. No.	Title of the Book	Author	Publication
1	Vehicular Electric Power system	Ali Emadi, John M. Millar	Marcel Dekker
2	Modern Electric, Hybrid Electric and fuel cell vehicles	Mehrdad Ehsani, Yimin Gao	CRC press
3.	Electric Vehicles	Sheldon R. Shacket	Domus Books
3	Electric Buses in India		STEP

Specification table with contact hours and marks for theory:

Unit No.	Teaching Hours	Distribution of Theory Mark			
		Remember Level	Understand Level	Apply Level	Total Marks
1	08	04	04	04	12
2	08	03	06	03	12
3	12	03	08	05	16
4	08	04	08	04	16
5	10	02	05	05	12
6	08	03	06	03	12

CO-PO Mapping

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO2
CO1	3	2	1	3	2	2	1	2	1	3
CO2	2	3	2	1	2	1	2	-	1	2
CO3	3	1	-	2	1	2	-	3	-	1
CO4	-	2	3	3	-	1	-	2	2	-
CO5	1	-	-	-	1	-	3	-	3	1
CO6	-	1	1	3	3	2	2	1	2	2

DIPLOMA PROGRAMME:ELECTRICAL ENGINEERING**Course Name: Electrical Maintenance of Building Complexes****Course code: R18 EE 5305****Course Category: Specialized****Credits: 06****Teaching and Examination Scheme:**

Teaching Scheme		Examination Scheme						
TH	PR	Papers HRS	TH	TT	PR	OR	TW	Total
3	2	3	80	20	--	25	25	150

Rationale: When students undergoes this course it makes them competent to work as a supervisor for the electrical as well as other auxiliary work carried to make the building ready for the use by the tenants/owners with all safety and standard needs. The modern aspect of building maintenance and repair /up gradation kept as the main object of this course with Integration of Emerging Technologies in Building Electrification and maintenance system.

Course Outcomes: The student should be able to –

CO1 : Understand and Explain the IS and IE rules related to Buildings Electrical Maintenance.

CO2: Identify, categorised and describes the list of Major electrical installation in multi-strayed building.

CO3 : Carry-out erection, maintenance and troubleshooting of the Dg set and Control Panel.

CO4 : Suggest correct and valid fire controlling/extinguishing component.

CO5 : Draw, design, maintains and troubleshoots Communication and Surveillance system of the Building.

CO6 : Understand and suggest the integration of Emerging Technologies in Building Electrification and maintenance system.

Course Contents:

Unit Title	Learning Objectives	Contains of Unit	Hrs	Mks
1. Various Important IS/IE Rules & regulations related to Buildings Electrical Maintenance.	<ul style="list-style-type: none"> - State the rules & regulations of building with respect to environment clearance to approve building plan. - State the I.E. rules regarding buildings clearances from transmission and distribution of electrical power system / operation, construction and maintenance of elevators and Escalators. - State the features of acts listed in theory content. 	1.1 Rules & regulations of building with respect to environment clearance. 1.2. I.E. rules of buildings clearances from transmission and distribution of electrical power system. 1.3. I. E. rules pertaining to operation, construction and maintenance of elevators and escalators. 1.4 Features of following acts a). Apprentices act 1961. b). Minimum wages act 1948, c). Workmen's compensation Act 1923, d). Contract labour (Regulation and Abolition Act 1970), e). Employer's liability Act 1938, and the industries dispute Act 1947.	07	12

		f). Maharashtra Lifts Act 1939 and lift rules 1958. g). Maharashtra Fire Prevention & Life Safety Measure Act, 2006 and measure rules 2009		
2. Major electrical installation in multi-storeyed building	<ul style="list-style-type: none"> - Design electrical installation of big establishment according to I.E Rules. - Develop Troubleshooting chart and Maintenance schedule of electrical installation of multi-storeyed building/ malls with Design of modern illumination and its control of multi-storeyed buildings. - Design electrical installation for HVAC, fire protection, water lifting pump, hot water system and its control. - List the safety devices for elevator / escalator and state their function. - State the necessity of electrical and mechanical interlock. - Explain the breaking system used in lift /escalator. - Need of Maintenance of lift and Also state the methods of maintenance. - State the types of lubricants with their properties used in lifts / escalator. - State the importance of regular cleaning, dusting and lubrication. - Write down the maintenance schedule for lift / escalator and state the check list for maintenance of lift/ escalator. - Differentiate between the Preventive maintenance and brake-down maintenance of lift /escalator. - Diagnosis of faults in electrical power and control circuit of lift. - Prepare trouble shooting chart based on logical sequence of testing of lift. - State the importance of recording parameters and other service records of lift. - Explanation of Auto rescue 	2.1 I.E. Rules regarding electrical installation of multi-storeyed building. 2.2 Electrical installation of Multi-storeyed building/mall, big hotels/ Hospitals, splitting load in accordance with standards. 2.3 Troubleshooting and Maintenance of electrical installation of multi-storeyed building. 2.4 Modern/automatic Illumination (lighting) system and control. 2.5 Electrical installation for HVAC, fire protection, water-lifting pump, hot water system. 2.6 Occupational Safety and Health: 2.6.1 Safety measures while working and emergency condition on elevator and escalator. 2.6.2 Review of general layout of elevator and escalator. 2.7 Components of car operating panel and their function. 2.8 Control panel components 2.8.1 Types of wires and cables used in lift and escalator. 2.8.2 Types of switches for control & power wiring 2.8.3 Types of sensors and limit switches used in elevators and escalators with their functions. 2.8.4 Concept of counter weight, buffer. 2.8.5 Difference between Geared and Gearless machine. 2.9 Protective systems in elevators and escalators: 2.9.1 Elevator and escalator safety devices and their function. 2.9.2 Necessity of electrical/mechanical interlocks. 2.9.3 Braking Systems. 2.10 Troubleshooting of elevator: 2.10.1 Troubleshooting elevator	10	16

	device (ARD)rescue device (ARD)	<p>in terms of electrical power and control system.</p> <p>2.10.2 Logical sequence of testing trouble in electrical power and control circuit.</p> <p>2.10.3 Effects faulty and loose braking system.Importance of recording parameters and other service records of lift.</p> <p>2.10.4 Auto rescue device (ARD)</p> <p>2.11 Technical specification of elevator.</p> <p>2.11.1 Different consideration for selection of elevators.</p> <p>2.12.2 Statutory provisions for getting license.</p>		
3. Control Panel and Back-up Power by DG Set	<ul style="list-style-type: none"> - State the types and specification of cables/ wires used in control and power wiring circuit in lift/ escalator. - List out the different types of sensors and limit switches used in elevator/escalator and also state their function. - Draw a layout of D.G. set and state the function of main components of D.G. set. - State the factors to be considered for selection and installation of D.G. set. - Explain operational testing of different systems (listed in theory content) of D.G. set. - State the protections of D.G. set and explain with neat diagram. - List out the safety measures and caution notices while working on D.G. set - State check list and maintenance schedule of D.G. set and prepare the trouble shooting chart of D.G. set. 	<p>Control panel components</p> <p>3.1.1Types of wires and cables used in lift and escalator.</p> <p>3.1. 2 Types of switches for control & power wiring</p> <p>3.1.3 Types of sensors and limit switches used in elevators and escalators with their functions.</p> <p>3.1. 4 Concept of counter weight, buffer.</p> <p>3.1.5 Difference between Geared and Gearless machine.</p> <p>Diesel Generator Set :</p> <p>3.2.1 Review of general block diagram of D.G. set.</p> <p>3.2.2 Diesel engine and its accessories,</p> <p>3.2.3. The AC Generator, The control systems and switchgear, AMF controller and panel layout.</p> <p>3.3 Factors to be considered for Selection and Installation of D.G. set and troubleshooting of DG set</p> <p>3.3.1 Operational testing of elements of D.G. set such as</p> <ol style="list-style-type: none"> 1. Engine starting system; 2. Engine speed governing system; 3. Generator voltage regulating system; 4. Engine and generator cooling systems; 5. Engine air intake and exhaust system; 6. Engine lubricating oil system; and 	07	12

		7. Engine fuel system (liquid or gaseous fuel) 8. D.G. set noise reduction system. 3.3.2 Prime mover and generator protection. 3.4 Safety measure and caution notices while working on D.G. set. 3.5 Installation, Maintenance and troubleshooting of D.G. set.		
4. Fire Protection System	<ul style="list-style-type: none"> - State the classification pump and explain with neat diagram the operation of centrifugal / submersible pump. - State the factors to be considered for size and selection of pump. Determine the size of pump and its energy consumption for given conditions. <ul style="list-style-type: none"> - Explain the installation procedure of water pump as per ratings of pump. - Preparation of the maintenance schedule of water pump with preparation of trouble shooting chart of water pump. - State the classification of buildings based on occupancy for fire protection. - State the classification of fire, Need of fire protection systems and different active and passive fire protection systems. - What are the requirements for fire protection & safety for clearance from competent authority for buildings. - Describe operation of fire blanket and fire bucket. - Draw and describe the basic elements of a hydrant system by Stating the function of each element of hydrant system. - Describe the operation and application on the following automatic fire sprinkler systems: 1.Wet-pipe system. 2.dry-pipe system. 3. pre-action system. 4. deluge system. - Differentiate between 	4.1 Fire protection system: 4.1.1 Classification of Buildings Based on Occupancy for fire protection 4.1.2 Principles of fire prevention. 4.1.3 Classification of fire. 4.1.4 Fire protection & safety requirements 4.1.5 Different active and Passive fire protection systems. 4.1.6 Portable fire extinguishers, Fire blankets, fire buckets and hose and hose fitting. 4.2 Hydrant system: 4.2.1 Layout of system from pump house to hydrant post. 4.2.2 Types hydrant system, function of elements of hydrant system. 4.3 Sprinklers: 4.3.1 Operation and use of automatic fire sprinkler systems (Wet-pipe system, dry-pipe system, pre-action system, deluge system) 4.3.2 Hydrant Vs sprinkler system. 4.4 Gaseous systems: Application, properties and operation of gaseous systems. 4.5 Fire detection and prevention system: 4.5.1 Fire Detection and Alarm system. 4.5.2 Maintenance and troubleshooting of above fire protection systems. 4.5.3 Do's and Don'ts in emergency of fire.	10	16

	<p>hydrant and sprinkler system.</p> <ul style="list-style-type: none"> -Categorise the different types of non-water based fire suppression systems and describe how these systems extinguish fire. - Describe the components of a fire alarm system and the different types of fire detectors. - Describe the maintenance schedule and troubleshooting chart of fire protection systems. - State Does and Don'ts in emergency of fire. 			
5 Electrical Aspect of Communication and Surveillance system of the Building.	<ul style="list-style-type: none"> - Define intercom. State the different types of intercoms system. - Draw general layout of intercom system and state the function of each components. - Describe with block diagram the Party-Line Systems/ Matrix Systems/Wireless Systems, and their Accessories. - State the Pro's&con's of surveillance system. - Draw layout of CCTV systems and state the function of each equipments of system. - State the Function, specifications and application of Sequential Switcher /Matrix switcher/ Multiplexer / Digital video recorders (DVRs). - List types of CCTV monitors and state its advantages. - Differentiate between CCTV Monitor & Commercial Monitor. - State the different sensors used in CCTV system. - State the effective implementation of remote controlled surveillance. 	<p>5.1 Intercom telephone system:</p> <p>5.1.1 Definition and different types of intercoms system.</p> <p>5.1.2 General Layout of intercom system, components of intercom system and their functions.</p> <p>5.1.3 The basic building blocks of various system such –</p> <ol style="list-style-type: none"> a)Party-Line Systems b) Matrix Systems, c)Wireless Systems, and their Accessories. <p>5.2 CCTV system:</p> <p>5.2.1 Surveillance system</p> <p>5.2.2 Pro's& cons of surveillance.</p> <p>Layout of CCTV systems, equipments of CCTV system, selection of equipments.</p> <p>5.2.3 Function, specifications and application of</p> <ol style="list-style-type: none"> 1. Sequential Switcher. 2. Matrix switcher 3. Multiplexer 4. Digital video recorders (DVRs). <p>5.2.4 CCTV Monitors & Its Advantages, Difference Between CCTV Monitor & Commercial Monitor.</p> <p>5.2.5 Sensors: Infrared sensors, Passive sensors, Motion detectors</p> <p>5.3 REMOTE -CONTROLLED SURVEILLANCE AND NETWORK CAMERAS</p> <p>5.3.1 Remote-controlled surveillance</p>	07	12

		5.3.2 Network camera system 5.3.3 Video Signal and Control Signal Transmission		
6. Integration of Emerging Technologies in Building Electrification and maintenance system.	- Suggest the alternate energy source to overcome the energy fuel crises.	6.1 Renewable energy Technologies 6.1.1 Solar Water Heating Systems 6.1.2 Solar Air Heating Systems 6.1.3 Solar Cooking Systems 6.1.4 Solar Photovoltaic Devices 6.1.5 Biomass 6.2 Promotional Incentives 6.3 Conservation Measures 6.4 Examples of above systems and their implementations on actual site	07	12

Term work: Following practices are to be performed and block diagrams/related self-illustrative drawing sheet on half imperial sheet with detailed report of the same should be submitted.

List of practicals :

Sr. No	Unit	Practical	Hrs.
1	1	Study and interpretation of Institute's building/Hostel building /Departments building drawings, showing electrical installation on it and writing down the list of important structural and non-structural members of building.	02+01
2	1&2	Develop electrical drawings (i.e. layout, single line diagram and wiring diagram) of your department /institute's building/ Hotels/Hospitals/mall/ hostel/ multi-storeyed building.	02+01
3	2	Visit to nearby lift installation site or working lift site. a) Demonstrate the working of elevator and components of elevator. b) Preparation of checklist for Do's and Don'ts for operation, maintenance and troubleshooting of elevator/escalator.	02+01
4	3	Visit to nearby working D.G. set and control room for Institution/ Hotels /Hospitals /malls /hostel/ multi-storeyed building with detailed specifications.	02+01
5	3	Develop maintenance schedule and troubleshooting chart for D.G. set.	02+01
6	4	Determine water requirement and study of the size of electrical pump for Hotels /Hospitals /malls /hostel/ multi-storeyed building with detailed specifications.	02+01
7	4	Develop maintenance schedule and troubleshooting chart for Water pump.	02+01
8	4	Identify the electrical and mechanical components of dissembled refrigerator in mechanical department laboratory.A) Tracing the electrical wiring diagram.B)Develop trouble shooting chart of refrigerator.	02+01
9	5	Visit to nearby building to study firefighting system or fire detection and alarm system. Draw its layout and list important components of system with function. Prepare the List of the precautionary measures to be taken to keep system up-to-date.	02+01
10	6	Visit to nearby building to study Solar Water Heating Systems	02+01
11	5	Visit and Report preparation of General Layout of intercom system, components of intercom system and their functions with Layout of CCTV systems, equipments of CCTV system, selection of equipments by having the visit in your Institute/Hostel/Hotel.	02+01

Reference Books:

Sr. No.	Title of the Book	Author	Publication
1	HANDBOOK ON ENERGY CONSCIOUS BUILDINGS	J. K. Nayak J.A. Prajapati	Prepared under the interactive R & D project no. 3/4(03)/99-SEC between Indian Institute of Technology, Bombay and Solar Energy Centre, Ministry of Non-conventional Energy Sources May 2006
2	Fire protection engineering in building design	Jane I. Lataille.	Butterworth-Heinemann 2003[Butterworth-Heinemann is an imprint of Elsevier Science]
3	BRE Building Elements Building services Performance, diagnosis, maintenance, repair and the avoidance of defects	H W Harrison, P M Trotman	Construction Research Communications Ltd by permission of Building Research Establishment Ltd Year 2000, CRC Ltd, BRB Press.
4	BUILDING TECHNOLOGY - Mechanical and Electrical Systems	Benjamin Stein	JOHN WILEY & SONS, Second Edition

Specification table with contact hours and marks for theory:

Unit No.	Teaching Hours	Distribution of Theory Mark			
		Remember Level	Understand Level	Apply Level	Total Marks
1	08	04	04	04	12
2	08	04	06	06	16
3	12	03	04	05	12
4	08	04	08	04	16
5	10	02	05	05	12
6	08	03	06	03	12

CO-PO-PSO Mapping

CO/PO and PSO→	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3
CO1 Understand and Explain the IS and ME rules related to Buildings Electrical Maintenance.	2	-	1	1	3	-	3	2	2	3
CO2 Identify, categorised and describes the list of Major electrical installation in multi-storeyed building.	2	1	-	-	1	2	-	1	2	1
CO3 Carry-out erection, maintenance and troubleshooting of the Dg set and Control Panel.	2	2	1	2	-	1	1	2	2	3
CO4 Suggest correct and valid fire controlling/extinguishing component.	1	2	1	-	2	-	2	1	2	-
CO5 Draw, design, maintains and troubleshoots Communication and Surveillance system of the Building.	2	3	2	1	-	1	-	-	1	2
CO6 Understand and suggest the integration of Emerging Technologies in Building Electrification and maintenance	2	1	2	1	1	-	2	-	1	2



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ACKNOLEDGEMENT

We would like to extend our sincere gratitude towards the following experts from various fields and industries for their valuable time & suggestions towards development curriculum of MEPCS- 2018 for Diploma in Electrical Engineering.

<u>Sr.No.</u>	<u>Name of the expert</u>	<u>Organization</u>
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