1. COURSE DETAILS :

Programme: Electrical Engineering	**Semester: V**
Course: # Inplant Training	**Group: A***
Course Code: IPT 190324	**Duration: 26 Weeks**

2. EXAMINATION SCHEME:

Sr No	Course Name	Training Duration	Credits		Weekly Report	Quiz Test	Dissertation (Report)	Oral/ Viva	Total	Group (Gr)
1	# Inplant Training (IPT190324)	26 Weeks **	20	Maximum Marks	50	50	50	50	200	A*
				Minimum Marks	20	20	20	20	80	

****Total Inplant Training Duration 26 weeks equal to 24 weeks actual training plus 2 weeks examination and processing**

*Compulsory, # Award Winning, Weekly Report and Quiz Test are assessed by Internal Examiner Only, Dissertation and Oral/Viva are Assessed by Internal and External Examiner Jointly

Gr- Group, B - Basic, C - Core, A - Application, M – Management

3. COURSE OBJECTIVE: -

The inplant training facilitates students to understand the various domains of electrical engineering industry along with work environment and the students are exposed to the latest developments in technologies. By exposing and interacting with the real-life electrical engineering industrial environment, student will appreciate and understand the actual working and best practices adopted in the electrical engineering industries. This short association with industry will be instrumental in orienting the students for transforming them into electrical engineering industry ready after completion of diploma program.

4. SKILL COMPETENCY:

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

- **Soft Skill including Communication, Presentation and liaising etc.**
- **Life skills including Time management, Safety, Innovation, Entrepreneurship, Team building etc.**
- **Hands-on including Reading Drawings and Design, Testing, Repair and Maintenance, Implementation and Quality Assurance aspects etc.**
- **Industry specific tools including Value Engineering, Concurrent Engineering etc.**

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

CO. No.	COURSE OUTCOMES	Blooms Level
CO1	Develop work culture and industrial practices to integrate theory with practice.	Application
CO2	Interpret and solve routine technical problems through the application of engineering principles and tools.	Application
CO3	Enhance communication skills, maintain discipline and ethics.	Application
CO4	Understand scope, functions, working in team and job responsibility in various departments of organization and present the work done.	Application
CO5	Implement safety and environmental practices.	Application
CO6	Develop leadership and management skills.	Application

6. IMPLEMENTATION STRATEGY (PLANNING)

Students shall be sent for 24 weeks in plant training in the V semester. Students understand basic working of industry and its work culture. Students are made aware about industrial safety norms. Before the training begins, the students are addressed by the Principal about rules, safety precautions and discipline to be maintained in the company during the training. The same is reminded by the institute supervisor on every visit. The company supervisor also takes care about students' safety.

In the initial weeks company personnel train the students about their manufacturing process, products and services. The students are involved in project implementation for onsite execution, design and drawings, use of software and similar work.

Each company is visited by the institute supervisor on regular basis till the end of in plant training. Each student is monitored for performance, any difficulty, grievances and absenteeism. Accordingly corrective and preventive actions are taken.

7. EVALUATION CRITERIA

Each student performance is assessed by a company supervisor and is recorded in weekly report. The same record is maintained and assessed by the institute supervisor. Depending on the grades given by the company supervisor and also by examining the performance in the weekly report, marks are given out of 50 by the institute supervisor. Considering their work profile in the company, institute supervisor gives 5 quiz tests (comprising of five questions each) of 10 marks each to the students. The same are assessed by institute supervisor. The training report submitted by a student is assessed together by internal and external examiner and accordingly marks are given out of 50. Students presents the work done by them in the company and are examined by internal and external examiner together for 50 marks, constituting total 200 marks. These marks

are converted to out of 100 marks for final evaluation (Award of Diploma). The external examiner appointed for inplant training examination is from industry.

8. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.	Examiner	NAME	SIGNATURE
1	Internal	Mr. N D Adate	
2	Internal	Mrs.A N Kinhekar	
3	Internal	Mr.D G Rajmandai	
4	External	Mr.Ricky Uchil	
		Organization: Vice President , Adani Electricity Mumbai Ltd.	

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1. COURSE DETAILS

Programme: CH/EE/IE/DE	**Semester: IV/VI/VI/VI**
Course: Industrial Management	**Group: M***
Course Code:IMG190014	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+ D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
03	----	----	----	03	03	70	20	10	70	-----	-----	-----	100

3. COURSE OBJECTIVE

Engineering professional is responsible for a wide variety of tasks, requiring strong technical knowledge and managerial skills . This course provides broad knowledge about different managerial skills, managerial skills are essential for enhancing their employability and career growth. This course is therefore designed to provide the basic concepts in management principles, safety aspects and Industrial Acts.

4. SKILL COMPETENCY:

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

- **Use relevant managerial skills for ensuring efficient and effective management.**

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

CO No.	Course Outcome	Bloom's level
CO 1	Understand the importance of Indian industry.	I – Remembering II - Understanding
CO 2	Use principles of planning and organizing for accomplishment of tasks.	I – Remembering II - Understanding
CO 3	Use principles of directing and controlling for implementing the plans.	II - Understanding III - Apply
CO 4	Apply principles of safety management in all activities.	I – Apply
CO 5	Understand financial management	I - Remembering II - Understanding

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6. COURSE CONTENTS

Sr. No.	Topic/Sub-topic	Hours	Marks	COs
1	**Introduction to Indian Industry** 1.1 Meaning - Definition 1.2 Classification of Industry 1.3 Infrastructure and Location of Industry 1.4 Importance of Industry 1.5 Types of required in industries.	06	10	CO1
2	**Types of Ownership of Industry** 2.1 Proprietorship 2.2 Partnership 2.3 Private Ltd Company 2.4 Public Ltd Company 2.5 Co-operative Enterprises 2.6 Public Sector Enterprises	10	14	CO1
3	**Supervisor & Supervision** 3.1 Meaning and definition 3.2 Role and Responsibilities of supervisor 3.3 Qualities of Supervisor 3.4 Skills of Supervisor 3.5 Functions of Supervisor	06	10	CO2 CO3
4	**Management** 4.1Introduction to management 4.2Meaning, definition and importance. 4.3Relevance of management to engineers. 4.4Principles of management. 4.5Resorces of management 4.6 Recruitment, selecting and placement of man-power	10	14	CO2 CO3 CO4
5	**Industrial Relations** 5.1 Meaning and Importance. 5.2 Types of Industrial Relations. 5.3 Industrial disputes – Causes. 5.4 Methods and machinery for resolving industrial disputes. 5.5 Trade union – Its role in maintaining industrial peace. 5.6 Industrial safety 5.7 Industrial Acts	10	14	CO4
6	**Finance** 6.1 Sources of finance. 6.2 Working capital and fixed capital. 6.3 Financial statements of a company. 6.4 Financial ratios. 6.5 Budgets and budgetary control.	06	08	CO5
	Total	**48**	**70**	

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7. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan
2. PPT

8. LEARNING RESOURCES

Sr. No.	Title of book	Author	Publication
1.	Industrial Organisation and Management	T.R Banga S.C Sharma	Khanna Publication
2.	Industrial Management	O.P Khanna	Dhanpat Rai and Sons
3.	Industrial organization and engineering economics	T.R Banga S.C Sharma	Khanna Publication

9. WEB REFERENCES

a. http://nptel.ac.in /course (NPTEL)

10. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	Topic	Distribution of theory marks			
		R level	U level	A level	TOTAL Marks
1	Introduction to Indian Industry	02	04	04	10
2	Types of Ownership of Industry	02	06	06	14
3	Supervisor & Supervision	02	02	06	10
4	Management	02	06	06	14
5	Industrial Relations	04	06	04	14
6	Finance	---	04	04	08
TOTAL		12	28	30	70

11. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		Name	Signature
1	Internal	Shri A.S Shukla	
2	Internal	Shri G.J.Badwe	
3	Internal	Shri Pratik Sawant	
4	External	Shri Mangesh Mohan Organization:-Father Agnel Polytechnic, Bandra	

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1. COURSE DETAILS:

PROGRAMME: Electrical Engineering	**Semester: VI** **Group : A***
COURSE: # Power Electronics **Code : PEX190317**	**Duration : 16 weeks**

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
04	02	--	--	06	03	70	20	10	70	50	50	--	200

3. COURSE OBJECTIVE:

To become a perfect technician in electrical engineering, knowledge and applications of electronic Power Devices, AC-DC Motor controls, Inverters, Choppers and SMPS is essential. The knowledge of power electronics will assist the diploma engineers to upkeep the various power controlled devices used in power industry.

4. SKILL COMPETENCY:

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

- **Maintain the power electronic devices and circuits used in industries**

5. COURSE OUTCOMES (CO's): at the end of this Semester student will be able to:

CO.NO	COURSE OUTCOMES	Blooms LEVEL
CO 1	Select appropriate power electronic devices, protection circuits and commutation techniques for specific applications.	U,A
CO 2	Maintain different types of chopper circuits.	R,U,A
CO 3	Maintain different types of inverter circuits.	R, U,A
CO 4	Use power electronic devices in various industrial applications.	R,U,A
CO 5	Test and check the performance of various power electronics circuits.	U, A

6. COURSE CONTENTS:

Sr.No.	Topic / Sub-Topics	Hours	Marks	COs
1	**Thyristors and other Switching Devices:** 1.1 Power Semiconductor Devices 1.1.1 Thyristors (SCR), Two-Transistor Model of Thyristors 1.1.2 GTO, PUT, SUS, SCS, Light Activated Thyristor (LAT) 1.1.3 Diac, Triac, 1.1.4 IGBT 1.2. Characteristics of SCR, Diac and Triac.	12	12	CO 1 CO 5

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	1.3. Switching Characteristics of SCR and TRICS 1.4. Turn-on and Turn-off Methods in SCR and Triac. 1.6. SCR and Triac Ratings. 1.7 SIT: construction, working, V-I characteristics and applications 1.8 MCT: construction, working, V-I characteristics and applications 1.9 FCT: construction, working, V-I characteristics and applications			
2	**Thyristor Protection Circuits :** 2.1 Snubber Circuit. 2.2 Over-Voltage Protection. 2.3 Over-Current Protection. 2.4 Gate Protection.	06	08	CO 1
3	**Firing Circuits & Commutation Techniques :** **3.1** Firing Circuits for SCR and Triacs. 3.2 Main Features of Firing Circuits. 3.3 Resistance & Resistance-Capacitive Firing Circuit. 3.4 UJT based Firing Circuit. 3.5 Pulse Transformer in firing Circuit.	08	10	CO 1
4	**Phase Controlled Rectifier:** 4.1. Principle of Phase Control. 4.1.1. Single Phase Half-Wave Circuit With R-L Load. 4.1.2. Freewheeling Diode. 4.2. Full Wave Controlled Rectifier. 4.2.1. Single Phase Full Converter. 4.2.2. Single Phase Semi Converter. 4.3. Three Phase Full Converters. 4.4. Three Phase Semi Converters. 4.5. Three Phase Converter System Using Diodes. 4.6.Applications of SCR.	10	10	CO 1 CO 5
5	**Choppers:** 5.1 Principles of Chopper 5.2 Control strategies 5.2.1 Constant frequency system 5.2.2 Variable frequency system 5.3 Step up choppers 5.4 Types of chopper circuits 5.4.1 Type A,B, C, D and E Chopper circuits	10	10	CO 2 CO 5
6	**Inverters :** 6.1 Operating principles of inverter 6.1.1 Single phase voltage source Inverters 6.1.2 Single phase bridge Inverters 6.2 Principles of operation of different inverter circuits 6.3 Inverter waveforms 6.4 Inverter using Thyristors 6.5 Series and Parallel Inverters 6.6 A.C Voltage Control 6.7 Application of Inverter 6.8 Switch Mode Power Supply (SMPS) 6.9 Uninterruptable Power Supply (UPS)	10	12	CO 3 CO 5
7	**Industrial Control Circuits :** **7.1** Applications: Burglar's alarm system, 7.2 Battery charger system using SCR,	08	08	CO 4

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	7.3 Emergency light system, 7.4 SMPS 7.5 UPS: offline, online 7.6 SCR based AC and DC circuit breakers			CO 5
	Total	**64**	**70**	

7.LIST OF PRACTICALS / ASSIGNMENTS / TUTORIALS / DRAWINGS

The term work consist of journals consisting of minimum 8-10 experiments and 2-3 Assignments with approximate number of hours required with corresponding CO's

Sr. No.	Title of Experiment/Assignment/Exercise /Tutorial/Drawings	Approx. Hrs required	Cos
1.	Test the functioning of RC triggered HWR	02	CO 5
2.	Test the functioning RC triggered FWR	02	CO 5
3.	Test and plot functioning IGBT Characteristics	02	CO 1
4.	Test and plot functioning UJT triggering of SCR	02	CO 5
5.	Test and plot functioning Digital firing circuits	02	CO 5
6.	Check the performance of phase controlled rectifiers (any one type)	02	CO 2
7.	Test and functioning Impulse commutated chopper	04	CO 5
8.	Check the performance of single phase /three phase Series inverter	04	CO 3
9.	Check the performance of single phase /three phase Parallel inverter	04	CO 5
10.	Test the functioning of Study of SMPS	02	CO4, CO5
11.	Test the functioning of Study of UPS	02	CO4, CO5
12.	Study industrial applications of controlled circuits	04	CO4 CO5
13.	Assignment on single phase and three phase SCR circuits.	-	CO1 CO5
14.	Assignment on power electronic devices.	-	CO1
15.	Assignment on applications of power electronic devices.	-	CO4
	Total	32	

8 . IMPLEMENTATION STRATEGY (PLANNING) :

1 Teaching Plan
2 Minimum number of practicals/assignments
3 Industrial visit
4 Self learning online resources
5 Guest lecture

9. LEARNING RESOURCES:

Sr. No	Title of Book	Author	Publishers
1	Thyristors: Theory and Applications	Sugandhi R,K and Sugandhi K.K	New Age International Publisher, New Delhi, 2009, ISBN: 978-0852268520
2	Electronics in Industry	Chute and Chute	Tata-Mcgraw Hill, New Delhi
3	Modern power Electronics	Sen P.C	S. Chand & Company, New Delhi;2013, ISBN:978-8121924252
4	Power Electroncis and Applications	Alok Jain	Penram International Publishing Mumbai, 2006, ISBN:978-8187972228
5	Power Elecronics	M.D Singh and K B Khanchandani	McGraw Hill Publishing Co.Ltd, New Delhi, 2008 ISBN:978-0070583894
6	Power Electronics	P.S.Bimbhra	Khanna Publishers, New Delhi, New Delhi, 2008, ISBN-13:978-8174092793
7	Rajashekara, K., Bhat, A.K.S., Bose, B.K.	Power Electronics, The Electrical Engineering Handbook	

10. WEB REFERANCES:

1. www.nptel.ac.in/courses/108101038
2. www.electrical4u.com
3. www.powerguru.org/power-electronics-videos
4. www,youtube.com/watch?v=1Auay7ja20Y
5. http://www.slideshare.net/rssraaz/power-electronics-16419609

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	Topic	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Thyristors and Other Switching Devices	4	4	4	12
2	Thyristors Protection Circuits	4	4	-	08
3	Firing Circuits & Commutation Techniques	4	-	6	10
4	Phase Controlled Rectifier	4	-	6	10
5	Choppers	-	4	6	10
6	Inverters	2	4	6	12
7	Industrial Control Circuits	-	4	4	8
	Total	**18**	**20**	**32**	**70**

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

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

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12. COURSE EXPERT COMMITTEE MEMBERS:

Sr. No.	Expert	NAME	SIGNATURE
1	Internal	Mr.N D Adate	
2	Internal	Mrs.A N Kinhekar	
3	Internal	Mrs.Pooja Nikhade	
4	External	Deepak K. Kajrolkar (Dy. Gen. Mgr.)	
	Organization	Adani Electricity Mumbai Ltd.	

1. COURSE DETAILS:

PROGRAMME : Electrical Engineering	**Semester: VI**
COURSE : #PROJECT	**Group : A***
Course Code : PRJ190318	**Duration : 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
-	06	--	--	06	-	-	-	-	-	50	-	50	100

3. COURSE OBJECTIVE:

This course is introduced for the final year students in order to give them the scope to utilize their theoretical knowledge that is fundamental of electrical and electronics engineering, group projects and make them to understand the importance of team work, Leadership and time management. In order build up self-confidence and experiencing themselves before the audience are have introduce the presentation of the project is planned at the end of the term.

4. SKILL COMPETANCY:

The aim of this course is to help the students to attain following industry identified competency through various teaching-learning experiences:

- **Develop project proposals to launch small scale enterprises**

5. COURSE OURCOMES (CO's): at the end of the Semester student will be able to:-

CO.No	COURSE OUTCOMES	Blooms Level
CO 1	Select most contemporary subject for the project work	R, U, A
CO 2	Prepare project proposal with action plan and time duration scientifically before the beginning of the project	U, A
CO 3	Apply their practical skill and choose the techno economical solution to the problem identified.	U, A
CO 4	Develop team work and leadership and consider ethical and environmental issues related to project.	U, A
CO 5	Prepare and present technical report along with project demonstration	R, U, A

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6. Activity plan:

Activity No.	Activities	Week No
1	Formation of Group	1
2	Selection of Project: Individual/Group discussions	
3	Define Problem statement for project work	2
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	3
9	Allocation of work responsibility to individual/team	4
10	Visits to Industries / Institutions / Market/field work/sites	5
11	Collection of Data /Survey/Analysis	6
12	Design of Components, preparation of drawing, estimates wherever required,printed circuits design, its checking,	7
13	Fabrication, Assembling, Model/Prototype development, Testing as per projectrequirements	8
14	Progressive presentation of work and recording in diary	9-10
15	Consolidation of work allotted to individual or team	11-12
16	Presentation of initial draft: pre submission draft	13
17	Final Project Report: Printed: Submission: soft & Hard copy	14
18	Group presentation of project work at the time of final evaluation	15-16

N.B:

- 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.
- The activities mentioned above shall be monitored and guided by Project Guide every weekduring 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 groupdiscussions, 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

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12	Renewable Energy
13	Any other topics related to Electrical Engineering

7. TERM WORK:

The term-work shall comprise of one electrical or inter disciplinary group project (maximum 4-5 students)

Students shall note there is presentation for project work at three levels based on following points such as:

Leader ship, Understanding, Observation&Accuracy, Contribution and Timely Completion

- Phase –I – 15 Marks
- Phase –II- 15 Marks and
- Final Presentation – 20 Marks
- Total = 50 Marks

TW to be assessed by external & internal examiners.

➢ GUIDELINE FOR PREPARATION OF PROJECT REPORT:

1. The student shall get the initial draft copy of the project approved from the Project guide.
2. Structure: It shall be as follows :
   - 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
3. Each group has to submit one copy of project report to the library and one soft and hard copy to the department apart from the individual copy.
4. The project report will be of 40 to 50, A4 Size pages with 1.5 line spacing. Font: New Times Roman, left margin 3 cm, right margin 1.5 cm, top margin 2.5 cm, bottom margin 1.5 cm, header & footer 1.5 cm, page numbers, size of font 12 pt, paragraphs left and right justified.
5. Chapters (to be numbered in Arabic) containing Introduction-which usually specifies scope of work and the present developments. Main body of the report divided appropriately into chapters, sections and subsections. The chapters, sections and subsections may be numbered in the decimal form for e.g. Chapter 2, sections as 2.1, 2.2 etc. and subsections as 2.2.3, 2.5.1 etc.
6. The chapter must be left or right justified (font size 16). Followed by the title of chapter centered (font size 18), section/subsection numbers along with their headings must be left justified with section number and its heading in font size 16 and subsection and its heading in font size 14. The body or the text of the report should have font size 12.
7. The figures and tables must be numbered chapter wise.
8. The last chapter should contain the summary of the work carried, contributions if any, their utility along with the scope for further work.
9. Reference OR Bibliography:
   The references should be numbered serially in the order of their occurrence in the text and their numbers should be indicated within square brackets for e.g. [4]. Thesection on references should list them in serial order in the following format.
   a. For textbooks – Dr.D .P. Kothari & Dr. I .J Nagrath, Electrical Machines, McGraw Hill Publications, New Delhi 1 Edition, 2009.

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b. For papers - David, Insulation design to combat pollution problem, Proc ofIEEE, PAS, Vol 71, Aug 1981, pp 1901-1907.
c. Only SI units are to be used in the report. Important equations must be numbered in decimal form.

10. Each student from group shall have one copy with individual certificate only.
11. The project report and progressive assessment sheets are to be submitted before theend of term declared in the Academic Calendar of the institute.

8. LEARNING RESOURCES: 1. Magazine Electrical India

2. Electronics for you

9. WEB REFERANCES: 1.www.wikipedia.com
2. www.1000projects.org
3. www.projectreportstore.com
4. www.project.webcrawler.com

10. COURSE EXPERT COMMITTEE MEMBERS:

Sr. No.	Expert	NAME	SIGNATURE
1	Internal	Mr N D Adate	
2	Internal	Mrs. Ajayshree Kinhekar	
3	Internal	Mr Dinesh Rajmandai	
4	External	Mr.Sandip Dalvi Organisation: Adani Electricity Senior Manager	

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1. COURSE DETAILS

Programme: Electrical Engineering	**Semester: VI**
Course: # Electrical Testing and Maintenance	**Group: A***
Course Code: ETM190319	**Duration:16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	3	70	20	10	70	50	50	-	200

3. COURSE OBJECTIVE

The knowledge of testing, maintenance, erection and installation of electrical equipment's in industries, power plants and state electricity board is essential. This subject provides the detailed guidelines as per I.S. codes/I.E. Rules for testing, maintenance, erection and installation of electrical equipment's.

4. SKILL COMPETENCY

The aim of this course is to help the students to attain following industry identified competency through various teaching-learning experiences:

- **Use, repair and maintain various electrical equipments used in domestic & commercial fields.**

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

CO No.	COURSE OUTCOME	Bloom's Level
CO1	Follow electrical safety measures and use fire extinguisher for fire due to electrical causes.	R, U, A
CO2	Install Static and Dynamic Electrical machines.	R, U, A
CO3	Test and maintain different electrical machines such as Transformers, DC machines, Synchronous machines and Induction motor as per I.S	R, U, A
CO4	Identify and test different Class of insulation as per ISS 1271- 1958.	R, U, A

6. COURSE CONTENTS

Sr. No.	Topic / Sub-Topics	Hours	Marks	COs
1	**Safety & Prevention of Accidents.** 1.1 Definition of terminology used in safety: safety, hazard, accident. 1.2 Electrical accidents, its causes & preventions. 1.3 I.E. Act & statutory regulations for safety of persons & equipments working with electrical installation. 1.4 Electrical Fire:- Causes of Fire & precautions to avoid fire, fire extinguishers.	05	06	CO1
2	**Installation of Electrical Machines.** 2.1 Concept of foundation for machinery installation. 2.2 Requirements of Foundation for static & rotating electrical machinery. 2.3 Concept and procedure of leveling & aligning. 2.4 Alignment of direct coupled drive. 2.5 Effects of misalignment. 2.6 Installation of rotating machines as per I.S. 900-1992 2.7 Earthing. Types of earthing and factors affecting earth resistance.	07	08	CO2
3	**Testing and Maintenance of Transformers.** 3.1 Listing type test, routine test & special test as per I.S. 2026-1981 3.2 Specifications of Transformers. 3.3 Procedure for conducting following tests: Polarity and phasing out test, DC resistance of windings. Measurement of voltage ratio, Efficiency Test, Temperature rise test, Insulation resistance test, H.V. Test and impulse test. 3.4 Preventive and routine maintenance for distribution transformers as per ISS 10028-1981. 3.5 Test before commissioning of the Transformer as per ISS 2026-1962, ISS 1886-1967.	13	14	CO3
4	**Testing and Maintenance of D.C. Machines and Synchronous Machines.** 4.1 Objectives of testing 4.2 Types of Tests as per ISS. Roles of Bureau of Indian Standards (BIS) in testing of electrical Equipment's. 4.3 Specifications of DC machines. 4.4 Methods of testing 4.4.1 Brake test 4.4.2 Swinburne's test 4.4.3 Hopkinson's test 4.4.4 Calibrated machine test.	18	18	CO3

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	4.5 Concept of routine, preventive & breakdown maintenance 4.6 Trouble shooting chart of DC machines. 4.7 Testing and Maintenance of BLDC Motor. 4.8 Maintenance schedule of DC Machines. 4.9 Specifications of Synchronous machines. 4.10 Maintenance schedule of alternators & synchronous machines as per IS 4884-1968			
5	**Testing and Maintenance of Induction motor** 5.1 Specifications of single phase and three phase induction motor. 5.2 Routine tests of Single phase & Three phase Induction motors: Measurement of D.C resistance, Measurement of insulation resistance, High voltage test, Reduced voltage running up test, No load test, voltage ratio test. 5.3 Type tests on Three phase induction motor: Temperature rise test, Momentary overload test, Full load test. 5.4 Trouble shooting chart of single phase and three phase induction motor. 5.5 Routine, Preventive, & breakdown maintenance of Single phase & Three phase Induction motors as per IS 9001-1992	**14**	**16**	**CO3**
6	**Testing of Insulation** 6.1 Classification of insulation as per ISS 1271-1958. 6.2 Factors affecting life of insulating materials. 6.3 Measurement of insulation resistance. 6.4 Reconditioning of insulation 6.4.1 Cleaning and drying the insulation 6.4.2 Re-varnishing 6.5 Resin Casting. 6.6 Construction and working of vacuum impregnation plant.	**07**	**08**	**CO4**
	Total	**64**	**70**	

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7. LIST OF PRACTICALS/ASSIGNMENTS/EXERCISES/TUTORIALS/DRAWINGS

The term work consist of journals consisting of minimum 8-10 experiments and 2-3 Assignments with approximate number of hours required with corresponding CO's

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx.Hrs required	COs
1	Performance of Swinburne's test on a D.C machine.	4	CO3
2	Performance of Hopkinson's test on two D.C shunt machines.	4	CO3
3	Performance of Brake test on Single phase induction motor.	2	CO3
4	Performance of Calibrated machine test on D.C machine.	2	CO3
5	Performance of Polarity test on single phase transformer	2	CO3
6	Performance of Parallel operation of two single phase transformer	4	CO3
7	Performance of Back to back test on single phase transformer and determination of efficiency & Regulation.	4	CO3
8	Testing of single-phase induction motors as per ISS 996-1964.	4	CO3
9	Synchronizing of Alternators	4	CO3
10	Study of testing and maintenance of BLDC Motor.	2	CO3
	Total	32	

Assignments

1	Assignment on Electrical Safety & Prevention of Accidents.	CO1
2	Assignment on Installation of Electrical Machines.	CO2
3	Assignment on Testing of Insulation	CO4

8. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan.
2. Assignments.
3. Guest/Expert lectures.
4. Visit to nearby testing laboratory if any
5. Continuous assessment.
6. Slides.
7. Any other method adopted.

9 LEARNING RESOURSES

Sr. No.	Title of Book	Author	Publication
1	Electrical Technology Vol -II	B. L. Theraja	S. Chand & Co., New Delhi
2	Operation & Maintenance of Electrical Equipments Vol-I & II	B.V.S. Rao	Media promoters and publisher Ltd. Mumbai
3	Electrical Machines	Bhattacharya	Tata McGraw Hill

10. WEB REFERENCES

1. www.lanl.gov/safety/electrical/docs/skilled_worker_module_6.ppt
2. www.sandia.gov/.../Electrical/Sand_2009_1947_P_Non-Electrical
3. www.bis.org.in
4. www.standardsbis.in
5. www.civilengineer.co.in

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr.No	Topic	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Safety & Prevention of Accidents	3	3	-	06
2	Installation of Electrical Machines.	-	-	8	08
3	Testing and Maintenance of Transformers.	4	4	6	14
4	Testing and Maintenance of D.C Machines and Synchronous Machines.	6	6	6	18
5	Testing and Maintenance of Induction motor.	4	6	6	16
6	Testing of Insulation	4	4	-	08
TOTAL		21	23	26	70

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

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

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Mr. Dinesh G.Rajmandai	
2	Internal	Mr. N.D.Adate	
3	Internal	Miss Urvi H.Sawant	
4	External	Mr. A.K.Dhulshette Organisation: Government Polytechnic, Bandra.	

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

1. COURSE DETAILS

Programme: Electrical Engineering	**Semester: VI**
Course: #Traction & Drives	**Group: A***
Course Code: TDR190320	**Duration: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	3	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE

Electrical drives are vary commonly used in industries and traction is a special application of electrical drive, this course deals with different type of drives, duty cycle of motors, type of enclosures of motors etc. it also deals with selection of motor for a given application, the control devices and methods etc. this subject deals with discussion of drives use for some typical application like steel mills, paper mills etc.

4. SKILL COMPETENCY

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

- **Suggest the appropriate method/systems for traction, its electrification, motors, braking, starting.**
- **Recommend appropriate drive, their mechanical features, ratings and flywheel for given load conditions and applications.**

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

CO No.	COURSE OUTCOME	Bloom's Level
1.	Suggest appropriate electric traction systems, track electrification methods, current collection system, substation equipment and signaling mechanism.	R, U, A
2.	Determine tractive efforts and specific energy consumption for given traction duty.	R, U, A
3.	Select suitable motors, their starting and braking methods for traction duty.	R, U, A
4.	Recommend appropriate drive, their mechanical features, ratings and flywheel for given load conditions.	R, U, A
5.	Suggest suitable drives for specific application.	U, A

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6. COURSE CONTENTS

Sr. No.	Topic /Sub-Topics	Hours	Marks	COs
1	**Types, Supply arrangements and signaling system for Electric traction**: 1.1 System of electric traction 1.2 Advantages and disadvantages of electric traction 1.3 Requirements of an Ideal Traction System 1.4 Types of Traction systems & track electrification 1.4.1 Railways 1.4.2 Metro systems 1.4.3 Monorail systems 1.5 Overhead supply arrangement for railways 1.6 Current collection systems 1.7 Block diagram of an AC Electric locomotive 1.8 Major Traction substation equipment 1.8.1 Transformer 1.8.2 Circuit breaker 1.8.3 Interrupter 1.9 Protective systems for electric traction 1.9.1 Transformer protection 1.9.2 25kV Catenary protection 1.10 Signaling	**13**	**10**	**CO1**
2	**Traction mechanics**: 2.1 Speed time curve & simplified speed time curves 2.2 Max. and schedule speed & factors affecting maximum speed 2.3 Problems associated with max speed 2.4 Tractive effort 2.5 Power of traction motor 2.6 Coefficient of adhesion, factors affecting coefficient of adhesion 2.7 Problems associated with tractive effort 2.8 Specific energy consumption 2.9 Factors affecting specific energy consumption 2.10 Problems associated with specific energy consumption	**07**	**12**	**CO2**
3	**Traction Motor**: 3.1 Requirements. 3.2 Traction Control of DC Locomotives and EMUs: Chopper Control of Motors in DC Traction Systems. 3.3 Traction Control System of AC Locomotives: Tap Changer, Step less Voltage Control through Use of Thyristors, PWM Control of Induction Motors. 3.4 Braking 3.4.1 Requirements of braking systems 3.4.2 Types of electric braking 3.4.3 Rheostatic braking, plugging and regenerative braking 3.4.4 Conditions necessary to achieve electric regenerative braking 3.4.5 Suitability of motors for E.R.B.	**11**	**12**	**CO3**

4	**Electric drive**: 4.1 Concept of an electric drive 4.2 Advantages of electrical drive 4.3 Mechanical features of electric drive 4.4 Multi-Quadrant operation of drives 4.5 Classification of electric drives 4.6 Nature and classification of Load torques 4.7 DC Drives: Speed control & Braking operation of DC separately/shunt/series motor with single phase and three phase half and full controlled converter, Chopper Drives. 4.8 AC Drives: Methods of speed control of three phase Induction Motor. Speed control and braking operation by using converters and choppers	**13**	**14**	**CO4**
5	**Rating & heating of motors**: 5.1 Heating effects 5.2 Heating & cooling curves 5.3 Classes of duty cycles 5.4 Determination of motor rating for different applications 5.5 Load equalization 5.6 Flywheel calculations	**11**	**12**	**CO4**
6	**Industrial applications**: Descriptive study of electrical drives needed for (1) steel mills, (2) Paper mills (3) Textile mills and different processes in textile mills, (4) sugar mills (5)coal mills (6) cement mills (7) machine tool applications	**09**	**10**	**CO5**
	TOTAL	**64**	**70**	

7.LIST OF PPRACTICALS/ASSIGNMENTS/EXERCISES/TUTORIALS/DRAWINGS

The term work consists of journal consisting of 5 assignments and mini project/study project/industry visit with approximate number of hours required with corresponding CO's:

Sr. No	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx. Hrs required	COs
1	Supply and signaling system for Electric traction	2	CO1
2	Traction mechanics	3	CO2
3	Traction Motor	2	CO3
4	Electric drive, Rating & heating of motors	3	CO4
5	Industrial applications	2	CO5
6	Mini project/Study project/Project based on Industry visit	20	CO1/ CO2/ CO3/ CO4/ CO5

8.IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan.
2. Assignments.
3. Industrial visit.
4. Guest/Expert lectures.
5. Continuous assessment.
6. Slides.
7. Any other method adopted.

9. LEARNING RESOURSES

Sr. No.	Title of Book	Author	Publication
1	Modern electric traction	H.Partap	Pritam surat & brothers
2	Utilization of electrical power and electric traction	J.B.Gupta	S.Chand
3	Art & science of electric drives	H.Partap	Khanna publications
4	Electrical drives	S.K.Pillai	Wiley eastern limited
5	Fundamentals of electrical drives	G.K.Dubey	Narosa publishing house
6	Modern electric traction	M. A. Chaudhari, S. M. Chaudhari	Nirali Prakashan

10. WEB REFERENCES

1. www.irieen.indianrailways.gov.in
2. www.wikipedia.com
3. www.techeduhry.nii
4. www.aast.edu

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Supply and signalling system for Electric traction	3	4	3	10
2	Traction mechanics	3	3	6	12
3	Traction Motor	3	6	3	12
4	Electric drive	4	4	6	14
5	Rating & heating of motors	3	3	6	12
6	Industrial applications	-	4	6	10
Total		**16**	**24**	**30**	**70**

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

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

12. COURSE EXPERT COMMITTEE MEMBERS

SR.NO.		NAME	SIGNATURE
1	Internal	Miss. Urvi H. Sawant	
2	Internal	Mr. Dinesh G. Rajmandai	
3	Internal	Mrs. Ajayshree N. Kinhekar	
4	External	Ms Sheeja Nair	
	Organization	D. J Sanghvi College of Engg.	

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

1. COURSE DETAILS:

Programme: Electrical Engineering	**Semester: VI**
Course : # Industrial Automation	**Group : A***
Course Code : INA190321	**Duration : 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	3	70	20	10	70	50	-	50	200

3. COURSE OBJECTIVE :

This course aims acquaint students with vital components of automation such as motor control circuits, typical input/output devices, Programmable Logic Controller (PLC), Distributed control system (DCS), Supervisory Control and Data Acquisition System (SCADA) and Human Machine Interface (HMI). This will facilitate students to develop understanding and skills related with operation and maintenance of basic building blocks of industrial automation, which will in turn enable them to effectively upkeep the automated systems in industry.

4. SKILL COMPENTANCY:

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

- **Maintain PLC and SCADA based industrial automation systems.**

5. COURSE OUTCOMES (CO's) : - at the end of the semester student will be able to:-

CO. NO	COURSE OUTCOMES	Blooms Level
CO 1	Maintain the relevant input/output components in industrial control circuits	R,U,A
CO 2	Wire PLC's for different applications	R,U,A
CO 3	Troubleshoot the PLC ladder diagrams for simple applications	U,A
CO 4	Test the PLC program in different applications	U,A
CO 5	Maintain the DCS and SCADA for different applications	R,U,A

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

6. COURSE CONTENTS:

Sr .No.	Topic/Sub-Topics	Hours	Marks	CO
1.0	**Introduction to Industrial Automation** 1.1 Need and benefits of Industrial Automation, Different input devices such as push button, selector switch, limit switch, proximity switch and pressure switch 1.2 Different output devices such as relay, contactor, solenoid valves, solid state relay (SSR) 1.3 Different symbols used in industrial control circuits, concept of control and power circuit diagram. 1.4 Commonly used motor control circuits such as a) DOL starting b) Star-delta starter c) FWD-REV control and random reversing of induction motor d) Soft starters. 1.5 Typical control and power circuit diagrams of hoist control, conveyer's control, lifting magnet and Mill and Extruders.	12	16	CO 1 CO 2
2.0	**PLC Fundamentals :** 2.1 Functions of different parts of PLC such as CPU, memory, power supply and IO modules. 2.2 Digital IO modules of PLC, Block diagram and specifications 2.3 Analog IO modules of PLC, Block diagram and specifications 2.4 Special modules of PLC: 2.4.1Communication module 2.4.2 PID controller module 2.4.3 Stepper motor control module 2.5 PLCs in market based on CPU type, no of IOs, Speed and memory 2.6 Micro PLCs	14	14	CO 2
3.0	**PLC Programming and applications** 3.1 PLCI/o addressing 3.2 PLC Programming Instructions: Relay type instructions, timer instructions: On delay, off delay retentive, Counter instructions, Up, Down, High speed, Logical instructions, and Comparison instructions. Data handling Instructions, Arithmetic instructions 3.3 PLC programming language Functional Block Diagram (FBD), Instruction List, Structural text, Sequential Function Chart (SFC),Ladder Programming 3.4 Simple Programming examples using ladder logic: Language based on relay, timer counter, logical, comparison, arithmetic and date handling instructions	14	14	CO 1 CO 2

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	3.5 PLC based applications: Motor sequence control, Traffic light control, elevator control, Tank level control, conveyor system, Stepper motor control, reactor control			
4.0	**PLC Wiring Diagrams and Ladder logic:** 4.1 Seal in circuits using PLC 4.2 Ladder and wiring diagram of DOL starter with OLR 4.3 PLC based water level controller 4.4 Forward reverse control of 3-phase induction motors using PLC 4.6 Temperature control ON/OFF 4.7 Stepper motor control 4.8 Bottle filling system 4.9 Traffic light control	16	18	CO 3
5.0	**Supervisory Control and Data Acquisition System** 6.1 SCADA (Supervisory Control and Data Acquisition) Overview 6.2 Use of HMI 6.3 SCADA architecture, monolithic, distributed and networked 6.4 Concept of DCS(Distributed control System)	08	08	CO 4
	Total	**64**	**70**	

7. LIST OF PRACTICALS / ASSIGNMENTS / EXERCISES / TUTORIALS / DRAWINGS

The term work consist of journals consisting of minimum 10-12 experiments with approximate number of hours required with corresponding CO's

Sr. No.	Title of experiment/Assignment/Exercise/Tutorial/Drawings	Approx.Hrs required	COs
1.	Identify symbols in industrial control diagrams	02	CO 1
2.	Connect DOL Starter control and power circuit for small rating of 3-phase induction motor	02	CO 1
3.	Connect FOR-REV control and power circuit for small rating of 3-phase induction motor	02	CO 1
4.	Connect STAR-DELTA control and power circuit for small rating of 3-phase induction motor	02	CO 1
5.	Simulate a simple seal in circuit using PLC simulator	02	CO 2
6.	Connect PLC to PC and test execution of ladder programs for basic logic operations using two input switches and one output indicating lamp	02	CO 2
7.	Execute PLC program by using timer to turn on a lamp for 10 seconds after a push button press	02	CO 4
8.	Execute PLC program to count number of push button press events and display the same on the screen.	02	CO 4
9.	Connect PLC for STAR-DELTA starting of 3-phase Induction motor and test the ladder program for the same.	04	CO 3

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10	Connect PLC for FOR-STOP-REV control of 3-phase Induction motor and test the ladder program for the same.	02	CO 3
11	Use the PLC for running a stepper motor in clockwise/anticlockwise direction	02	CO 3
12	Use PLC for sensing the level of water tank using float switch and control level of water using ON/OFF solenoid valve	02	CO 4
13	Use PLC for ON/OFF temperature control.	02	CO 4
14	Use PLC for simulating traffic light control	02	CO 4
15	Use PLC HMI for display input switch status on screen	02	CO 5
	Total	**32**	

8. IMLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan.
2. Minimum number of practicals/assignments
3. Industrial visit.
4. Guest/Expert lectures.
5. Continuous assessment.
6. Slides.
7. Self learning online resources.
8. Any other method adopted.

9. LEARNING RESOURCES:

Sr. No.	Title of Book	Author	Publication
1.	Handbook of Electrical Motor Control Systems	Eswar, U.S	McGraw Hill Education, New Delhi,2013,ISBN:9780074604380
2.	Control of Machines	Bhattacharya, S.K.; Singh.B	New Age International Publishers, New Delhi 2006,ISBN:978122418187
3.	Programmable Logic Controllers – Principles and Applications	Webb, J.W; Reis, R.A	PHI learning Pvt. Ltd, New Delhi, 2003;ISBN:9780130416728
4.	Programmable Logic Controllers	Hackworth, J.R.; Hackworth, F.	Pearson Education, New Delhi, 2015, ISBN:9788177587715
5.	Programmable Logic Controllers	Petruzella, F.D.	McGraw Hill Education (India) Edition, New York ,2016, ISBN:9780073510880
6.	Programmable Logic Controllers	Bolton, W.	Elsevier India Pvt. Ltd New Delhi, 2016, ISBN: 9780128029299
7.	Introduction to PLC	Dunning, G.	Cengage India (2009), ISBN: 9788131503027

10. WEB REFERANCES:

1. http://electrical-engineering-portal.com/resources/plc-programming-training
2. PLC Basic Fundamentals and Wiring (Hindi): https://www.youtube.com/watch?v=g7ONCWmRy0w

3. Programmable Logic Controller Basics PLC Professor: https://www.youtube.com/watch?v=PLYosK87D8E
4. Basics of PLC ladder diagram: https://www.youtube.com/watch?v=Hci-eW5lihM
5. Controlling water level by using PLC: https://www.youtube.com/watch?v=1pRv-p_HbRk
6. Traffic signal control using PLC: https://www.youtube.com/watch?v=3WATUnwCwRA
7. Bottle Filling Process using PLC: https://www.youtube.com/watch?v=8UQOhGp8gqY

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN:

Sr. No.	Topic	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Industrial Control Circuits	2	6	8	16
2	PLC Fundamentals	2	4	8	14
3	PLC programming basics	2	4	8	14
4	PLC Wiring diagrams and Ladder logics	4	6	8	18
5	SCADA and DCS	2	2	4	08
	Total	12	22	36	70

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

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

12. COURSE EXPERT COMMITTEE MEMBERS:

Sr. No.	Expert	NAME	SIGNATURE
1	Internal	Mr.N D Adate	
2	Internal	Miss. Urvi H Sawant	
3	Internal	Mrs.Anita Kulkarni	
4	External	Deepak K. Kajrolkar (Dy. Gen. Mgr.)	
	Organization	Adani Electricity Mumbai ltd.	

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

1. COURSE DETAILS

PROGRAMME : Electrical Engineering	**Semester: VI**
COURSE : Industrial Instrumentation	**Group : A**
Course Code : INI190322	**Duration : 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME:

Scheme of Instructions and Periods per					Examination Scheme and Maximum Marks							
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
04	02	-	-	06	03	70	20	10	70	25	-	50	175

3. COURSE OBJECTIVE

In industries, there are many requirements of measuring non – electrical quantities like pressure, strain, temperature etc. this course provides an introduction to the students of electrical engineering, regarding the measurement of such quantities.

This course introduces different transducers, some schemes involving such transducers and it also deals with qualities of measurement like precision, reliability, and sensitivity etc. this subject also deals with indicating and recording techniques and it also gives some introduction to telemetering.

4. SKILL COMPETENCY

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

- **Use various transducers for measurement of Electrical and Non Electrical quantities.**
- **Maintain different signal conditioning circuits and Data Acquisition System.**

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

CO No.	COURSE OUTCOME	Bloom's LEVEL
CO1	Identify different components of instrumentation system.	Remember, understand
CO2	Use different types of transducer for measurement of Electrical and Non Electrical quantities.	Remember, Understand
CO3	Describe different signal conditioning circuits.	Understand and Apply
CO4	Understand different Data Acquisition System and their use.	Understand and Apply

6. COURSE CONTENTS:

Sr.No.	Topic / Sub-Topics	Hours	Marks	COs
1	**Introduction to Instrumentation system** 1.1 Facts and concept of Instrumentation 1.2 Basic block diagram of Instrumentation system & its function 1.3 Static and dynamic characteristics 1.4 Accuracy and precision 1.5 Sensitivity and Resolution 1.6 Linearity and nonlinearity 1.7 Repeatability and reproductively 1.8 Hysteresis and Drift 1.9 Speed of Response, lag, fidelity, dynamic error	**8**	**8**	**CO1**
2	**Transducers** 2.1 Concept of Transducers 2.2 Classification of Transducers 2.2.1 Primary and Secondary Transducers 2.2.2 Electrical and Mechanical Transducers 2.2.3 Analog and Digital Transducers 2.2.4 Active and passive Transducers 2.3 Construction and working principles of 2.3.1 Resistive Transducers 2.3.2 Inductive Transducers 2.3.3 Capacitive transducers 2.3.4 Piezoelectric transducer, photoconductive cell, photovoltaic cells, load cell.	**10**	**10**	**CO2**
3	**Signal Conditioning** 3.1Concept of signal conditioning 3.2Block diagram of AC and DC signal conditioning and working 3.3Operational Amplifiers, OP AMP - 741, signal Operational Amplifier and its characteristic parameters Circuit Symbols and Terminals. OPAMP IC's: 741 pin diagram and pin function. Ideal op-amp: electrical characteristics. Ideal voltage transfer curve. Definitions of parameters of op-amp: Input offset voltage, input offset current, input bias current, Differential input resistance, Input capacitance, CMMR, SVRR, large signal voltage gain, output resistance, slew rate OP-AMP basic circuits Open loop and closed loop configuration of op-amp configuration: Inverting, non-inverting, differential amplifier 3.4Integrator, Differentiator, adder, subtractor, Inverter V to I converter, I to V converter , V to F converter Instrumentation Amplifier, Differential amplifier 3.5Filters:- Types and frequency response (No derivation) Multiplexing 3.6Use of signal conditioning circuit for Instrumentation system for Industrial applications	**10**	**12**	**CO3**

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4.	**DATA Processors & Data transmission** 4.1 Necessity of data processing in Instrumentation. 4.2 Generalized Data acquisition system: Block diagram. & explanation 4.3 Objectives of DAS 4.4 Concept of Data transmission 4.5 Block diagram of data transmission system & explanation 4.6Analog-to-digital and digital-to-analog conversion 4.7Advantages and disadvantages of digital data transmission over analog transmission	**6**	**8**	**CO4**
5.	**Temperature Measurement** 5.1 Electrical and non-electrical methods. 5.2 Different transducers used Liquid filled thermometers, 5.3 Mercury thermometers,Vapor pressure thermometers, 5.4 Gas thermometers, Bi-metal thermometers, 5.5 Resistance thermometers, 5.6 Thermocouples 5.7 Optical pyrometer, radiation pyrometer. **5.8** Errors of temperature measurements and remedies 5.9 Sensors used for temperature measurement.	**10**	**10**	**CO2**
6	**Pressure Measurement** 6.1 Measurements using mechanical methods- 61.1 U-tube manometer 6.1.2 Well type manometer, 6.1.3 Limp diaphragm, 6.1.4 Metal diaphragms or bellows. 6.1.5 Bourdon tubes-spiral or helical tubes. 6.2 Electric transducers. 6.2.1 The Pirani gauges, strain gauges. 6.2.2 Linear variable differential transducers. 6.2.3 Variable capacitance gauges 6.2.4 Electro pneumatic transducers. Piezo electrical transducers. 6.3 sensors used for pressure Measurement	**10**	**10**	**CO2**
7	**Flow and pH Measurement** Mechanical transducers, 7.1 Elbow flow meters, 7.2 Variable area meters, 7.3 Pilot tube, 7.4 Flow construction head meters, 7.5 Electrical transducers, 7.6 Magnetic flow meter, 7.7 Differential transformer transducers, 7.8 Turbine meters. 7.9 P-H measurements- 7.9.1 pH scale 7.9.2 pH Electrodes. 7.10 Principles of pH meters 7.11 sensors used for Flow Measurement	**10**	**12**	**CO2**
	Total	**64**	**70**	

MAFATLAL POLYTECHNIC

7. LIST OF PRACTICALS / ASSIGNMENTS / EXERCISES / TUTORIALS / DRAWINGS: Term Work consists of Journal containing minimum no of 10 experiments/assignments with approximate number of hours requires with corresponding CO's

Sr. No.	Title of Experiment	Approx.Hrs required	Cos
1	To study the characteristics of LVDT	4	CO1,CO2
2	To study the characteristics of LDR	4	CO1,CO2
3	To study the characteristics of Thermistor	2	CO1,CO2
4	To study the characteristics of Thermocouple	2	CO1,CO2
5	Study of Strain Gauge	2	CO1,CO2
6	Study of Integrator	2	CO3
7	Study of Differentiator	2	CO3
8	Study of Adder and Subtractor	4	CO3
9	Study of Instrumentation Amplifier	4	CO3
10	Study of Potentiometer	2	CO3
11	Study of V to I converter	2	CO3
12	Study of I to V converter	2	CO3
	Assignments- 1.Introduction to Instrumentation System 2. DATA Processors & Data transmission		CO1 CO4

8. IMPLEMENTATION STRATEGY (PLANNING)

1. Teaching Plan/Tutorials
2. Minimum no of practical/assignments.
3. Slides
4. Group discussions
5. Seminar
6. Self-Learning Online Resources
7. Any other method adopted

9. LEARNING RESOURSES

Sr. No	Title of Book	Author	Publication
1	Electrical measurements and instruments	A.K.Sawhney	Dhanpatrai & sons
2	Industrial Instrumentation control	S.K.Singh	Tata McGraw-hill
3.	Instrumentation control	Rangan & Sharma	Tata McGraw-hill

10. WEB REFERANCES

1 http://instrumentationtek.com
2 www.onlinelibrary.wiley.com
3 www.wikipedia.com
4 http://www.instrumentationcontrolbox.com
5 https://www.edgefx.in/industrial-instrumentation-in-real-time-applications

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1.	Introduction to Instrumentation system	4	4	-	8
2.	Transducers	2	4	4	10
3.	Signal Conditioning	2	4	6	12
4.	DATA Processors & Data transmission	2	2	4	8
5.	Temperature Measurement	2	4	4	10
6.	Pressure Measurement	2	4	4	10
7.	Flow and pH Measurement	4	4	4	12
TOTAL		18	26	26	70

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

12. COURSE EXPERT COMMITTEE MEMBERS

Sr. No.		NAME	SIGNATURE
1	Internal	Dr.Zafar Shaikh	
2	Internal	Mrs Ajayshree N. Kinhekar	
3	Internal	Mr.N.D.Adate	
4	External	Prof.Kishor Dawane Organisation:G.P.Mumbai	

1. COURSE DETAILS

Programme: Electrical Engineering	**Semester: VI**
Course: Principles of Control System	**Group: A**
Course Code: PCS190323	**Duration: 16 Weeks**

2. TEACHING AND EXAMINATION SCHEME

Scheme of Instructions and Periods per Week					Examination Scheme and Maximum Marks								
Theory Hrs L	Practical Hrs P	Drawing Hrs D	Tutorial Hrs T	Credits (L+P+D+T)	Theory Paper Duration and marks(ESE)		SSL	TA	TH	TW	PR	OR	TOTAL
					Hours	Marks							
4	2	-	-	6	3	70	20	10	70	25	-	50	175

3. COURSE OBJECTIVE

Control system deals with the concepts of mathematical modelling of physical components and feedback systems. Advances in theory and practice of automatic control provide the means of attaining high performance of dynamic systems improving the productivity. Engineers will have good understanding and improve the logical thinking.

4. SKILL COMPETENCY

The aim of this course is to help the student to attain following competency through various teaching-learning experiences:

- **Determine transfer function and stability of the system**
- **Suggest the appropriate components and their controls for various applications.**

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

CO No.	COURSE OUTCOME	Bloom's Level
1.	Select appropriate type of system for given application.	**R, U**
2.	Determine response, transfer function and stability of the given system.	**R, U**
3.	Suggest the appropriate control system component and their control for given applications.	**R, U A**

6. COURSE CONTENTS

Sr. No.	Topic /Sub-Topics	Hours	Marks	COs
1	**Introduction to control systems** 1.1 Introduction to control systems 1.2 Definitions 1.3 Classification of control systems 1.4 Open loop & closed loop systems advantages and disadvantages 1.5 Real time applications of open loop and closed loop system 1.6 Feedback control & effects of feedback	10	11	CO1
2	**Transfer function & mathematical modeling of Systems** 2.1 Definition of Laplace transform, Differential Equations in time Domain using Laplace transforms 2.2 Concept of transfer function 2.3 Procedure for determining the transfer function of the control system 2.4 Poles, zeros, pole-zero plot and order of the transfer function 2.5 Mathematical modeling of physical, electrical, mechanical systems (only concept)	11	12	CO2
3	**First order systems:** 3.1 Step and impulse response 3.2 Time constant 3.3 Transient and steady state response **Second order system:** 3.4 Step response: Under damped, over damped and critically damped 3.5 Damping ratio, natural frequency, damped oscillation frequency, rise time, settling time, peak time, overshoot	11	12	CO2
4	**Block diagram Reduction** 4.1 Introduction 4.2 Representation of control system by block diagram 4.3 Rules for block diagram reduction 4.4 Procedure to solve block diagram reduction problems (simple problems) **Signal flow graphs** 4.5 Representation of control system by signal flow graphs 4.6 Rules for drawing signal flow graphs 4.7 Drawing signal flow graph from a given block diagram and vice-versa (simple problems)	12	13	CO2
5	**Stability Analysis** 5.1 Concept of Stability 5.2 Routh-Hurwitz stability criterion 5.3 Relative stability	10	11	CO2
6	**Control system components:** 6.1 A.C. & D.C. Servomotors 6.2 Potentiometer 6.3 BLDC motor and its control 6.4 Synchros 6.5 A.C. Position & D.C. Position servomechanism 6.6 Stepper motor	10	11	CO3
	TOTAL	64	70	

7. LIST OF PRACTICALS/ASSIGNMENTS/EXERCISES/TUTORIALS/DRAWINGS:

The term work consists of journal consisting of 10 experiments/assignments with approximate number of hours required with corresponding CO's:

Sr. No.	Title of Experiment/Assignment/Exercise/Tutorial/Drawings	Approx.Hrs required	COs
1	DC Motor Speed Control (Open Loop and Closed Loop)	4	CO1
2	Time domain analysis of First order RC circuit	2	CO2
3	Time domain analysis of First order CR circuit	2	CO2
4	Time domain analysis of First order RRC circuit	4	CO2
5	Comparison of RC and RRC circuits	4	CO2
6	Synchro Transmitter	4	CO3
7	Synchro pair as an error detector	4	CO3
8	Study of closed loop control of DC servomotor	2	CO3
9	Study of closed loop control of Permanent magnet BLDC motor	2	CO3
10	Study of stepper motor control	2	CO3
11	Assignment on Block diagram reduction	-	CO2
12	Assignment on signal flow graph	-	CO2
	Total	**32**	

8. IMPLEMENTATION STRATEGY(PLANNING)

1. Teaching Plan.
2. Assignments.
3. Industrial visit.
4. Guest/Expert lectures.
5. Continuous assessment.
6. Slides.
7. Any other method adopted.

9. LEARNING RESOURSES

Sr. no.	Title of Book	Author	Publications
1	Control System	U.A. Bakshi, V.U. Bakshi	Technical Publication
2	Control System Engineering	Norman S. Nise	Wiley India publication Co.
3	Mechatronics: Electronic control systems in mechanical and electrical engineering (Sixth Edition)	William Bolton	Pearson Education PVT. Ltd.
4	Control Systems	Ashfaq Husain, Haroon Ashfaq	Dhanpat Rai & Co.
5	Control Systems Engineering	I J Nagrath and M Gopal	New Age International

MAFATLAL POLYTECHNIC

10. WEB REFERENCES

1. www.nptel.com
2. www.swayam.com
3. www.youtube.com/channel/UCq0imsn84ShAe9PBOFnoIrg
4. https://ocw.mit.edu/

11. SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

Sr. No.	TOPIC	Distribution of Theory Marks			
		R Level	U Level	A Level	Total Marks
1	Introduction to control systems	4	4	3	11
2	Transfer function & mathematical modelling of Systems	3	3	6	12
3	First order systems	3	3	6	12
4	Block diagram Reduction & Signal flow graph	3	3	7	13
5	Stability Analysis	3	3	5	11
6	Control system components	5	3	3	11
Total		**21**	**19**	**30**	**70**

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

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

12. COURSE EXPERT COMMITTEE MEMBERS

SR.NO.		NAME	SIGNATURE
1	Internal	Miss. Urvi H. Sawant	
2	Internal	Mr. Dinesh G. Rajmandai	
3	Internal	Mrs. Ajayshree N. Kinhekar	
4	External	Dr. M.S.Narkhede	
		Organisation- Lecturer G.P Mumbai	

SHRI BHAI MAFATLAL POLYTECHNIC

Annexure:-I

Committees

I.1 Managing Council (MC)

Representatives of Shri Vile Parle Kelavani Mandal		Shri Amit Balwant Sheth, Chairman Shri Nayan Patel Shri Hiten V.Parekh Shri Asoke Basak Dr.Madhav N.Welling Dr.Sharad Mhaiskar Dr.D.J.Shah
Member, Industry Representative		Mr, Hemant Minocha , MD,Rajiv Plastics,Mumbai
Representatives of Government		
Representative of the State Government		Dr.Abhay Wagh Director, Directorate of Technical Education, Maharashtra State,
Representative of the Maharashtra State Board of Technical Education		Dr.Vinod Mohitkar Director, Maharashtra State Board of Tech.Education
Representative of Central Government		Shri P.N.Jumle Director, Board of Apprenticeship Training (W.R.)
Representative of the All India Council for Technical Education		Dr. Ajeet Singh, Regional Officer& Assistant Director,All India Council for Technical Education (Western Region)
Expert Members *nominated* by the State Government/AICTE		----------
Ex-Officio –Secretary-Principal		Dr.M.Z.Shaikh

I.2 Board of Studies (BOS)

Sr. No.	Name	Designation & Organisation	BOS Designation
1.	Dr.(Mrs) Shubha Pandit	Principal,K.J.Somaiya Engg.College,Mumbai	Chairman
2.	Dr.Vinod Mohitkar	Director, MSBTE	Member
3.	Dr. M.Z.Shaikh	Principal, S.B.M.Polytechnic	Member
4.	Mrs.Neeta Kadukar	Vice Principal and Head, Information Technology Department,SBM Polytechnic	Member
5.	Shri Dhirajkumar Pandirkar	Chief Engineer, MHADA, Mumbai	Member
6.	Shri B.R.Patel,	Director, Procem Consultant (Alumni), Mumbai	Member
7.	Dr. A.V.Bhonsale	Rtd. Principal, Vidyavardhini College of Engineering, Vasai	Member
8.	Shri Sunil Kangane,	Director, Invotech, (Alumni), Mumbai	Member
9.	Shri Ricky Uchil,	Vice President, Adani Electricity Mumbai	Member
10.	Shri Apurva Patel	Director, Exult Industries Ltd. Mumbai	Member
11.	Shri V.M.Joshi,	Adjunct Faculty. Swami Vivekananda Institute of Technology, Mumbai	Member
12.	Shri Paresh Haria,	General Manager PCS Technology, Mumbai	Member
13.	Shri Hemant Minocha	Managing Director, Rajiv Plastics, Mumbai	Member
14.	Prof.E.Narayanan	Ex-Faculty DJSCOE, Mumbai	Member
15.	Shri Ramesh Vulavala	Rtd, HOD DJSCOE, Mumbai	Member
16.	Dr.D.J.Shah	Ex-Principal SBMP	Member
17.	Shri Milind Kamat	General Manager, Toyo Engg. Ltd., Mumbai	Member
18.	Shri Harinder Salwan	Managing Director, Tircom Multimedia Pvt. Ltd. Mumbai	Member
19.	Shi Ashih Tapiawala	Trainer, Vibrant Bootcamp, (Alumni) Mumbai	Member
20.	Shri Ashok Mehta	Ex-Principal SBM Polytechnic	Invitee

I.3 Programme wise committee (PBOS)

Sr.No	Name & Office address	PBOS Designation
1.	Shri Ricky Uchil Adani Electricity Mumbai Ltd, Vice-president	Chairman
2.	Dr. Y S Rao , I/C Principal , SPIT	Expert Members
3.	Shri Apurva Patel, Director, Exalt Engineering Industries, Andheri	Industry Member
4.	Shri A K Dhulshettte,, G P Mumbai	Expert Member
5.	Dr. Zafar Shaikh, S B M Polytechnic	Principal
6.	Mrs. Neeta Kadukar, S B M Polytechnic	Vice Principal
7.	Shri Pravin Sanghavi, Prop.Sanghavi Enterprises,	Alumni Member
8.	Shri A K Dhulshettte,, G P Mumbai	Invitee
9.	Shri L.B. Deshpande, S B M Polytechnic	Secretary CDC
10.	Shri S. T. Khelkar, S B M Polytechnic	Controller of Examination
11.	G J Badwe , S B M Polytechnic	Training and Placement officer
12.	Mrs. A. N. Kinhekar, S B M Polytechnic	Member
13.	Ms Urvi Sawant, S B M Polytechnic	Member
14.	Shri.D.G.Rajmandai, S B M Polytechnic	Member
15.	Shri N D Adate, S B M Polytechnic	Convener

21.	Shri Vinod B.Vanvari,	Head, Civil Engg.Dept. SBM Polytechnic	Member
22.	ShriA.K.Chore	Head, Mechanical Engg.Deptt. SBM Polytechnic	Member
23.	Shri N.D.Adate	I/c. Head, Electrical Engg.Deptt. SBM Polytechnic	Member
24.	Mrs.A.A.Kulkarni	Head, Electronics Deptt. SBM Polytechnic	Member
25.	Shri D.M.Karad	Head, Plastics Engg.Deptt. SBM Polytechnic	Member
26.	Shri R.D.Shimpi	Head, Chemical Engg. Deptt. SBM Polytechnic	Member
27.	Shri J.S.Kulkarni	Head, Computer Engg.Deptt. SBM Polytechnic	Member
28.	Shri Abhijit Dongaonkar	Lecturer, IT SBM Polytechnic	Member
29.	Shri S.T.Khelkar	Controller of Exam. SBM Polytechnic	Member
30.	Shri Gajanan Badwe	Lecturer, Mechanical (TPO) SBM Polytechnic	Member
31.	Shri L.B.Deshpnade	Lecturer, Electronics SBM Polytechnic	Convenor

I.4 PROGRAMME CURRICULUM DEVELOPMENT COMMITTEE

Institute Level Curriculum Development Cell

Sr. No.	Name of the Faculty	Designation
1	Dr. M.Z.Shaikh,Principal	Chairman
2	Mrs. Neeta Kadukar, Vice-Principal and Head, IT Dept.	Member
3	Shri V.B.Vanvari, Head, Civil Engg.Dept.	Member
4	Shri A.K.Chore, Head, Mechanical Engg.Dept.	Member
5	Shri N.D.Adate,I/C Head, Electrical Engg.Dept.	Member
6	Mrs. A.A.Kulkarni, Head, Industrial and Digital Elex.Dept.	Member
7	Shri D.M.Karad, Head, Plastics Engg.Dept.	Member
8	Shri R.D.Shimpi, Head, Chemical Engg.Dept.	Member
9	Shri J.S.Kulkarni, Head, Computer Engg.Dept.	Member
10	Shri A.B.Dongaonkar, Lecturer, IT Dept.	Member
11	Mrs.K.P.Bhave,Lecturer,Chemistry Dept.	Member
12	Shri G.J.Badwe,Training and Placement Officer	Member
13	Shri S.T.Khelkar,Controller of Examinations	Member
14	Shri L.B.Deshpande,Lecturer,Electronics Dept.	Member Secretary

DEPARTMENT LEVEL COMMITTEE (DEPARTMENT CO-ORDINATORS)

Sr. No.	Name of the Faculty	Designation
1	Shri S. N. Ranshur	Lecturer, Civil Engineering
2	Shri A. S. Shukla	Lecturer, Mechanical Engineering
3	Shri D. G. Rajmandai	Lecturer, Electrical Engineering
4	Ms. P. J. Nikhade	Lecturer, Industrial/Digital Electronics
6	Shri S. A. Kamble	Lecturer, Plastics Engineering
5	Shri M. M. Belwalkar	Lecturer, Chemical Engineering
7	Shri P. H. Shah	Lecturer, Computer Engineering
8	Shri P. D. Rathod	Lecturer, Information Technology

Course-wise Curriculum Development Committee - SCHEME 2019

Department of ELECTRICL ENGINEERING

SEMESTER I

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	(BMT 190002)	Basic Mathematics	K K Dange	R R Ambade	U J Patel	Meena Gawas
2	(APH 190010)	Applied Physics	G R Waghmare	S S Salve	L B Deshpande	M J Jaiswal
3	(EVS190003)	Environmental Studies	S V Suvarna	K P Bhave	R D Shimpi	Dr.S Unni
4	(CMS 190011)	Communication skills	B M Pande	A A Kulkarni	K P Bhave	Archana Lalla
5	(EDG 190007)	Engineering Drawing	N M Pathak	N M Patil	P R Parate	Chirag Kachaliya
6	(DCF 190301)	DC Circuits Fundamentals	D G Rajmandai	U H Sawant	N D Adate	Pragati Samudre

SEMESTER II

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	(EMT 190009)	Engineering Mathematics	K K Dange	R R Ambade	U J Patel	Meena Gawas
2	(ACH190002)	Applied Chemistry	S V Suvarna	K P Bhave	R D Shimpi	Dr.S Unni
3	(DLS 190004)	Development of Life skills	B M Pande	A A Kulkarni	K P Bhave	Archana Lalla
4	(BEX 190302)	Basic Electronics	S S Rakade	P S Dhuri	N D Adate	Vivek Dhadam
5	(EMA 190303)	Electrical Materials & Appliances	N D Adate	A N Kinhekar	S G Borse	Sheeja Nair
6	(ACF190304)	AC Circuits Fundamentals	D G Rajmandai	U H Sawant	N D Adate	Sheeja Nair
7	(WPE190305)	Workshop Practice (EE)	N D Adate	A N Kinhekar	S G Borse	Vivek Dhadam

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SEMESTER III

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	(AMT190013)	Applied Mathematics	K K Dange	R R Ambade	U J Patel	Meena Gawas
2	(ECN190306)	Electrical Circuits and Networks	D G Rajmandai	U H Sawant	Vivek Dhadam	Deepak Kajrolkar
3	(EPG 190307)	Electrical Power Generation	U H Sawant	D G Rajmandai	N D Adate	Sheeja Nair
4	(ETD190308)	Electrical Transmission and Distribution	A N Kinhekar	D G Rajmandai	N D Adate	A K Dhulshette
5	(TIM190309)	Transformer and Induction Motors	N D Adate	A N Kinhekar	U H Sawant	A K Dhulshette
6	(DEX190310)	Digital Electronics	P J Nikhade	N D Adate	A A Kulkarni	A K Dhulshette
7	(CPR190019)	'C' Programming	A A Kulkarni	S S Rokade	J S Kulkarni	Umang Patel

SEMESTER IV

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	(EEM190311)	Electrical & Electronics Measurements	N D Adate	U H Sawant	A N Kinhekar	Deepak Kajrolkar
2	(DSM190312)	DC & Synchronous Machines	D G Rajmandai	N D Adate	Vivek Dhadam	A K Dhulshette
3	(SGP190313)	# Switchgears & Protection	A N Kinhekar	N D Adate	U H Sawant	Sheeja Nair
4	(EEC190314)	# Electrical Estimation & Costing	A N Kinhekar	N D Adate	U H Sawant	Sheeja Nair
5		**Elective-I**				
5.1	(UEE190315)	Utilisation of Electrical Energy	U H Sawant	D G Rajmandai	A N Kinhekar	Sheeja Nair
5.2	(RES 190316)	Renewable Energy Sources	U H Sawant	D G Rajmandai	N D Adate	Sheeja Nair
6	(EDP 190017)	Entrepreneurship Development	A S Shukla	Sachin Kamble	P P Sawant	Sanjay Deshmukh
7	(STM 190012)	Stress Management	N M Pathak	R D Shimpi	S A Kamble	Chirag Kachaliya

SEMESTER V

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	(IPT190324)	Inplant Training	N D Adate	A N Kinhekar	D G Rajmandai	Ricky Uchil

SEMESTER VI

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MUMBAI 400 056.

Sr. No	Course Code	Course Name	Course Expert Committee Member Internal			Course Expert External
1	(IMG 190014)	# Industrial Management	A S Shukla	G J Badwe	P P Sawant	Mangesh Mohan
2	(PEX 190317)	# Power Electronics	N D Adate	A N Kinhekar	P J Nikhade	Deepak Kajrolkar
3	(PRJ 190318)	# Project	N D Adate	A N Kinhekar	D G Rajmandai	Sandeep Dalvi
4	(ETM 190319)	# Electrical Testing & Maintenance	D G Rajmandai	N D Adate	U H Sawant	A K Dhulshette
5	**# Elective –II (Any one)**					
5.1	(TDR 190320)	Traction & Drives	U H Sawant	D G Rajmandai	A N Kinhekar	Sheeja Nair
5.2	(INA190321)	Industrial Automation	N D Adate	U H Sawant	A N Kinhekar	Deepak Kajrolkar
6	(INI 190322)	Industrial Instrumentation	Dr. M Z Shaikh	A N Kinhekar	N D Adate	Kishore Dawane
7	(PCS 190323)	Principles of Control System	U H Sawant	D G Rajmandai	A N Kinhekar	Dr. M S Narkhede

Rajmandai

CDC Co-Ordinator

(Department)

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC ★ MUMBAI 400 056.

Head of the Department

Certificate

The curriculum of the **Electrical Engineering** has been modified in the year 2019, as per the provisions made in the curriculum development process of Shri Bhagubhai Mafatlal Polytechnic, Mumbai.

This is the **outcome based Curriculum of Diploma in Electrical Engineering programme,** which shall be implemented from academic year 2019-20

Verified by

Department Level CDC Representative

S.B.M.Polytechnic, Mumbai.

Head of Department

Electrical Engineering

S.B.M.Polytechnic, Mumbai.

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC ★ MUMBAI 400 056.

Incharge, Curriculum Development Cell

S.B.M.Polytechnic, Mumbai.

Principal

S.B.M.Polytechnic, Mumbai.

PRINCIPAL
Shri Bhagubhai Mafatlal Polytechnic
Vile-Parle (W), Mumbai - 400 056.

CERTIFICATE OF BENCHMARKING OF CURRICULUM

adani Electricity

Date: 20.08.2021

This is to certify that the curriculum of Electrical Engineering at S.B.M. Polytechnic is in line with the industrial requirements.

The syllabus of scheme 2019 is well designed incorporating core engineering applications, emerging technologies and basic management skills.

The implant training conducted in the 5th semester provides a clear understanding about industry standards and different products and processes.

Emerging courses like Electrical Estimation and Costing, Testing and Maintenance, Traction and Drives, Renewable Energy etc. are much relevant to the power sector industry are included in the curriculum.

Further, the practice of reviewing the outcome-based curriculum frequently ensures that the course keeps pace with the industry's changing needs.

For Adani Electricity Mumbai Limited,

Ricky Uchil

Vice – President

DSM and EE

Mobile : 9323552981

Email: ricky.uchil@adani.com

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC ★ MUMBAI 400 056.

INDUSTRIAL SWITCHGEAR & CONTROLS (BOMBAY) Pvt. Ltd.

Date : 15/11/2021

Ref : CURRICULM REVISION AT SBM POLYTECHNIC

CERTIFICATE

THIS IS TO CERTIFY THAT THE CURRICULUM-2019 OF ELECTRICAL ENGINEERING DEPARTMENT AT SHRI BHAGUBHAI MAFATLAL POLYTECHNIC IS IN LINE WITH THE CURRENT REQUIREMENT OF INDUSTRY

WE ALSO CONFIRM THAT THE INDUSTRIAL TRAINING FOR 24 WEEKS (6 MONTHS) FOR EVERY STUDENT GIVES APPROPRIATE EXPOSURE TO CURRENT INDUSTRIAL REQUIREMENT/STANDARDS/PRODUCRS/PRECESS

WE ASSURE TO BE ASSOCIATED WITH SHRI BHABUBHAI MAFATLAL POLYTECHNIC FOR UPDATING THE SYLLABUS AS PER THE NORMS FROM TIME TO TIME

For INDUSRTIAL SWITCHGEAR & CONTROL (BOM) PVT. LTD.

INDUSTRIAL SWITCHGEAR & CONTROLS (BOM) PVT. LTD. VASAI 401 208

B A CHHEDA

DIRECTOR (SEAL)

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC MUMBAI 400 056.

Kristron Controls & Systems Pvt. Ltd.

Office & Factory Address: [illegible]
[illegible]
Phone: [illegible] Fax: [illegible] E-mail: [illegible]

Manufacturers of:

[illegible]

WHOMSOEVER IT MAY CONCERN

Date: 19/11/2021

This is to certify that the curriculum of Electrical Engineering at S.B.M. Polytechnic is in the line with the industrial requirements.

The syllabus of scheme 2019 is well designed incorporating core Engineering applications. Emerging technologies and basic management skills.

The implant training conducted in 5th semester gives the clear understanding about the industry standards and different products and processes.

Emerging sources like Electrical Estimation and Costing, Industrial Automation, Renewable Energy Sources, etc. are much relevant to the power sector industry.

Further the practice of reviving the curriculum frequently which enables the course to keep the pace with the industry and industrial revolution 4.0 requirements.

Looking forward to successful association.

For Kristron Controls & Systems Pvt. Ltd.

For Kristron Controls & Systems Pvt. Ltd.

Director

Mr. Rushabh Kothari

Director

Regd. Office: [illegible]
CIN No: [illegible]

SHRI BHAGUBHAI MAFATLAL POLYTECHNIC
MUMBAI 400 056.

PROGRAMME - ELECTRICAL ENGINEERING

MAPPING MATRIX OF PO'S, PSO's AND CO'S:

- **CO numbering scheme -**
- **First year – start from 101**
- **Second year – start from 201**
- **Third year – start from 301**

Semester - I

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Basic Mathematics (BMT190001)	C101.1	3	1	1	-	1	-	2	-	1
	C1O1.2	3	2	2	2	1	2	2	1	1
	C1O1.3	3	1	1	-	1	-	2	1	1
	C1O1.4	3	1	-	-	1	2	2	-	1
	Avg - C101	**3.00**	**1.25**	**1.33**	**2.00**	**1.00**	**2.00**	**2.00**	**1.00**	**1.00**

3: High Relationship, 2: Medium Relationship, 1: Low Relationship.

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Applied Physics (APH 190010)	C102.1	3	2	1	1	1	2	1	2	2
	C102.2	3	2	2	2	1	2	1	2	2
	C102.3	3	2	3	2	2	2	1	1	1
	C102.4	3	2	3	2	2	2	1	1	1
	Avg- C102	**3.00**	**2.00**	**2.25**	**1.75**	**1.50**	**2.00**	**1.00**	**1.50**	**1.50**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Environmental Studies (EVS 190003)	C103.1	-	-	1	-	2	-	1	-	-
	C103.2	-	-	1	-	2	-	1	-	-
	C103.3	-	-	1	-	2	-	1	1	2
	C103.4	-	-	2	-	2	-	1	2	2
	C103.5	-	-	3	-	2	-	1	1	2
	AVG-C103	-	-	**1.60**	-	**2.00**	-	**1.00**	**1.33**	**2.00**

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Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Communication Skills (CMS 190011)	C104.1	1	2	2	-	2	3	1	-	-
	C104.2	-	1	1	1	1	3	1	1	1
	C104.3	2	1	1	-	-	3	1	-	-
	C104.4	-	1	1	1	1	3	1	1	1
	Avg.-C104	**1.50**	**1.25**	**1.25**	**1.00**	**1.33**	**3.00**	**1.00**	**1.00**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Engineering Drawing (EDG 190007)	C105.1	3	2	3	1	-	-	1	2	3
	C105.2	3	2	3	1	-	-	1	2	3
	C105.3	3	2	3	1	-	-	1	2	3
	C105.4	3	2	3	1	-	-	1	2	3
	C105.5	3	2	3	1	-	-	2	2	3
	Avg –C105	**3.00**	**2.00**	**3.00**	**1.00**	**-**	**-**	**1.2**	**2.00**	**3.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
DC Circuits Fundamentals (DCF 190301)	C106.1	2	3	1	1	-	-	1	2	2
	C106.2	2	3	1	1	-	-	1	2	2
	C106.3	2	3	1	1	-	-	1	2	2
	C106.4	2	3	1	-	-	-	1	2	2
	C106.5	2	3	1	-	-	-	1	2	2
	Avg-C106	**2.00**	**3.00**	**1.00**	**1.00**	**-**	**-**	**1.00**	**2.00**	**2.00**

Semester - II

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Engineering Mathematics (EMT 190009)	C107.1	3	2	2	1	1	1	2	2	2
	C107.2	3	-	1	1	1	1	2	2	2
	C107.3	3	1	1	1	1	1	2	1	1
	C107.4	3	2	2	2	1	2	2	1	1
	Avg.-C107	**3.00**	**1.67**	**1.50**	**1.25**	**1.00**	**1.25**	**2.00**	**1.50**	**1.50**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Applied Chemistry (ACH 190002)	C108.1	3	-	1	-	-	-	-	-	
	C108.2	3	1	2	1		-	-	-	1
	C108.3	3	1	2	1	2	-	1	-	1
	C108.4	2	1	1	-	2	-	1	-	1
	C108.5	2	-	-	-	1	-	-	-	-
	AVG-C108	**2.60**	**1.00**	**1.50**	**1.00**	**1.67**	**-**	**1.00**	**-**	**1.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Development of Life Skills (DLS 190004)	C109.1	-	-	1	-	2	3	1	-	-
	C109.2	1	1	1	1	1	3	2	1	1
	C109.3	1	2	2	1	2	3	2	1	1
	C109.4	-	-	1	-	2	3	2	1	1
	Avg.-C109	**1.00**	**1.50**	**1.25**	**1.00**	**1.75**	**3.00**	**1.75**	**1.00**	**1.00**

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Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Basic Electronics (BEX 190302)	C110.1	3	-	1		-	-	-	1	1
	C110.2	2	2	-	-	-	-	2	1	1
	C110.3	2	2	2	2	-	-	-	1	2
	C110.4	1	2	2	2	-	-	-	1	1
	C110.5	-	2	3	3	-	2	1	1	1
	Avg-C110	**2.00**	**2.00**	**2.00**	**2.33**	**-**	**2.00**	**1.50**	**1.00**	**1.20**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical Materials & Appliances (EMA 190303)	C111.1	3	-	2	-	1	1	1	1	1
	C111.2	3	-	2	-	-	1	-	1	1
	C111.3	2	3	2	-	2	1	1	3	3
	C111.4	1	3	2	-	1	1		3	1
	C111.5	1	3	2	-	2	1	1	3	3
	Avg.-C111	**2.00**	**3.00**	**2.00**	**-**	**1.50**	**1.00**	**1.00**	**2.20**	**1.80**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
AC Circuits Fundamentals (ACF 190304)	C112.1	3	1	-	1	-	-	-	2	2
	C112.2	2	1	3	-	-	-	-	2	2
	C112.3	2	1	3	-	-	-	-	2	2
	C112.4	2	3	-	1	-	-	-	1	1
	C112.5	3	1	2	-	-	-	-	2	2
	Avg.-C112	**2.40**	**1.40**	**2.67**	**1.00**	**-**	**-**	**-**	**1.80**	**1.80**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Workshop Practice(EE) (WPE 190305)	C113.1	1	-	-	3	2	-	-	2	1
	C113.2	2	1	-	3	-	-	-	3	-
	C113.3	1	-	2	-	-	-	3	2	1
	C113.4	1	-	2	3	-	2	2	2	2
	C113.5	1	1	3	-	2	2	2	2	1
	Avg.-C113	**1.20**	**1.00**	**2.33**	**3.00**	**2.00**	**2.00**	**2.33**	**2.20**	**1.25**

Semester-III

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Applied Mathematics (AMT 190013)	C201.1	3	3	3	2	1	2	2	2	2
	C201.2	3	3	3	2	2	2	2	2	2
	C201.3	3	3	3	2	1	1	2	2	2
	C201.4	3	3	3	2	1	2	2	1	1
	AVG-C201	**3.00**	**3.00**	**3.00**	**2.00**	**1.25**	**1.75**	**2.00**	**1.75**	**1.75**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical Circuits and Networks (ECN 190306)	C202.1	3	2	1	2	-	-	-	2	2
	C202.2	1	3	2	1	-	-	-	2	2
	C202.3	3	2	1	1	-	-	-	2	2
	C202.4	1	3	2	1	-	-	-	2	2
	Avg-C202	**2.00**	**2.50**	**1.50**	**1.25**	**-**	**-**	**-**	**2.00**	**2.00**

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Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical Power Generation (EPG 190307)	C203.1	2	-	-	-	3	-	1	1	1
	C203.2	2	1	-	-	3	-	1	2	2
	C203.3	2	2	-	-	3	-	1	2	2
	C203.4	2	2	-	-	3	-	1	1	3
	Avg-C203	**2.00**	**1.67**	**-**	**-**	**3.00**	**-**	**1.00**	**1.50**	**2.00**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical Transmission and Distribution (ETD 190308)	C204.1	3	-	-	-	-	1	2	2	1
	C204.2	3	-	-	-	-	2	1	2	2
	C204.3	3	-	2	-	-	-	1	2	2
	C204.4	1	2	-	3	-	-	-	2	2
	C204.5	1	-	-	-	2	3	-	1	1
	Avg.-C204	**2.20**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**	**1.33**	**1.80**	**1.60**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Transformer and Induction Motors (TIM 190309)	C205.1	3	-	-	-	2	-	1	2	2
	C205.2	2	1	-	3	2	-	-	2	3
	C205.3	2	1	-	3	-	-	-	2	3
	C205.4	2	1	-	3	-	-	-	3	3
	C205.5	2	-	3	2	1	-	1	3	3
	Avg.- C205	**2.20**	**1.00**	**3.00**	**2.75**	**1.67**	**-**	**1.00**	**2.40**	**2.80**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Digital Electronics (DEX 190310)	C206.1	3	2	2	-	-	2	1	2	2
	C206.2	3	2	2	-	-	2	1	1	1
	C206.3	3	2	2	-	-	2	1	1	1
	C206.4	3	2	2	-	-	2	1	2	2
	C206.5	3	2	2	-	-	2	1	-	-
	AVG-C206	**3.00**	**2.25**	**2.00**	**1.00**	**1.00**	**1.33**	**2.00**	**1.75**	**1.75**

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
C Programming (CPR 190019)	C207.1	3	2	2	-	-	2	1	1	1
	C207.2	3	2	2	-	-	2	1	1	1
	C207.3	3	2	2	-	-	2	1	1	1
	C207.4	3	2	2	-	-	2	1	1	1
	C207.5	3	2	2	-	-	2	1	1	1
	AVG-C207	**3.00**	**2.00**	**2.00**	**-**	**-**	**2.00**	**1.00**	**1.00**	**1.00**

Semester-IV

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical & Electronics Measurements (EEM 190311)	C208.1	2	-	1	3	-	-	-	3	1
	C208.2	3	2	-	1	-	-	2	1	2
	C208.3	2	2	-	3	-	-	2	2	2
	C208.4	2	-	2	3	1	-	2	2	2
	C208.5	2	1	-	1	3	-	2	3	2
	AVG-C208	**2.20**	**1.67**	**1.50**	**2.20**	**2.00**	**-**	**2.00**	**2.20**	**1.80**

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Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
DC & Synchronous Machines (DSM 190312)	C209.1	3	1	1	2	-	-	-	2	2
	C209.2	1	2	3	1	-	-	-	2	2
	C209.3	1	1	2	3	1	-	-	3	3
	C209.4	1	1	2	3	1	-	-	3	3
	AVG-C209	1.50	1.25	2.00	2.25	1.00	-	-	2.50	2.50

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Switchgears & Protection (SGP 190313)	C210.1	2	-	3	2	1	2	-	2	2
	C210.2	2	1	3	2	1	2	1	3	2
	C210.3	2	-	3	2	-	2	1	3	2
	C210.4	2	-	-	-	-	2	1	2	1
	AVG-C210	2.00	1.00	3.00	2.00	1.00	2.00	1.00	2.50	1.75

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical Estimation & Costing (EEC 190314)	C211.1	1	-	-	2	2	3	1	2	2
	C211.2	3	-	3	-	2	2	1	2	2
	C211.3	1	-	3	2	2	2	1	2	3
	C211.4	1	-	3	-	1	3	2	2	3
	C211.5	-	1	2	2	1	2	2	2	3
	AVG-C211	1.50	1.00	2.75	2.00	1.60	2.40	1.40	2.00	2.60

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Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Utilisation of Electrical Energy (UEE 190315)	C212.1	2	2	3	1	1	-	1	2	3
	C212.2	2	2	3	1	1	-	1	2	3
	C212.3	2	3	2	-	2	1	1	2	3
	C212.4	2	3	2	1	1	-	1	2	3
	C212.5	2	3	2	1	2	1	1	2	3
	AVG-C212	**2.00**	**2.60**	**2.40**	**1.00**	**1.40**	**1.00**	**1.00**	**2.00**	**3.00**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Renewable Energy Sources (RES 190316)	C213.1	2	1	-	-	3	-	1	1	2
	C213.2	2	-	2	-	3	-	1	1	2
	C213.3	2	-	2	-	3	-	1	1	2
	C213.4	2	-	2	-	3	-	1	1	2
	C213.5	2	-	2	-	3	-	1	1	2
	AVG-C213	**2.00**	**1.00**	**2.00**	**-**	**3.00**	**-**	**1.00**	**1.00**	**2.00**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Entrepreneurship Development (EDP 190017)	C214.1	2	-	-	-	-	-	-	1	1
	C214.2	-	-	2	-	-	-	-	1	1
	C214.3	2	2	-	-	-	2	1	1	1
	C214.4	-	2	-	-	-	3	-	1	1
	C214.5	-	2	3	-	2	-	-	1	1
	C214.6	-	2	-	-	3	-	1	1	1
	AVG-C214	**2.00**	**2.00**	**2.50**	**-**	**2.50**	**2.50**	**1.00**	**2.00**	**2.83**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Stress Management (STM 190012)	C215.1	1	2	1	1	1	1	-	2	2
	C215.2	1	2	2	1	-	-	-	1	1
	C215.3	-	-	2	3	3	3	3	2	2
	C215.4	-	-	2	2	2	2	3	3	3
	AVG-C215	**1.00**	**2.00**	**1.75**	**1.75**	**2.00**	**2.00**	**3.00**	**2.00**	**2.00**

Semester-V

Course and Code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Inplant Training (IPT190324)	C301.1	1	-	-	-	3	-	2	2	2
	C301.2	3	-	2	-	2	-	-	3	2
	C301.3	2	-	1	-	-	3	2	2	3
	C301.4	1	-	2	-	3		2	3	1
	C301.5	2	2	2	2	-	3	1	3	1
	C301.6	2	2	3	1	1	1	-	3	2
	AVG-C301	**1.83**	**2.00**	**2.00**	**1.50**	**2.25**	**2.33**	**1.75**	**2.67**	**2.67**

Semester-VI

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Industrial Management (IMG 190014)	C302.1	1	2	2	1	2	-	-	2	2
	C302.2	-		2	2	3	-	3	2	2
	C302.3	1	1	2	-	1	-	1	2	2
	C302.4	2	-	2	-	1	-	3	2	2
	C302.5	1	-	2	1	2	-	2	2	2
	AVG-C302	**1.25**	**1.50**	**2.00**	**1.33**	**1.80**	**-**	**2.25**	**2.00**	**2.00**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Power Electronics (PEX 190317)	C303.1	3	-	1	-	2	-	1	2	2
	C303.2	2	-	3	-	1	-	1	2	2
	C303.3	2	1	-	-	3	1	1	2	2
	C303.4	1	-	3	-	-	2	1	3	3
	C303.5	1	2	-	3	-	2	1	2	2
	AVG-C303	**1.80**	**1.50**	**2.33**	**3.00**	**2.00**	**1.67**	**1.00**	**2.20**	**2.20**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Project (PRJ 190318)	C304.1	1	3	2	-	2	-	-	3	3
	C304.2	2	1	-	-	-	3	-	3	3
	C304.3	-	3	-	2	-	-	-	3	3
	C304.4	1	2	-	-	-	3	2	3	3
	C304.5	-	-	3	-	-	-	2	3	3
	AVG-C304	**1.33**	**2.25**	**2.50**	**2.00**	**2.00**	**3.00**	**2.00**	**3.00**	**3.00**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Electrical Testing & Maintenance (ETM 190319)	C305.1	1	-	-	-	3	-	2	3	3
	C305.2	1	2	2	3	-	-	-	3	3
	C305.3	1	2	2	3	1	-	-	3	3
	C305.4	-	2	1	3	-	-	-	3	3
	AVG-C305	**1.00**	**2.00**	**1.67**	**3.00**	**2.00**	**-**	**2.00**	**3.00**	**3.00**

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Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Traction & Drives (TDR 190320)	C306.1	1	2	3	1	2	-	1	2	3
	C306.2	1	3	2	-	1	-	1	2	3
	C306.3	1	2	3	1	2	-	1	2	3
	C306.4	1	2	3	1	2	-	1	2	3
	C306.5	1	2	3	1	2	-	1	2	3
	AVG-C306	**1.00**	**2.20**	**2.80**	**1.00**	**1.80**	**-**	**1.00**	**2.00**	**3.00**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Industrial Automation (INA 190321)	C307.1	2	2	2	2	2	2	2	2	2
	C307.2	2	3	3	2	2	1	1	2	2
	C307.3	2	2	3	1	1	1	-	3	3
	C307.4	2	2	2	2	2	2	-	2	2
	C307.5	3	3	3	2	2	2	1	3	3
	AVG-C307	**2.20**	**2.40**	**2.60**	**1.80**	**1.80**	**1.60**	**1.33**	**2.40**	**2.40**

Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Industrial Instrumentation (INI 190322)	C308.1	1	2	-	3		2	-	2	2
	C607.2	2	2	2	2	2	3	-	3	3
	C308.3	2	2	3	2	-	3	2	3	3
	C308.4	2	2	2	2	-	2	-	2	2
	C308.5	3	2	2	2	2	1	2	3	3
	AVG-C308	**2.00**	**2.00**	**2.25**	**2.20**	**2.00**	**2.20**	**2.00**	**2.60**	**2.60**

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Name of the Course & Course code	Course Outcomes	Programme Outcomes							Programme Specific Outcomes	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2
Principles of Control Systems	C309.1	1	2	3	-	1	-	1	1	2
	C309.2	1	3	2	-	1	-	1	1	2
	C309.3	1	3	2	-	1		1	1	2
(PCS 190323)	**AVG-C309**	**1.00**	**2.67**	**2.33**	**-**	**1.00**	**-**	**1.00**	**1.00**	**2.00**