Programme : Diploma in CE/EE/ET/ ME/MT/CM/IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : English
Course Code : HU 161

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	20	80	--	--	25

Course Rationale:

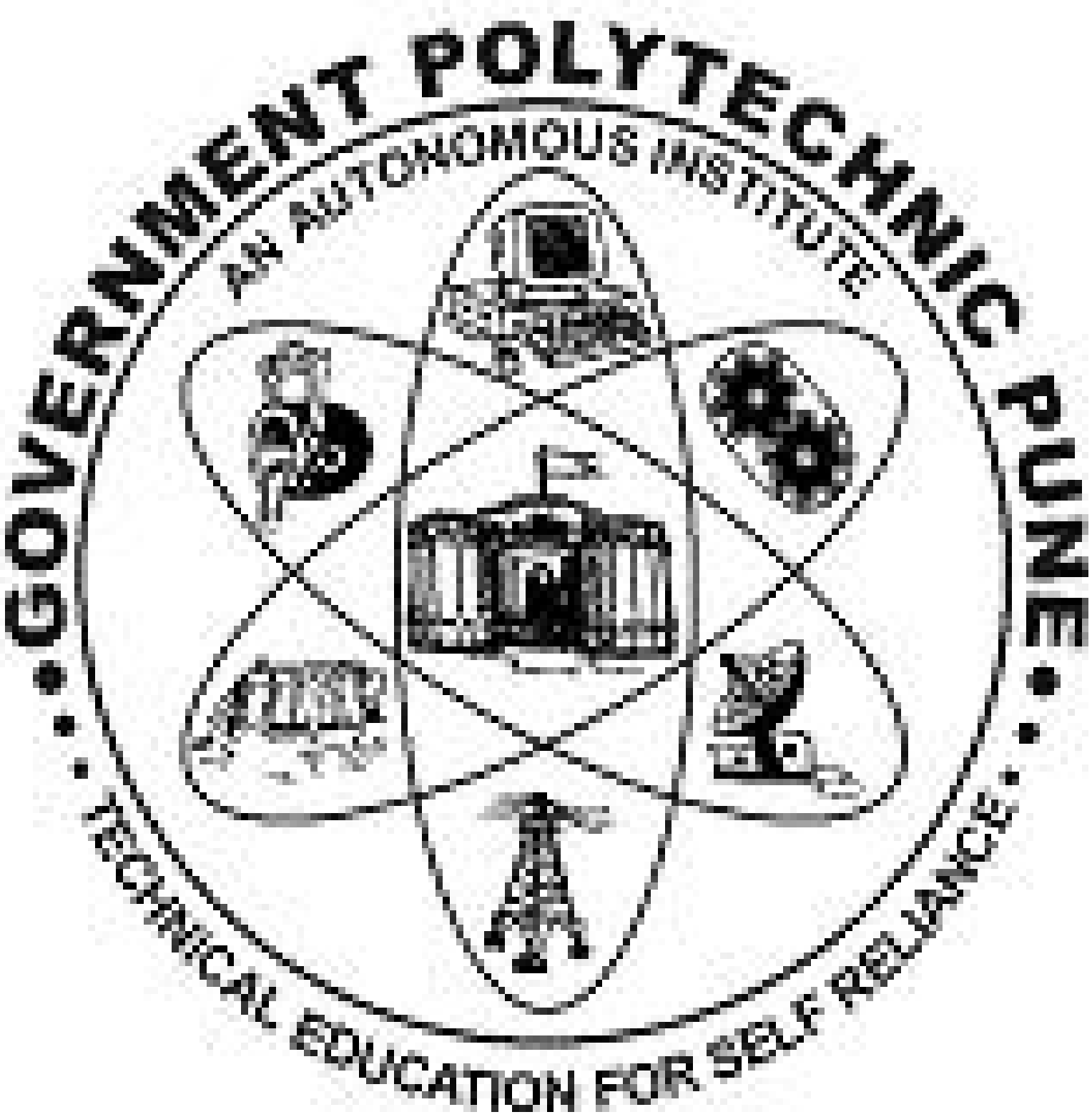
This is been noticed that diploma pass outs lack in grammatically correct written and oral communication in English. It is also been noticed that communication is not a problem of students, communication in correct English is the basic problem of diploma pass outs. Students will have to interact in this language so far as their career in industry is concerned. In order to enhance this ability in students English is introduced as a subject to groom their personality.

Course Objectives:

After studying this course, the student will be able to

Comprehend the given passage.
Answer correctly the questions on seen and unseen passages.
Increase the vocabulary.
Apply rules of grammar for correct writing.
Speak correct English.

Course Content:



List of Practicals/Experiments/Assignments:

The term work will consist of 10 assignments.

Instructional Strategy:

Text Books:

Reference Books:

Sr. No	Author	Title	Publication
1.	J.D.O. Connors	Better English Pronunciation	London Cambridge University Press ELBS
2.	Geofrey Leech	A Communicative Grammar of English	Essex Longman Group Ltd.: ELBS
3.	Randolf Quirk	University Grammar of English	Essex Longman Group Ltd.: ELBS
4.	--	Spectrum- A Text Book on English (To be referred by students to improve comprehension ability)	MSBTE

Learning Resources:

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	PART I: GRAMMAR	--	10	10	20
2.	PART II: PARAGRAPH WRITING	--	05	05	10
3.	PART III: PHONETICS	--	--	10	10
4.	PART IV: COMPREHENSION OF TEXT	--	30	10	40
	Total	--	**45**	**35**	**80**

(Prof. M.A. Surdikar)	(Prof. S. B. Kulkarni)	(Prof.D.A.Katare)
Prepared By	**Secretary, PBOS**	**Chairman, PBOS**

Programme	**:**	**Diploma in CE/EE/ET/ MT/CM/IT**
Programme Code	**:**	**01/02/03/05/06/07/15/16/17/19**
Name of Course	**:**	**Communication Skills**
Course Code	**:**	**HU162**

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	**Practical**	**Oral**	**Term work**
Duration	Two Class Tests each of 60 Minutes + One Oral Compulsory	**03 Hrs.**	--	--	--
Marks	**20**	**80**	--	--	**25**

Course Rationale:

Classified under human sciences this subject is intended to introduce students with the process of communication so that they can identify conditions favourable to effective communication. They will also be taught basic and applied language skills viz. listening, speaking, reading and writing – all useful for the study of a technical course and communication. Specifically, writing and oral presentation skills are two top ranking capabilities needed for professional careers and must be developed systematically.

Course Objectives:

After studying this course, the student will be able to

Understand and use the basic concepts of communication and principles of effective communication in an organized set up and social context.

Give a positive feedback in various situations to use appropriate body language & to avoid barriers for effective communication.

Write the various types of letters, reports and office drafting with the appropriate format.
Communicate with the Industry Professionals.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Basic Concepts And Principles Of Communication**		
	1.1 **The Communication Event** The communication event : Definition The elements of communication: the sender, receiver, message, channel, feedback and context. 1.2 **The communication Process** The Communication process: definition Stages in the process: defining the context, knowing the audience, designing the message, encoding, selecting proper channels, transmitting, receiving, decoding and giving feedback. 1.3 **Principles of Effective communication** Effective Communication: definition Communication Barriers and how to overcome them at each stage of communication process. Developing effective message: thinking about purpose, knowing the audience, structuring the message, selecting proper channels, minimizing barriers and facilitating feedback.	**12**	**24**
2.	**Organizational Communication**		
	2.1 What is an organization? Goal, structure, hierarchy. Patterns of communication: Upward, Downward, Horizontal and Grapevine	**04**	**12**
3.	**Non-verbal Communication**		
	3.1 Non Verbal Codes: Kinesics (eye- contact, gestures, Postures, body movements and facial expressions) Proxemics (using space), Haptics (touch), Vocalics (aspects of speech like tone, emphasis, volume, pauses etc.) Physical Appearance, Chronemics (manipulating time), Silence.	**06**	**12**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Self Introduction	02
2.	Elocution	04
3.	Extempore	04
4.	Mock Interview	04
5.	Debate	02
6.	Variety Applications/Reports.	02
7.	Writing Paragraphs on Technical Subjects	02
8.	Business letters	02
9.	Individual/Group Presentation on identified Topics	02
10.	Group Discussion	02
11.	Role Play	06
	Total	**32**

Instructional Strategy:

Text Books:

Sr. No	Author	Title	Publication
1.	MSBTE	Communication Skills	MSBTE

Reference Books:

Sr. No	Author	Title	Publication
1.	Joyeeta Bhatacharya	Communicaion Skills	Macmillan Co.
2.	Sarah Freeman	Written Communication in English	Orient Longman Ltd.
3.	Krishna Mohan and Meera Banerji	Developing Communication Skills	Macmillan India Ltd.

Learning Resources: Nil

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Basic Concepts and Principles of Communication	08	08	08	24
2.	Organizational Communication	04	04	04	12
3.	Non Verbal Communication	--	--	12	12
4.	Business Correspondence and Office Drafting	--	--	32	32
	Total	**12**	**12**	**56**	**80**

(Prof. M.A.Surdikar)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in CE/EE/ET/ ME/MT/CM/IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Applied Mathematics – I
Course Code : SC 161

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	**Practical**	**Oral**	**Term work**
Duration	Three Class Tests each of 60 Minutes	**03 Hrs.**	--	--	--
Marks	**20**	**80**	--	--	--

Course Rationale:

The students of Diploma in Engineering and technology must acquire some essential competencies in Mathematics.

Course Objectives:

The students will be able to think logically and systematically. They will learn the importance of accuracy and develop attitude of problem solving with diligence and perseverance**.**

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Algebra**		
1.1	**Determinants:** Determinants of second and third orders, solution of simultaneous equations in two and three unknowns (Cramer's method), Properties of determinants of order 3 and examples.	**04**	**06**
1.2	**Partial fractions**: Rational fractions, resolving given rational fraction into partial fraction (Type : Denominator containing non-repeated, repeated linear factors and quadratic factor non repeated)	**04**	**06**
1.3	**Matrix Algebra** - Definition of a matrix, types of matrices, Equal Matrices, Addition, subtraction, multiplication of matrices, Scalar multiple of a matrix. Transpose of a matrix, Singular and non singular Matrix. Adjoint of a square matrix. Inverse of a matrix. Solution of simultaneous linear equations in 3 unknowns.	**04**	**06**
1.4	**Binomial Theorem** Definition of factorial notation, definition of permutation and combinations with formula, Binomial theorem for positive index, General term, Binomial theorem for negative index, Approximate value (only formula)	**04**	**06**
2.	**Trigonometry**		
2.1	Trigonometric ratios and fundamental identities.	**04**	**08**
2.2	Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), sub multiple angle.	**06**	**08**
2.3	Sum and product formulae.	**06**	**08**
2.4	Inverse Circular functions (Definition and simple problems)	**04**	**08**
3.	**Coordinate Geometry**		
3.1	**Point and Distances** Distance formula, Section formula, midpoint, centroid of triangle, Area of triangle and condition of co linearity	**03**	**08**

	3.2	**Straight Line**		

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
	Problems on following topics	
1.	Determinants	**02**
2.	Partial fractions	**01**
3.	Matrix Algebra	**02**
4.	Binomial Theorem	**02**
5.	Trigonometric ratios and fundamental identities	**01**
6.	Trigonometric ratios of allied angles, compound angles, multiple angles (2A, 3A), sub multiple angle.	**02**
7.	Sum and product formulae.	**01**
8.	Inverse Circular functions. (Definition and simple problems)	**01**
9.	Point and Distances	**01**
10.	Straight Line	**02**
11.	Circle	**01**
	Total	**16**

Text Books:

Sr. No	Author	Title	Publication
1.	Shri.G.V.Kumbhojkar	Engineering Mathematics	Phadke Publication,Kolhapur
2.	Shri.Patel & Rawat	Engineering Mathematics	Nirali Prakashan

Reference Books:

Sr. No	Author	Title	Publication
1.	Shri S.P. Deshpande	Mathematics for Polytechnic Students	Pune Vidyarthi Griha
2.	Shri S.L. Loney	Plane Trigonometry	Macmillan and London
3.	Shri H.K. Dass	Mathematics for Engineers (Vol-I)	S. Chand and Comp.
4.	Shri Shantinarayan	Engg. Maths Vol-I and Vol-II	S. Chand and Comp.

Learning Resources: Chalk, Board etc.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Algebra	06	10	08	24
2.	Trigonometry	08	16	08	32
3.	Co-ordinate Geometry	06	10	08	24
	Total	**20**	**36**	**24**	**80**

(Prof. R.A.Pawar)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in CE/EE/ET/ ME/MT/CM/IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Applied Mathematics – II
Course Code : SC162

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Theory	Semester End Examination Practical	Oral	Termwork
Duration	Three Class Tests each of 60 Minutes	03 Hrs.	--		--
Marks	20	80	--	--	--

Course Rationale:

This subject intends to teach students basic facts, concepts, principles and procedures of Mathematics as a tool to analyze Engineering problems and as such it lays down foundation for the understanding of engineering science and core technology subjects.

Course Objectives:

After studying this course, the student will be able to

Under stand basic facts of Mathematics about the field of analysis of any Engineering problem.

Know the standard ways in which the problem can be approached.

Apply basic concepts to engineering problems.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Functions and Limits**		
	1.1 Functions: Concept of functions, Types of functions; (only definitions)	**02**	**04**
	1.2 Limits: Concept of limits and limits of functions. (algebric, trigonometric, Logarithmic and exponential.)	**06**	**12**
2.	**Derivatives**		
	2.1 Definition of the derivative, derivatives of standard Functions	**05**	**04**
	2.2 Differentiation of sum, difference, product and quotient of two or more functions	**03**	**04**
	2.3 Differentiation of composite, inverse, implicit functions.	**04**	**06**
	2.4 Differentiation of parametric exponential and logarithmic Functions.	**04**	**06**
	2.5 Successive differentiation.	**02**	**04**
3.	**Applications of Derivatives**		
	3.1 Geometrical meaning of derivative (Equations of tangents and Normals)	**04**	**08**
	3.2 Maxima and minima of functions.	**02**	**04**
4.	**Integration**		
	4.1 Definitions, standard formulae, integration of algebraic sum of two or more functions, integration by substitutions and by trigonometric transformations, integration of $1/ax^2+bx+c$, $1/\sqrt{ax^2+bx+c}$, integration by parts, integration by partial fractions.	**12**	**20**
5.	**Definite Integrals**		
	5.1 Definition and properties of definite integrals Example based on these properties	**06**	**12**
		Total **48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
	Problems on following topics	
1.	Functions	01
2.	Limits	02
3.	Derivatives	04
4.	Applications of Derivatives	01
5.	Integration	06
6.	Definite Integrals	02
	Total	**16**

Text Books:

Sr. No	Author	Title	Publication
1.	S.P. Deshpande	Mathematic for polytechnic students I and II	Pune Vidyarthi Griha Prakashan
2.	G.V.Kumbhojkar	Applied Mathematics	Phadke Prakashan,Kolhapur
3.	Patel & Rawal	Applied Mathematics	Nirali Prakashan

Reference Books:

Sr. No	Author	Title	Publication
1.	Vishwanath	Engineering Mathematics Vol.I	Satya Prakashan, New Delhi
3.	H.K. Dass	Mathematics for Engineering Vol-I	S.Chand and Company
4.	Shantinarayan	Engineering Mathematics vol-I and II	S.Chand and Company

Learning Resources: Chalk, Board etc

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Function and Limits	04	06	06	16
2.	Derivatives	08	16	00	24
3.	Applications of derivatives	00	00	08	08
4.	Integration	06	10	04	20
5.	Definite Integrals	04	04	04	12
	Total	**22**	**36**	**22**	**80**

Prepared By (Prof.R.A.Pawar) **Secretary, PBOS (Prof. S. B. Kulkarni)** **Chairman, PBOS (Prof. D.A.Katare)**

Programme : Diploma in CE/EE/MT
Programme Code : 01/02/05/15/16/17
Name of Course : Engineering Physics
Course Code : SC164

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Termwork
Duration	Two class tests , each of 60 Min. duration	03 Hrs.	03 Hrs.	---	---
Marks	20	80	50	---	---

Course Rationale:

The development of various engineering topics is primarily based on the fundamental principles. The different principles of physics have a wide range of applications in all the braches of engineering. A reasonably good level of knowledge of physics, therefore, forms sound base for engineering students. Physics can be considered as a basic tool in the hands of an engineer through which he can purse his studies and research work in technical field. The foundation level of the subject acquired by the student is kept in mind for selection of the topics. To create interest in the students more stress is given on the applications, in engineering field.

Course Objectives:

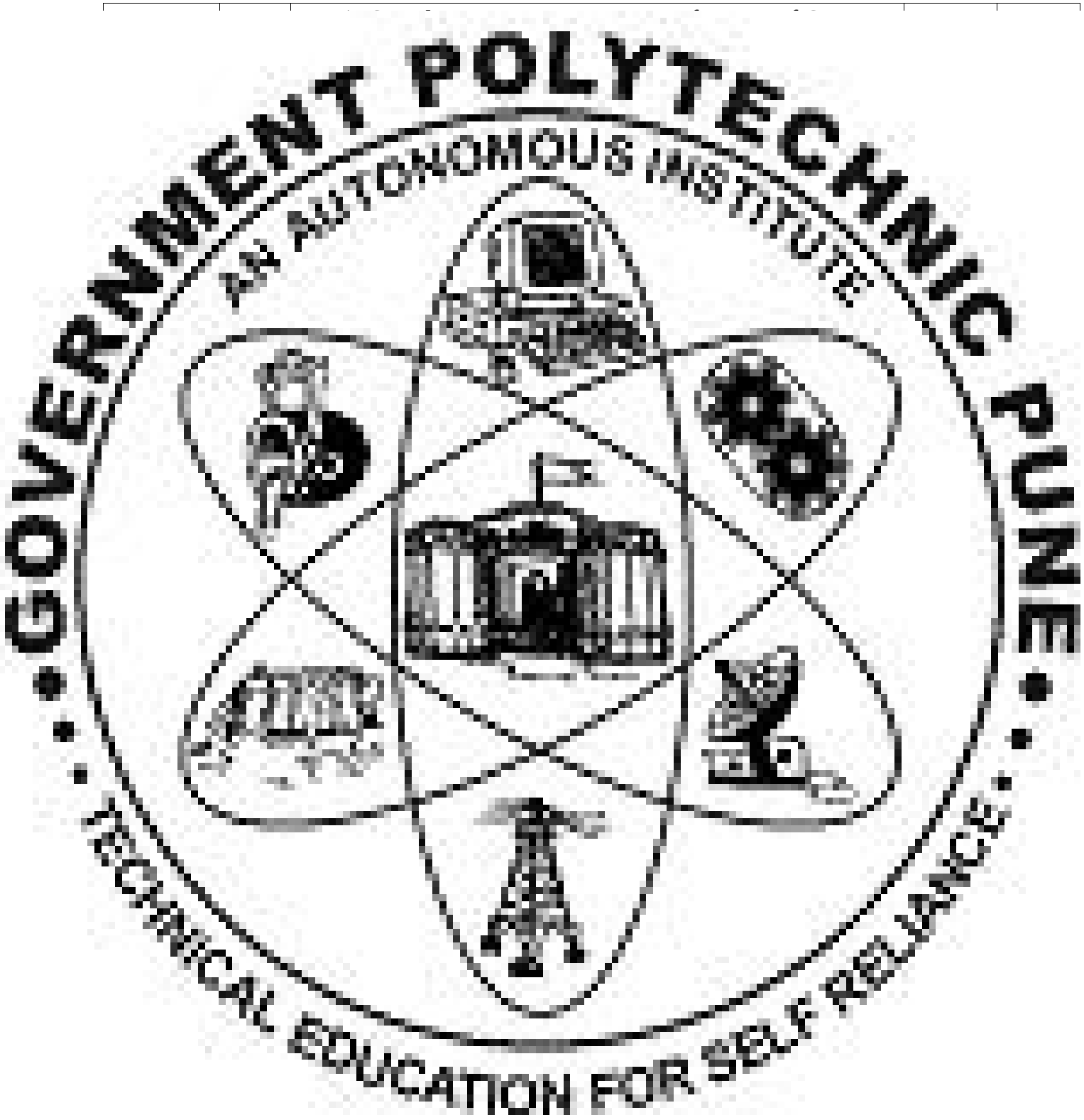
After studying this course, the student will be able to

To appreciate the role of fundamentals of Physics in different branches of Engineering.

To think in scientific manner and apply the knowledge gained in different situations.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**General Physics**		
1.1	**Units and Measurement:** Need of measurement, Unit of Physical Quantity, Requirements of standard unit, systems of unit, classification of physical quantities into fundamental and derived. Examples of conversion of unit.		
1.2	**Errors** : Instrumental, systematic and random error. Definition, Explanation, Examples and estimation of errors.		
1.3	**Motion :** a) Introduction to Rectilinear motion, $v = u + at$, $S = u + \frac{1}{2} at^2$, $v^2 = u^2 + 2as$ b) Circular Motion : Types of motion, uniform circular motion, angular displacement, radial velocity, tangential velocity, periodic time, frequency, relation between linear and angular velocity, definition and explanation of centripetal and centrifugal force, applications of circular motion, banking of road – definition and expression. Problems on banking and velocity limit on curved road.	14	20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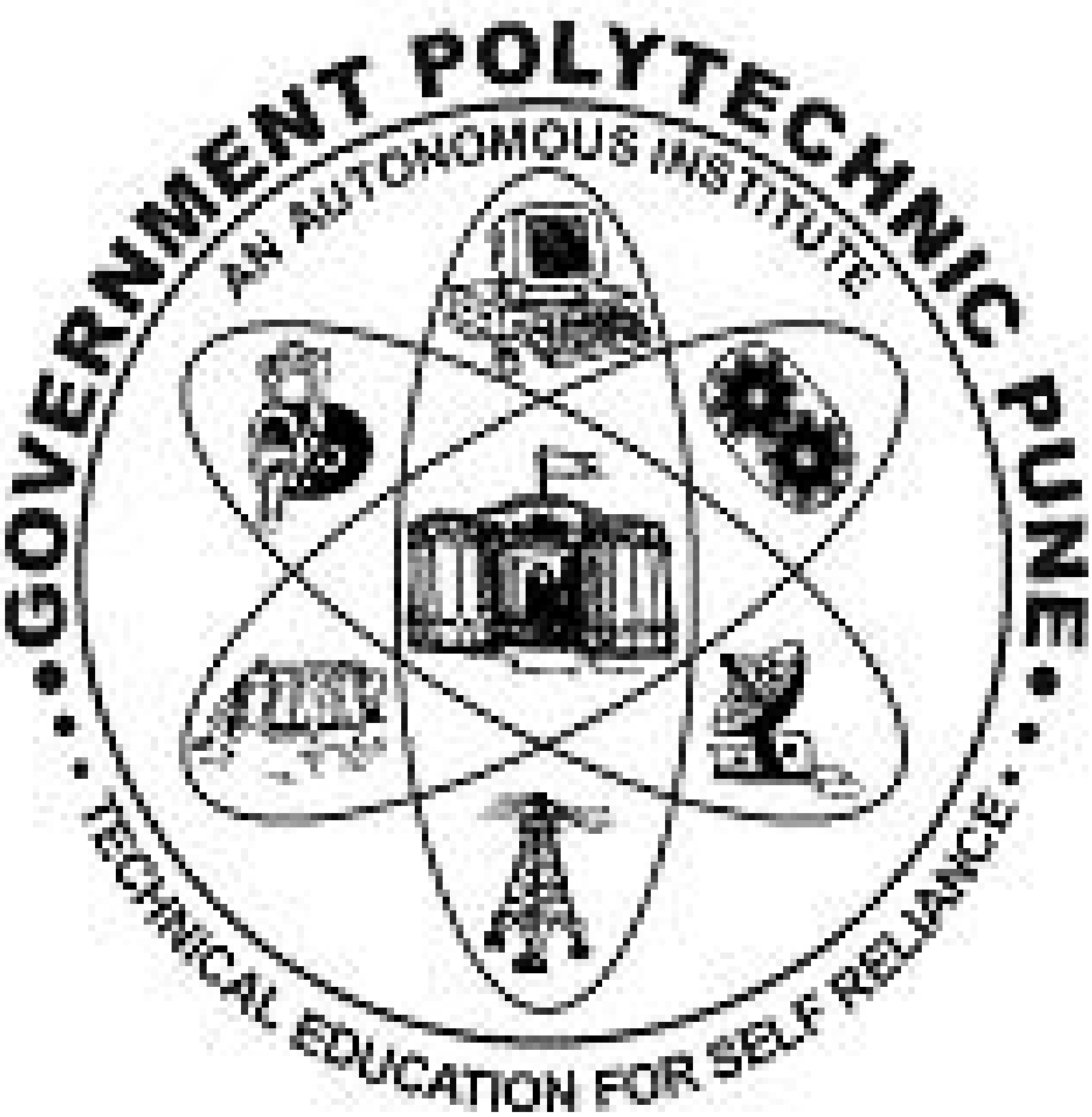
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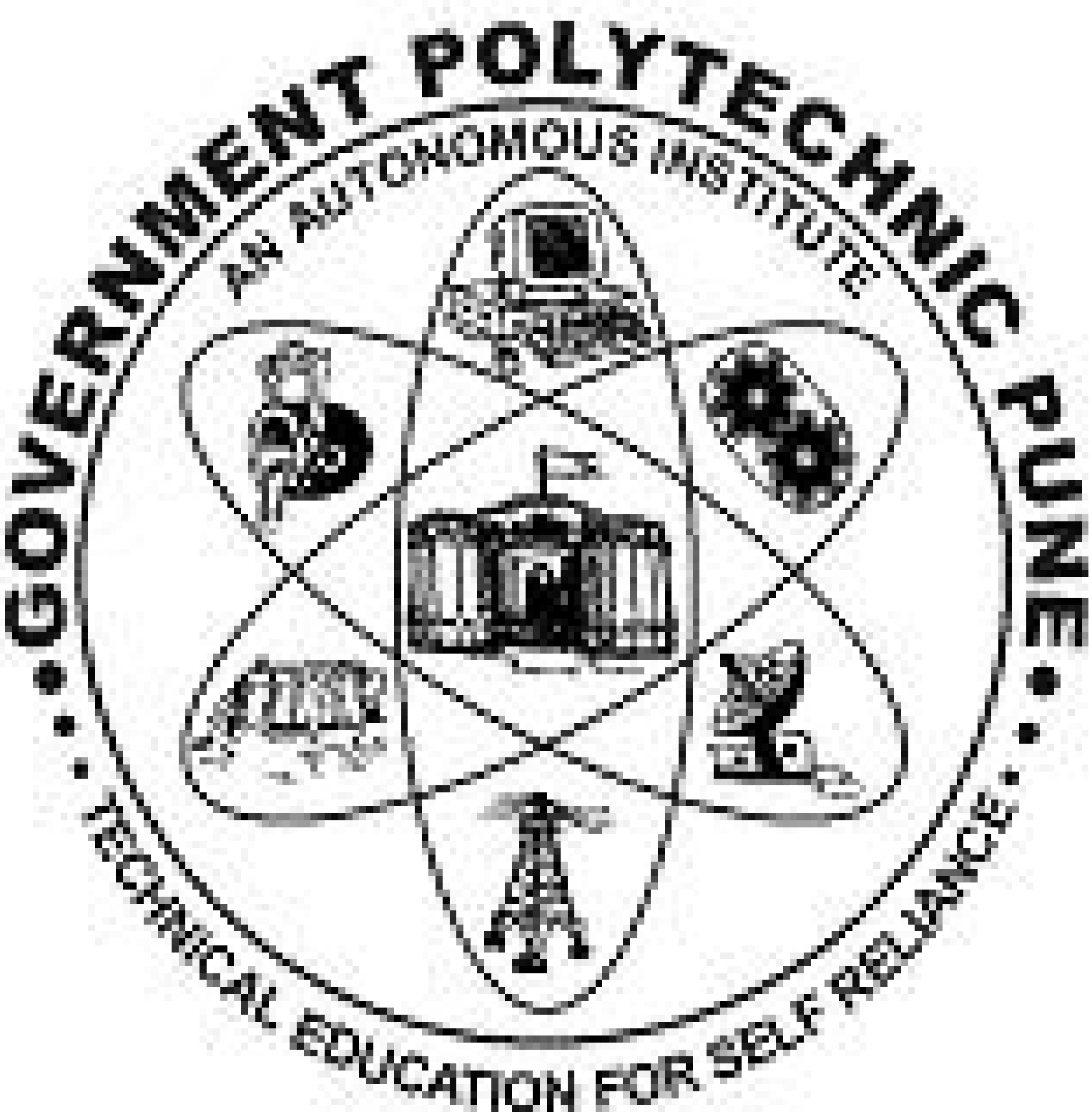
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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
1.	Use of vernier calliper to measure the dimensions of different objects.	02
2.	To understand the concept of error in instrument and to measure the dimensions of different objects using micrometer screw gauge.	02
3.	To understand the concept of resonance and to determine the velocity of sound using resonance tube method.	02
4.	Measurement of unknown temperature using thermocouple.	02
5.	Measurement of unknown temperature using platinum resistance thermometer.	02
6.	To determine the refractive index using spectrometer.	02
7.	To determine the specific resistance using Ohm's law.	02
8.	To understand the concept of Whetstone's network and to determine the specific resistance using the meter bridge.	02
9.	To study the principle of potentiometer.	02
10.	To verify Ampere's rule using Orested experiment and find the variation of intensity of magnetic field with current and distance.	02
11.	To observe the rise in liquid level in capillary (Jurine's Law)	02
12.	To verify Boyle's law	04
13.	To understand the concept of viscosity and hence to determine the coefficient of viscosity using Stokes' method.	02
14.	Study of Spectra	04
	Total	**32**

Instructional Strategy:

Text Books:

Sr. No	Author	Title	Publication
1.	R.K. Gaur and S. L. Gupta	Engineering Physics	Dhanpal Rai and Sons
2.	Manikpure, Deshpande and Dagwar	Prakash Basic Applied Physics.	S. Chand and Co. New Delhi.

Reference Books:

Sr. No	Author	Title	Publication
1.	Modern Physics	Text book in Physics for diploma Engg. Student.	Sony Publications Pvt. Ltd.
2.	Applid Physics	Schum's Series.	---
3.	Kshirsagar, Avdhanalu	Engineering Physics	---

Learning Resources: Chart, Black Board, Television, Internet, Educational CD's, Models, Experimentation, Diagram Demonstration

Specification Table:

Sr. No.	Topic	Cognitive Levels: Knowledge	Comprehension	Application	Total
1.	General Physics	5(9)	4(6)	2(3)	11(18)
2.	Properties of matter	5(7)	3(5)	2(3)	10(15)
3.	Sound	2(3)	2(3)	1(1)	5(7)
4.	Heat	2(3)	2(3)	1(1)	5(7)
5.	Light	4(7)	3(5)	2(3)	9(15)
6.	Electrostatic	5(7)	3(5)	2(3)	10(15)
7.	Current Electricity	5(7)	2(5)	2(3)	9(15)
8.	Thermoelectricity	2(3)	2(3)	1(1)	5(7)
9.	Electromagnetism	2(3)	2(3)	1(1)	5(7)
10.	Magnetism	2(3)	1(2)	1(1)	4(6)
11.	Modern Physics	3(5)	2(3)	2(3)	7(11)
	Total	**37**	**26**	**17**	**80**

Note: Figures in the bracket indicate the marks for which question will be set to account for internal options.

(Prof. Dr. A. U. Warad)	**(Prof. S. B. Kulkarni)**	**(Prof. D.A.Katare)**
Prepared By	**Secretary, PBOS**	**Chairman, PBOS**

Programme : Diploma in CE/EE/MT
Programme Code : 01/02/07/15/16/19
Name of Course : Engineering Chemistry
Course Code : SC166

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests, each of 60 Min. duration	03 Hrs.	03 Hrs.	---	---
Marks	20	80	50	---	

Course Rationale:

Material Science is the science that investigates the composition and structure of matter, the changes that matter undergoes, the amount and kind of energy necessary for these changes, and the law that govern the changes.
Applications of Material Science and Chemical Principles have resulted into the Development of new materials used in modern medicines and automobiles, synthetic fibers polymers, alloys, new energy sources and many other important products and processes.
Hence, Material Science is an important and expanding branch in scientific engineering and economic field of our society.
Thus the principles of Material Science have a wide application in all the branches of engineering and technologies.
In this syllabus, the coverage of various topics will orient the students to appreciate the principles Material Science in the fields of engineering and Technology.
The topic microstructure includes the basic structure of matter, which governs the Mechanical, Electrical and Magnetic properties of the matter. Steels, alloys, plastic resins and Elastometers are included in the syllabus considering their present extensive use in automobiles, chemicals and heavy engineering industries.

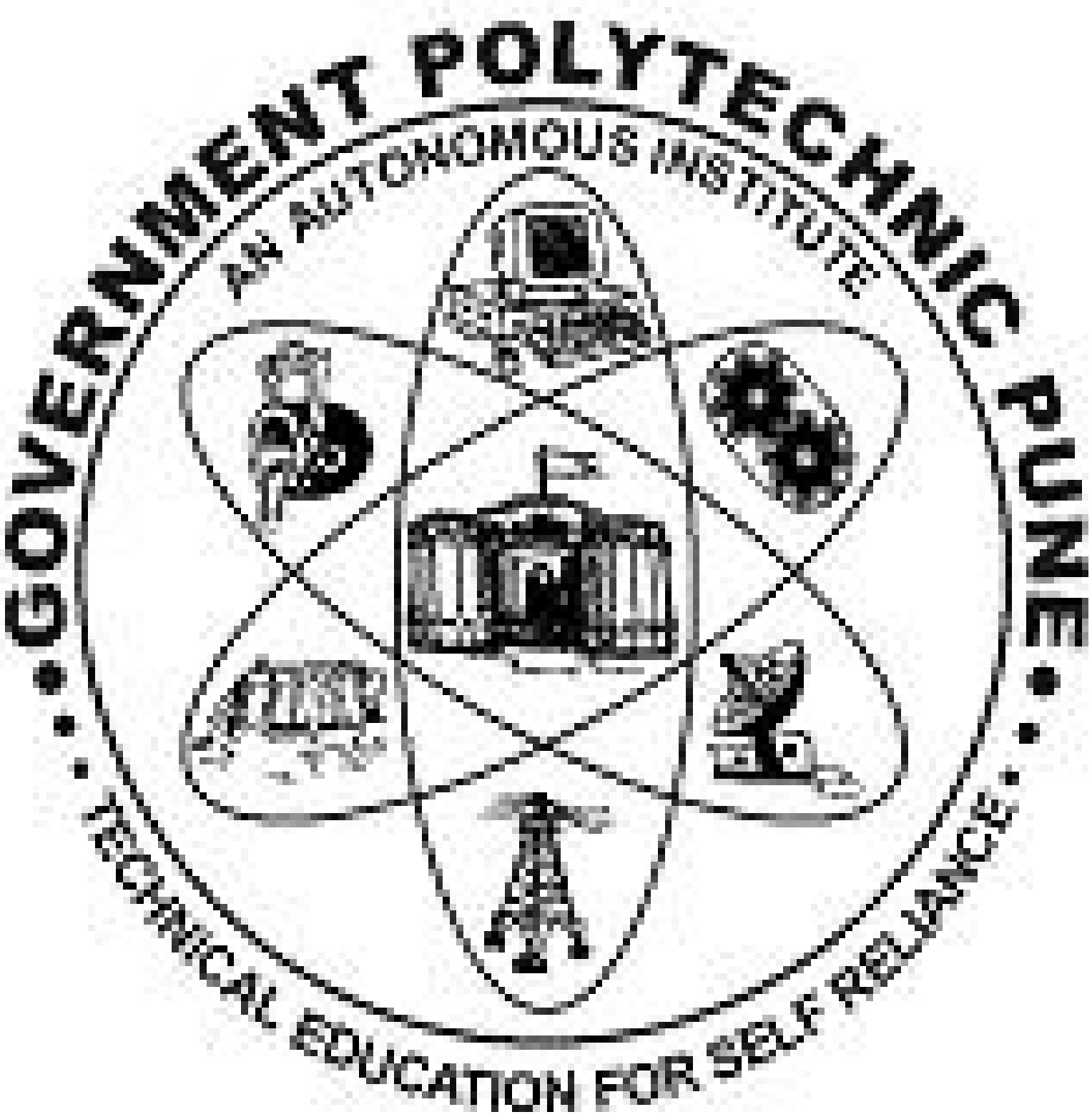
Course Objectives:

After studying this course, the student will be able to

Develop interest in the fundamental structure of matter, which governs the properties of matter.
Apply principles of chemistry, to Engineering situations.
Understand applications of basic concepts in chemistry.
Appreciate effect of chemical changes.
Understand various Chemical Technology processes.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Introduction to Material Science**		
1.1	**Atomic Structure and Chemical bonding –** Fundamental particles. Electronic configuration, Atomic Orbital, Main and sub energy levels, Quantum Numbers and their significance, formation of molecules, electro valency and ionic Bonds, Covalent Bonds, Nuclear stability, mass defect Nuclear fusion, fission.	04	08
1.2	**Introduction to crystal structure-** Unit cell, , seven systems, closed packed structures, hexagonal closed packed structure, cubic close packed structure, body-centered cubic structure and explanation of metallic properties based on these Structure. Inter Atomic Distances and Ionic Radii Correlation between Crystal structure and properties.		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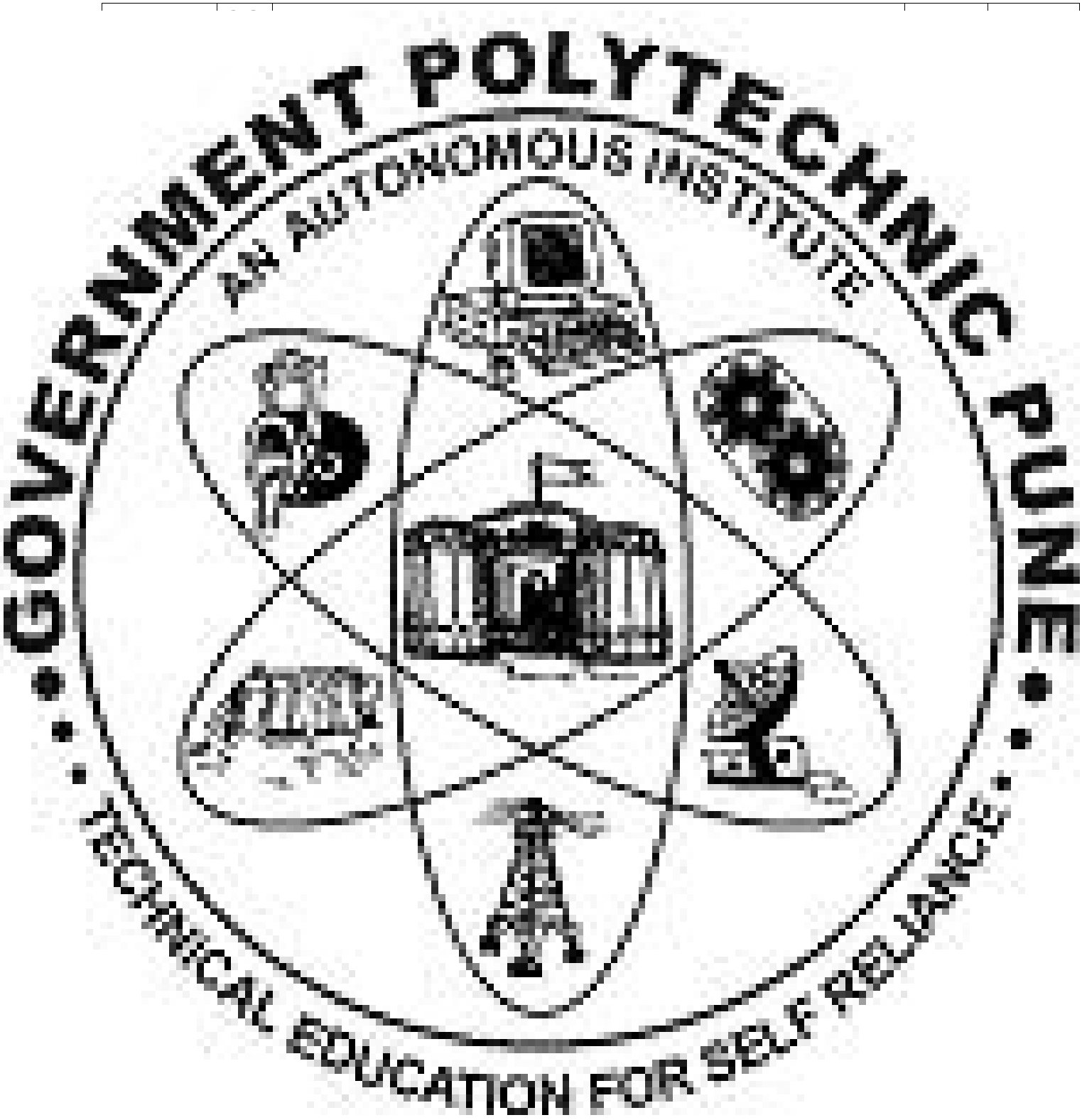
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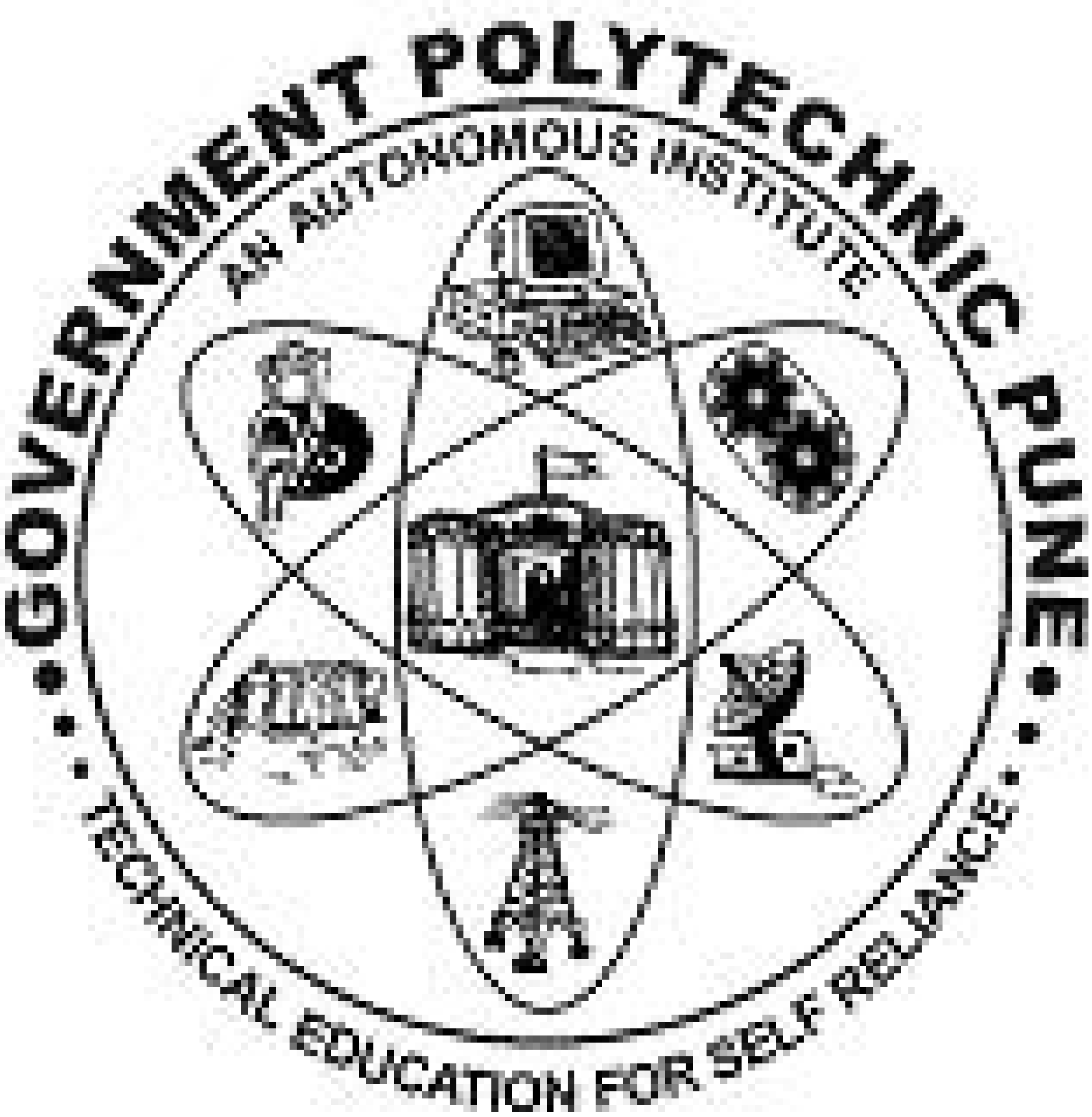
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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Drawing of electronic configuration of items from Z = 1 to Z = 20 Drawing of Molecular structures of electrovalent and covalent compounds and + ve and – ve ions	02
2.	Qualitative Analysis of salts of metals such as Hg, Pb, Cu, Sn, Fe, Al, Cr, Ni, Zn, Mn, Ca, Ba, Mg, NH_4, Na (Any two)	04
3.	To find the electrochemical equivalent of copper by electrolysis and to verify Faraday's 1st law of Electrolysis.	02
4.	Determine conductivity of different electrolytes by using conductometer.	02
5.	Study of Mechanism of electrochemical Corrosion due to evolution of H_2 And absorption of O_2	02
6.	To find Acid value/neutralization number of given lubricant.	02
7.	To determine the viscosity of oil lubricant using by using Ostwald's viscometer.	02
8.	Determination of pH value of unknown solutions and better mixtures.	02
9	To estimate the chloride content in given water sample.	02
10.	To determine the degree of hardness in terms of ppm of $CaCO_3$, given water sample by EDTA method.	02
11.	Estimation of calorific value of given liquid fuel OR proximate analysis of coal.	02
12.	Formation of phenol formaldehyde resin.	02

13.	To estimate percentage of pure iron in iron alloy or impure iron by	02

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction to material science	Class room Teaching, Demonstration, Models, Charts
2.	Electrochemistry	Class room Teaching
3.	Corrosion	Class room Teaching, Demonstration, Models
4.	Lubricant	Class room Teaching, Demonstration
5.	Water	Class room Teaching
6.	Fuels	Class room Teaching, Demonstration
7.	Polymers	Class room Teaching
8.	Metal and alloy	Class room Teaching
9.	Engineering Materials	Class room Teaching
10.	Environmental effects	Class room Teaching

Text Books:

Sr. No	Author	Title	Publication
1.	S.N.Narkhede	Chemistry of Engineering Materials	Nirali Publication

Reference Books:

Sr. No	Author	Title	Publication
1.	V. P. Mehta	Polytechnic Chemistry	Jain Brothers, New Delhi.
2.	P.C. Jain and Monica Jain	Applied Chemistry	Dhanpat Rai and sons, New Delhi.
3.	M.M. Uppal	Engineering Chemistry	Khanna Publisher, Delhi.
4.	S.N. Narkhede, M.M. Thatte	Applied Chemistry	Nirali Prakashan, Pune.

Learning Resources: Chalk, Board, Books, Video cassette no 51, 55, 56, 60, 61, 63 of GPP Library

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction to Material Science	03	02	03	08
2.	Electrochemistry	05	03	02	10
3.	Corrosion	06	04	02	12
4.	Lubricant	04	01	01	06
5.	Water	04	04	02	10
6.	Fuel	04	01	01	06
7.	Polymers	04	01	01	06
8.	Metal and alloy	03	02	03	08
9.	Engg. Materials.	03	02	03	08
10.	Environmental effects	02	02	02	06
	Total	**38**	**22**	**20**	**80**

(Prof. Smt.K.V.Mankar)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in CE/EE/ME/MT
Programme Code : 01/02/04/05/15/16/18/19
Name of Course : Engineering Mechanics
Course Code : AM261

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**04**	**64**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests, each of 60 minutes	3Hrs.	--	--	--
Marks		80	-		25

Course Rationale:

To find solutions to various practical problems, it is essential for the student to study and get acquainted with the various aspects of Statics and Dynamics. The fundamental concepts to be studied in this course are required for study of Strength of Materials, Mechanics of Structures and other courses of Mechanical & Civil Engineering to be studied at higher level.

Course Objectives:

After studying this course, the student will be able to,

- Understand various concepts & principles in Engineering Mechanics.
- Apply those principles for evaluating various problems coming across various fields of engineering

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weigh tage
1	**Introduction**			
	1.1	Fundamental Concept such as Fundamental units, Derived unit, system of Unit, Scalars, Vectors.	**02**	**02**
	1.2	Mechanics, Statics, Dynamics, Kinematics, Kinetics.		
	1.3	Gravity, Mass, Weight, Inertia, Newton's Law of Gravitation and Newton's Law of motion.		
2	**Resolution and composition of Forces**			
	2.1	Concept of force, unit for and graphical representation, Principle of transmissibility.	**08**	**12**
	2.2	System of forces: coplanar and non-coplanar, concurrent, non-concurrent, parallel.		
	2.3	Resolution of a force, resolved parts, orthogonal and non-orthogonal components of a force.		
	2.4	Concept of composition & resultant of forces.		
	2.5	Law of Parallelogram of Forces, Triangle Law of Forces, Polygon Law of Forces.		
	2.6	Moment of a force, Varignon's Theorem, couple & characteristics of couple.		
	2.7	Composition of Coplanar (concurrent, parallel (like & unlike) non concurrent forces by analytical methods.		
3	**Equilibrium**			
	3.1	Concept of equilibrium, equilibrant, Relation between resultant & equilibrant. Analytical conditions.	**08**	**12**
	3.2	Equilibrium of coplanar concurrent forces, Lami's theorem and its application.		
	3.3	Equilibrium of coplanar parallel and non-concurrent forces.		
	3.4	Beam reactions - simply supported beams subjected to concentrated and distributed loads, beam supported on roller and hinge supports, overhanging beams.		
4	**Graphic Statics**			
	4.1	Concept of equilibrium, equilibrant, Relation between resultant & equilibrant. Analytical conditions.	**06**	**08**
	4.2	Equilibrium of coplanar concurrent forces, Lami's theorem and its application.		

	4.3	Equilibrium of coplanar parallel and non-concurrent forces.		
5	**Centroid and Centre of gravity**			
	5.1	Concept of Centre of Gravity & Centroid.	**06**	**08**
	5.2	Centroid of regular plane areas & compound areas consisting of regular plane areas. Centroid of hollow solids such as hollow cylinder, hollow cone, hollow sphere.		
	5.3	Centre of gravity of simple solids-cylinder, prism, cone, sphere etc. and C.G. of compound solid objects made up of simple solids.		
6	**Friction**			
	6.1	Introduction to friction.	**08**	**10**
	6.2	Types of friction, Laws of static friction, coefficient of friction, angle of friction, and angle of repose.		
	6.3	Equilibrium of body on horizontal & inclined planes.		
	6.4	Ladder friction.		
7	**Kinetics**			
	7.1	Concept of force, mass, acceleration, momentum, impulse & impact.	**08**	**10**
	7.2	Types of friction, Laws of static friction, coefficient of friction, angle of friction and angle of repose.		
	7.3	Principle of Conservation of momentum, principle-its application, recoil velocity of gun.		
8	**Work, Power, Energy**			
	8.1	Definitions and units of work, graphical representation of work, work done by torque, work done by constant and variable force.	**08**	**08**
	8.2	Energy, forms, law of conservation of energy, work-energy principle and its applications.		
	8.3	Power-Definition, units.		

9	**Simple Machines**			
	9.1	Definition of simple machine, mechanical advantage, velocity ratio, efficiency. Relation between them, friction in machines.	**10**	**10**
	9.2	Reversibility, law of machine, max MA & max efficiency.		
	9.3	Study of machine – levers, pulleys, wheel and axle, screws, worm & worm wheel, winches, gears etc.		
		Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Law of Polygon of Forces.	02
2	Law of Moments.	02
3	Lami's Theorem.	02
4	Beam Reactions.	02
5	Graphic statics-Two Problems each on composition of concurrent and parallel forces.	06
6	Graphic statics-Two Problems on beam reactions.	04
7	Centroid of Regular and Irregular Laminas.	02
8	Determination of coefficient of friction for different surfaces.	02
9	To study various lifting machines – Differential axle and wheel, Worm and worm wheel, Simple screw jack, Single purchase crab, Double purchase crab.	10
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Introduction	Lecture method, Demonstration
2	Resolution and composition of Forces	Lecture method, Demonstration
3	Equilibrium	Lecture method, Transparencies
4	Graphic Statics	Lecture method, Transparencies
5	Centroid & Center of Gravity	Lecture, Demonstration & Discussion
6	Friction	Lecture method, Demonstration
7	Kinetics	Lecture method, Demonstration
8	Work, power, Energy	Lecture method, Demonstration
9	Simple lifting machines	Lecture method, Demonstration

Text Books:

Sr. No	Author	Title	Publication
1	Junnarkar, Adavi	Applied Mechanics	Charotar Publishers
2	Dadhe, Jamdar, Walawalkar	Applied Mechanics	Sarita Prakashan
3	Khurmi	Applied Mechanics	S. Chand

Reference Books:

Sr. No	Author	Title	Publication
1	Beer & Johnson	Vector Mechanics For Engineers (Statics & Dynamics)	Mc - Graw Hill Co., USA
2	McLean & Nelson (Schaum's Series)	Engineering Mechanics	Mc - Graw Hill Co., USA
3	Timoshenko & Young	Engineering Mechanics	Mc - Graw Hill Co., USA

Learning Resources: Books, Models

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1	Introduction	02	--	--	02
2	Resolution and composition of Forces	02	04	06	12
3	Equilibrium	02	02	08	12
4	Graphic Statics	04	04		08
5	Centroid & Center of Gravity	02	02	04	08
6	Friction	02	02	06	10
7	Kinetics	02	02	06	10
8	Work, power, Energy	02	02	04	08
9	Simple lifting machines	02	04	04	10
	Total	**20**	**22**	**38**	**80**

(Prof. R.M.Koranne)
Prepared By

(Prof. [illegible] Gulkarni)
[illegible] PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in CE/EE/ET/ MT/CM/IT
Programme Code : 01/02/03/05/06/07/15/16/17/19
Name of Course : Basics of Computer Systems
Course Code : CM 261

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Theory	Semester End Examination Practical	Oral	Termwork
Duration	---	---	2 hrs		2 hrs
Marks	---	---	50	---	25

Course Rationale:

In this world of high speed computing, it is essential for diploma in computer engineering students to know about device of computers, its operation and graphical base applications and latest technologies in the market. This course is designed for basic perspective for first year diploma students.

Course Objectives:

Use computer system effectively.
Describe and use different application software's.
Use the basic functions of an operating system.
Use five essential utility programs.
Compare major OS like Linux and MS-Windows.
Understand working of input output devices.
Understand working of secondary storage devices.

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Set the parameter required for effective use of hardware combined with and application software's.
Understand connectivity, internet multimedia and web.

Course Content:

Chapter No	Name of Topic/Sub topic	Hrs	Weigh tage
	Input and Output		
1.1	**What Is Input?**		
1.2	**Keyboard Entry**		
	Keyboards		
1.3	**Pointing Devices**		
	Mouse, Joystick, Touch-Screen, Light Pen, Stylus		
1.4	**Scanning Devices**		
	Optical Scanners, Bar Code Readers, Character and Mark Recognition Devices		
1.5	**Image Capturing Devices**		
	Digital Camera, Digital Video Camera		
1.6	**Audio-Input Devices**		
	Voice		
1.7	**Webcams and Instant Messaging**		
1.8	**What Is Output?**		04
1.9	**Monitors**		
	Cathode-Ray Tube, Panel Monitor, Monitors		
1.10	**Printers**		
	Features, Ink-Jet Printer, Laser Printer, Thermal Printer, Other Printers		
1.11	**Audio-Output Devices**		
1.12	**Combination Input and Output Devices**		
	Fax Machines, Multifunction Devices, Internet Telephone, Terminals		
	SECONDARY STORAGE		
1.13	**Storage**		
1.14	**Floppy Disks**		
	Traditional Floppy Disk, High Capacity Floppy Disks		

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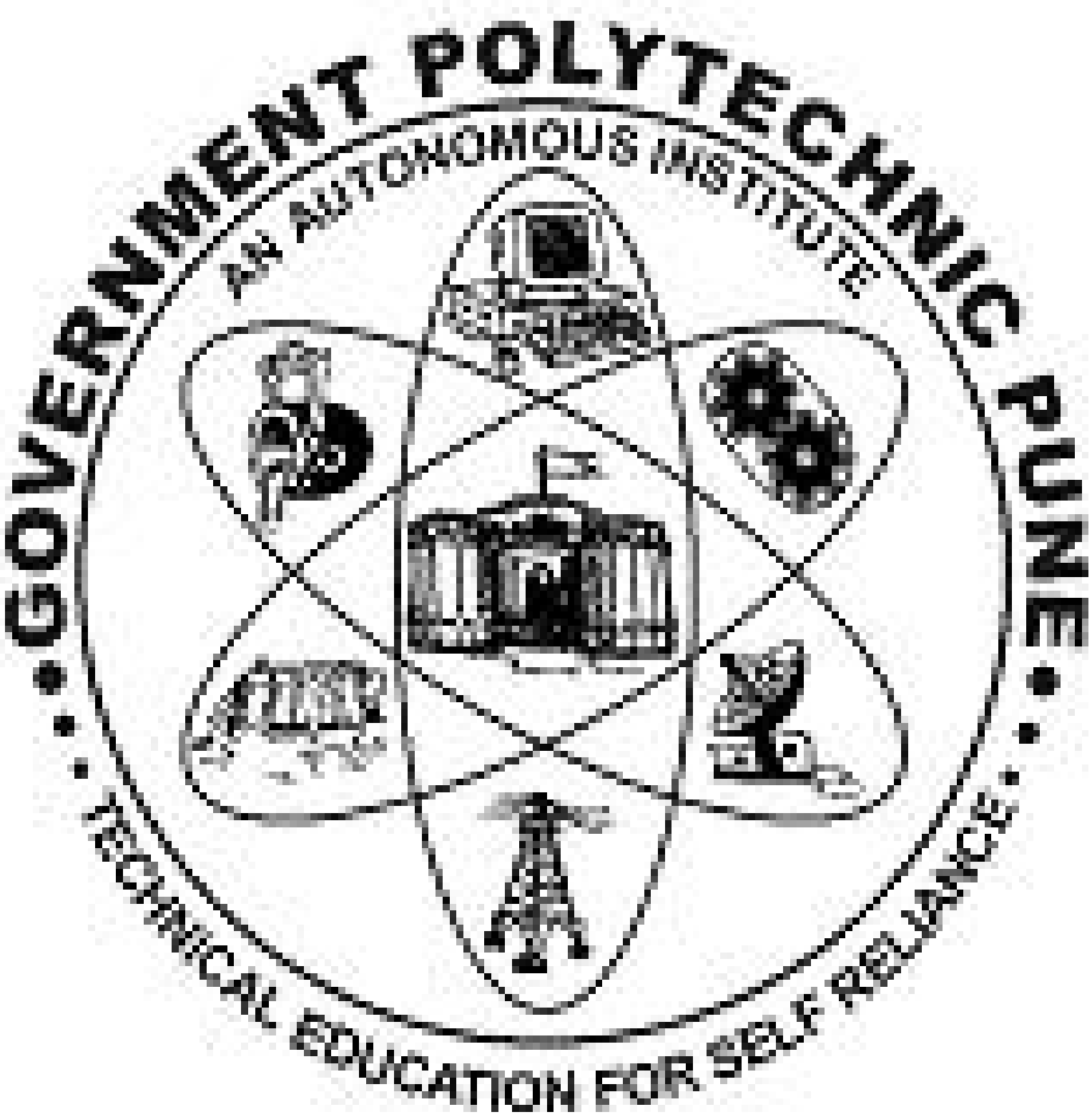
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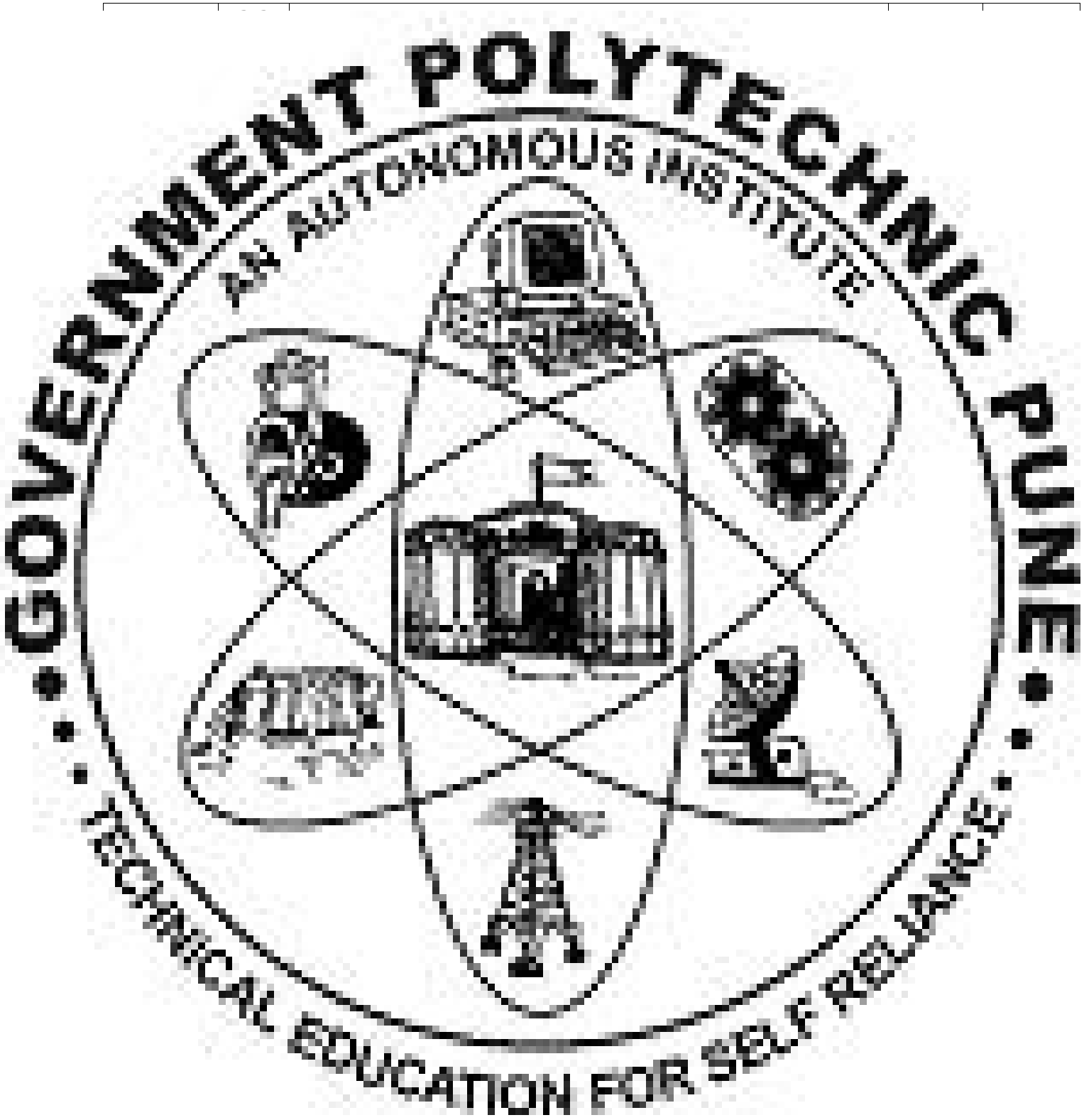
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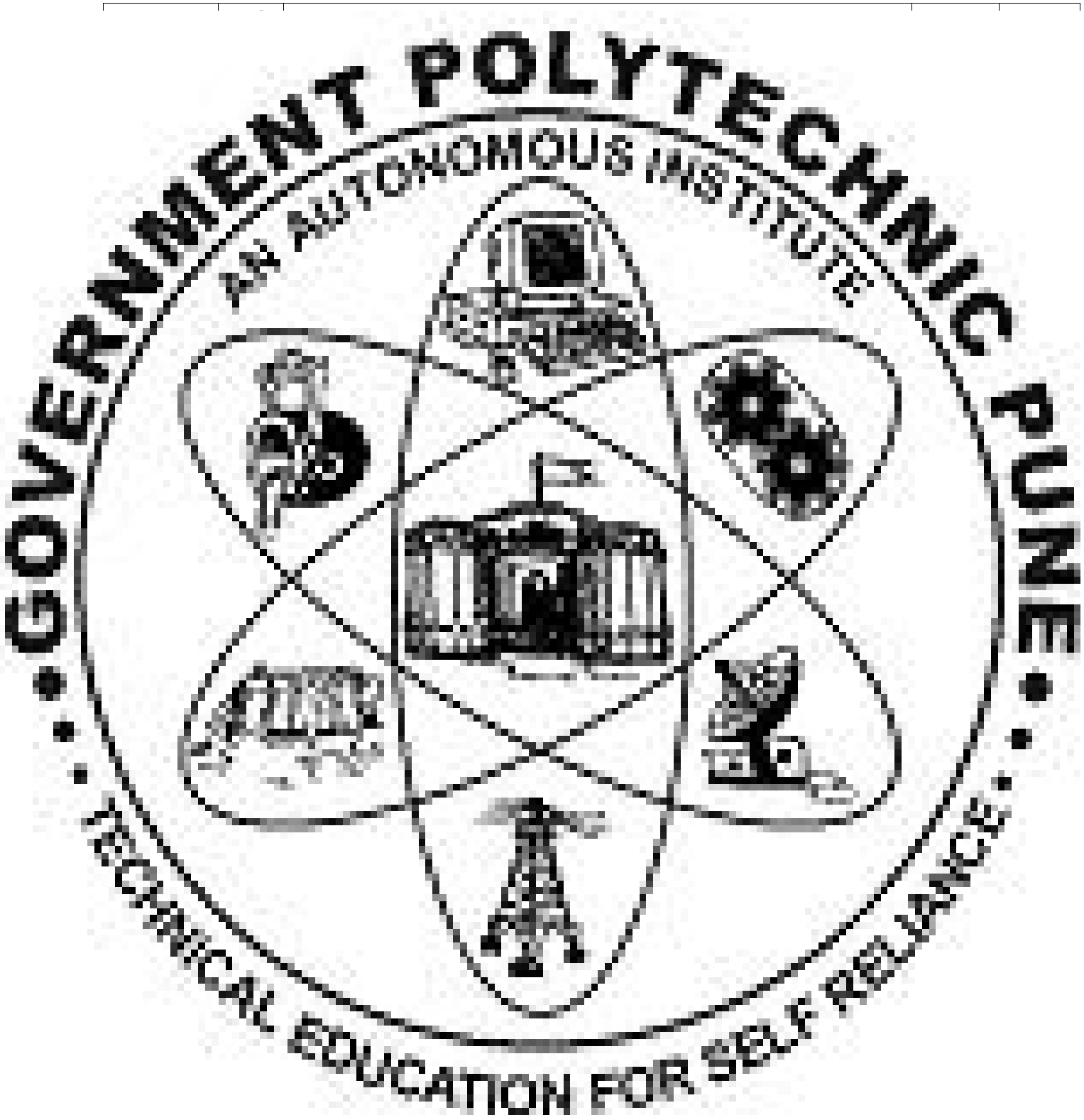
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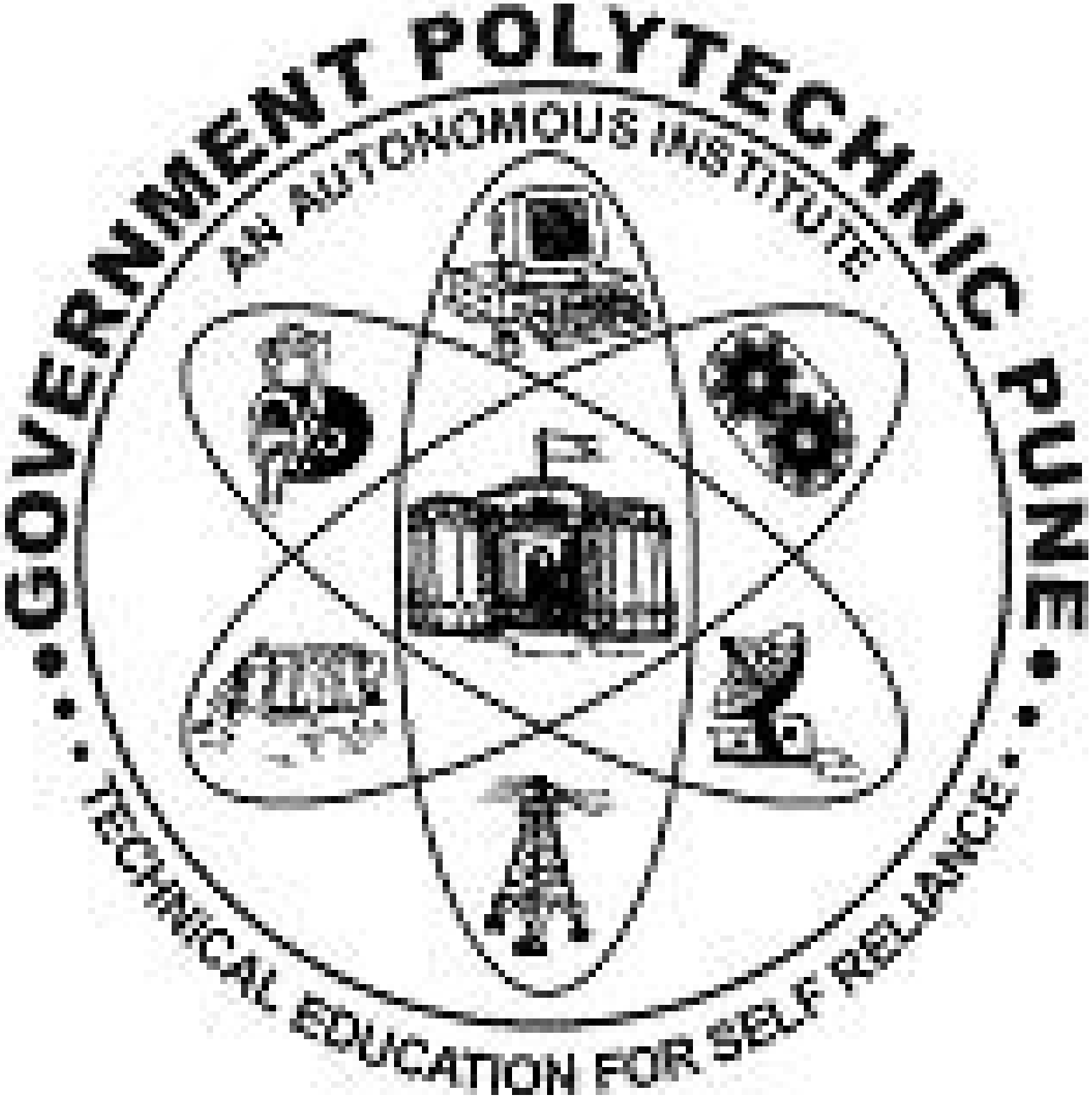
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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
1.	**Demonstrate types of Computers.** Demonstrate use of various I/O Devices . **(Maximum Devices Available in the LAB as per theory should be demonstrated)** Functioning of Cathode Ray Tube, TFT/Flat Monitors and other monitors. Introduction of interface of other output devices like Fax Machines, Internet phones, Digital Camera etc. Functioning of various types of Audio-Output Devices.	**02**
2.	**Functions and working of Secondary Storage devices** Types of Secondary Storage devices. Installation, configuration and setting of Hard Disks. BIOS Setting for Primary and secondary Memory. Installation and working of CD-ROM/DVD-ROM/ DVD Combo/ DVD-Writer (Internal and External). Future of Secondary Storage Devices.	**04**
3.	Practice of basic commands in command window: Ex: dir, md, copy, cd, move, rmdir, rd etc.	**04**
4.	**Operating System** Various operations on Window based operating system. Windows Operations: Minimising, Maximising, Resizing. Using windows Help. Creating, copying, moving files and folders. Creating shortcuts. Creating and Removing/Deleting User Accounts. Setting window views. Using Add /Remove Programs Utility. Using Add Hardware Utility. Adding Fonts. Viewing Computer Configuration.	**04**

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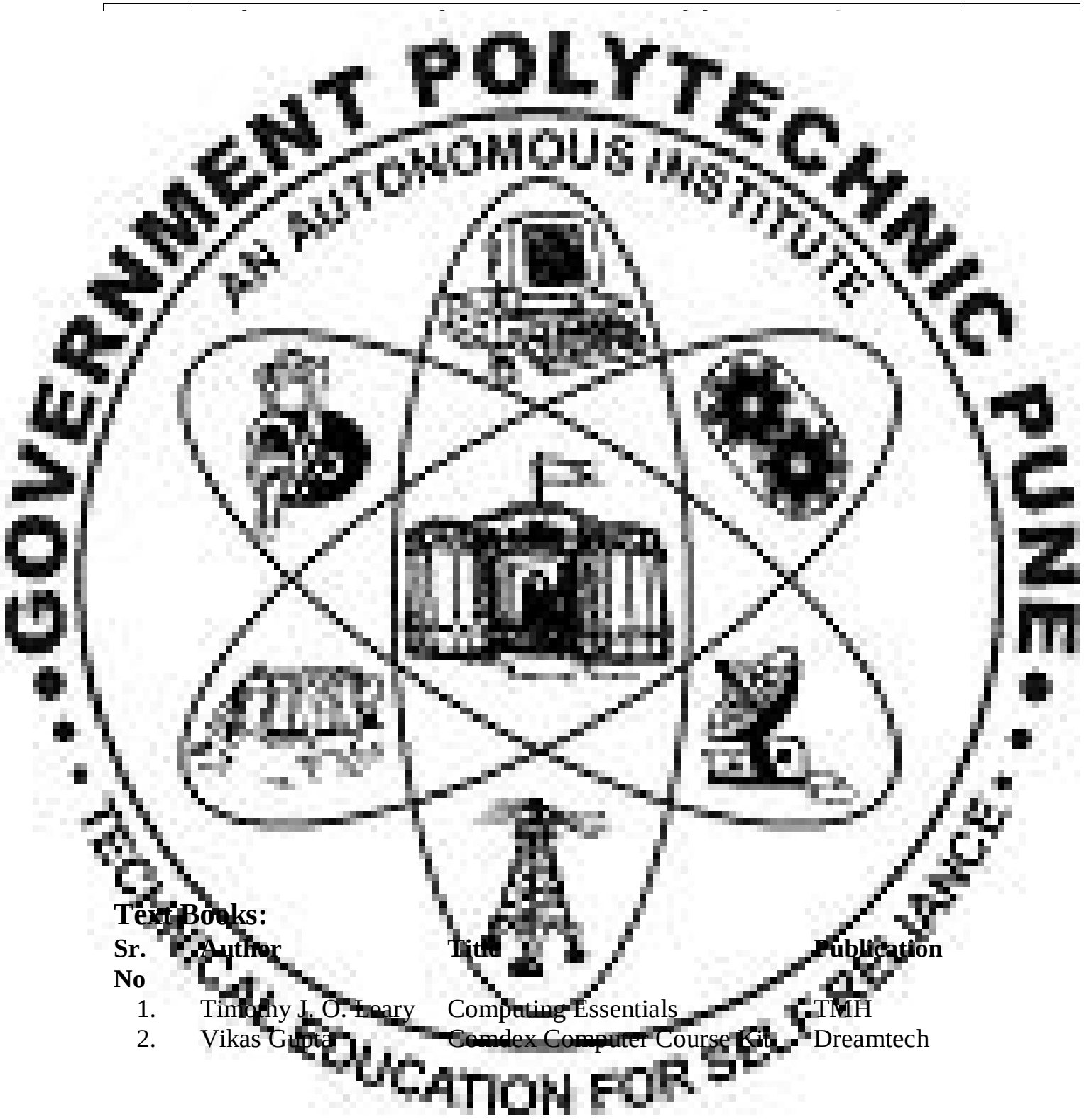

Text Books:

Sr. No	Author	Title	Publication
1.	Timothy J. O. Leary	Computing Essentials	TMH
2.	Vikas Gupta	Comdex Computer Course Kit	Dreamtech

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Reference Books:

Sr. No	Author	Title	Publication
1.	Computer Fundamentals	BPB	P.K. Sinha
2.	Information Technology for Management	Tata McGraw Hill	Henry C. Lucas, Jr.

Learning Resources: Books, Models

(Prof. Smt. M. H. Thakre)	**(Prof. S. B. Kulkarni)**	**(Prof. D.A.Katare)**
Prepared By	**Secretary, PBOS**	**Chairman, PBOS**

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Programme : Diploma in EE/ET /MT
Programme Code : 02/03/05/06/07/19
Name of Course : Programming in C
Course Code : CM262

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Theory	Semester End Examination Practical	Oral	Termwork
Duration	Two class tests, each of 60 minutes	3 Hrs.	--		--
Marks	**20**	**80**	**50**	--	--

Course Rationale:

In this era of high speed computing, it is necessary to program computers with the help of structured & dynamic languages like 'C' to study programming is useful in solving problems/tasks related to various domains. Now days almost every setup in software engineering domain chooses 'C' as a basic tool to develop software.

Course Objectives:

After studying this course, the student will be able to

- Write a programs using 'C' language
- Implement data types & structures related to problems.
- Solve the problems/tasks in structured way.

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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Overview of 'C'**		
1.1	Introduction: development of 'C', Importance of 'C', Basic structure of 'C' programs, programming style, sample 'C' programs, execution of 'C' program.	**02**	**05**
2.	**Data Types & Character set**		
2.1	Character set, 'C' tokens, keywords & identifiers, constants, variables, data types, declaration of variables, assigning values to variables, defining symbolic constants.	**04**	**10**
3.	**Operators & Expressions**		
3.1	Operators: Arithmetic, relational, logical, increment & decrement, conditional, bit-wise special.		
3.2	Expressions: Arithmetic expressions, evaluation of expressions, procedure of arithmetic operators, type conversions in expressions, operator precedence & associatively, mathematical functions.	**06**	**10**
3.3	Managing input & output operators: Introduction, reading a character, writing a character, formatted input, formatted output.		
4.	**Decision Making**		
4.1	Branching & looping introduction, decision making with if statement, simple if statement, the if-else statement, The else if ladder, The switch statement, The?: operator, the go to statement, looping , introduction, the while statement , jumps in the loop, break statement.	**06**	**08**
5.	**Arrays**		
5.1	Introduction, one- dimensional arrays, two-dimensional arrays, multidimensional arrays, Initialization of arrays.	**07**	**08**

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	**Demonstration of Turbo-C Compiler, Creating a program,** Compiling & linking executing programs.	02
2.	Write 'C' programs based on declaring variables & assigning values to variables. (Minimum 2)	02
3.	Write programs based on expressions and operators. Programs using scanf(), printf(), getch(), putch(). (Minimum 4)	02
4.	Programs using following control statements: If statement, Switch statements, ?: operator, go to statements Programs using following loop controls, while loop, do.. while loop, for loop. (Minimum 5)	06

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Note :

Minimum 20 programs as specified in practical coverage section should be executed.

Actual program statements on practical topics should be based on the respective Programme offering the course and their requirements .

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
10.	Overview of 'C'	Demonstration of 'C' Compiler, Create simple program.
11.	Data types & character set	Write 'C' programs based on declaring variables & assigning values to variables.
12.	Operators & Expressions	Explanation of operators, expressions & managing i/p & o/p operators.
13.	Decision Making	Theoretical explanation + writing program using different control statements.
14.	Arrays	Theoretical explanation & implementation of arrays.
15.	Strings	Theoretical explanation & implementation of strings.
16.	User defined functions	Explanation & implementation of examples on user defined functions,
17.	Structures and Unions	Theoretical explanation & implementation of structures & Unions.
18.	Introduction to Pointers	Explanation & implementation of basic examples on Pointers

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Text Books:

Sr. No	Author	Title	Publication
4.	E. Balagurusamy	Programming in ANSI 'C'	Tata- McGraw Hill pub.(Second Edition)

Reference Books:

Sr. No	Author	Title	Publication
5.	Yeshwant Kanetkar	Let us 'C'	BPB Publication
6.	Madhusudhan Mothe	C for Beginners	SPD Publication

Learning Resources: Black Board, Transparencies, Overhead projector, LCD, White Board.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Overview of 'C'	02	01	02	05
2	Data types & character set	03	03	04	10
3.	Operators & Expressions	03	03	04	10
4.	Decision Making	02	04	02	08
5.	Arrays	03	03	02	08
6.	Strings	02	03	03	08
7.	User defined functions	04	05	04	15
8	Structures and Unions	03	02	03	08
9.	Introduction to Pointers	04	03	03	08
	Total	**26**	**27**	**27**	**80**

(Prof. Smt.J.R.Hange)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

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Programme : Diploma in EE
Programme Code : 02 /16
Name of Course : Basics Electrical Engineering
Course Code : EE261

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests , each of 60 Min. duration	03 Hrs	---	---	---
Marks	**20**	**80**	**50**	---	---

Course Rationale:

This is an entry course to Electrical Engineering programme. The basic concepts, rules and laws of Electric and Magnetic Circuits must be studied & understood by students before studying Electrical Engineering Course. This course covers fundamentals of D.C. and A.C. circuits, electrostatics, electromagnetism and electrochemistry.

Course Objectives:

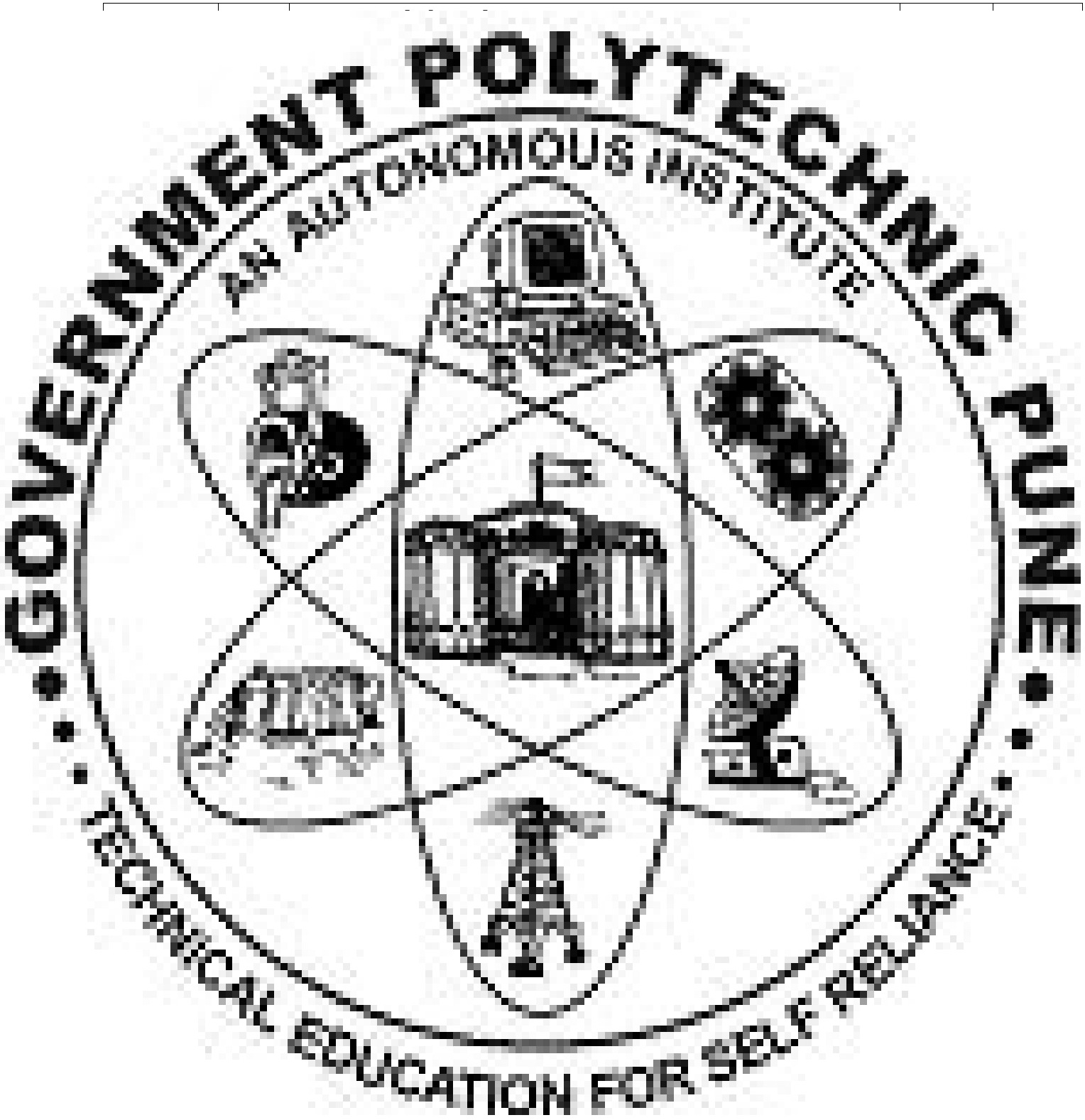
After studying this course, the student will be able to

State the basic principles with the explanation of the topics like, Electricity, Electrostatics, Electromagnetism and Electromagnetic induction.
State and explain the various rules, laws of Electric and Magnetic circuits and Electromagnetic Induction.
Apply the laws of Electrical circuits to analyze Electrical circuits (DC).
Apply the laws of Magnetic Circuits to solve problems on Magnetic circuits.
Describe the construction and State the application of storage batteries

Solve numericals based on D.C. circuits, Electrostatics, Electromagnetism and Electromagnetic induction.
Determine the rating of battery& battery backup required for particular application.
Charge battery by A.C. or D.C. supply.
Test battery.
Diagnose the problem with not working battery.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**D. C. Circuits**		
	1.1 Review concept of current, potential difference and e.m.f.		
	1.2 Concept of resistance and resistivity, conductors & conductivity, semiconductors and insulators.		
	1.3 Effect of temperature on resistance, temperature co-efficient of resistance (Simple numerical).		
	1.4 Types of resistors – fixed and variable, color-code.		
	1.5 Electric Current: Direct Current (DC) & Alternating Current (AC),	**06**	**10**
	1.6 Concept of Ideal and Practical Voltage Source,		
	1.7 Concept of Ideal and Practical Current Source, Source conversion. (simple numerical)		
	1.8 Ohm's law, series and parallel circuits, division of voltage in series circuit, division of current in parallel circuit (simple numerical).		
2.	**Energy Conversion**		
	2.1 Review concept of electrical work, power and energy.		
	2.2 Mechanical, electrical & thermal quantities and their SI units related to conversion of energy from one form to another.	**08**	**12**
	2.3 Relation between torque & power.		
	2.4 Concept of efficiency for conversion of energy from one form to another.		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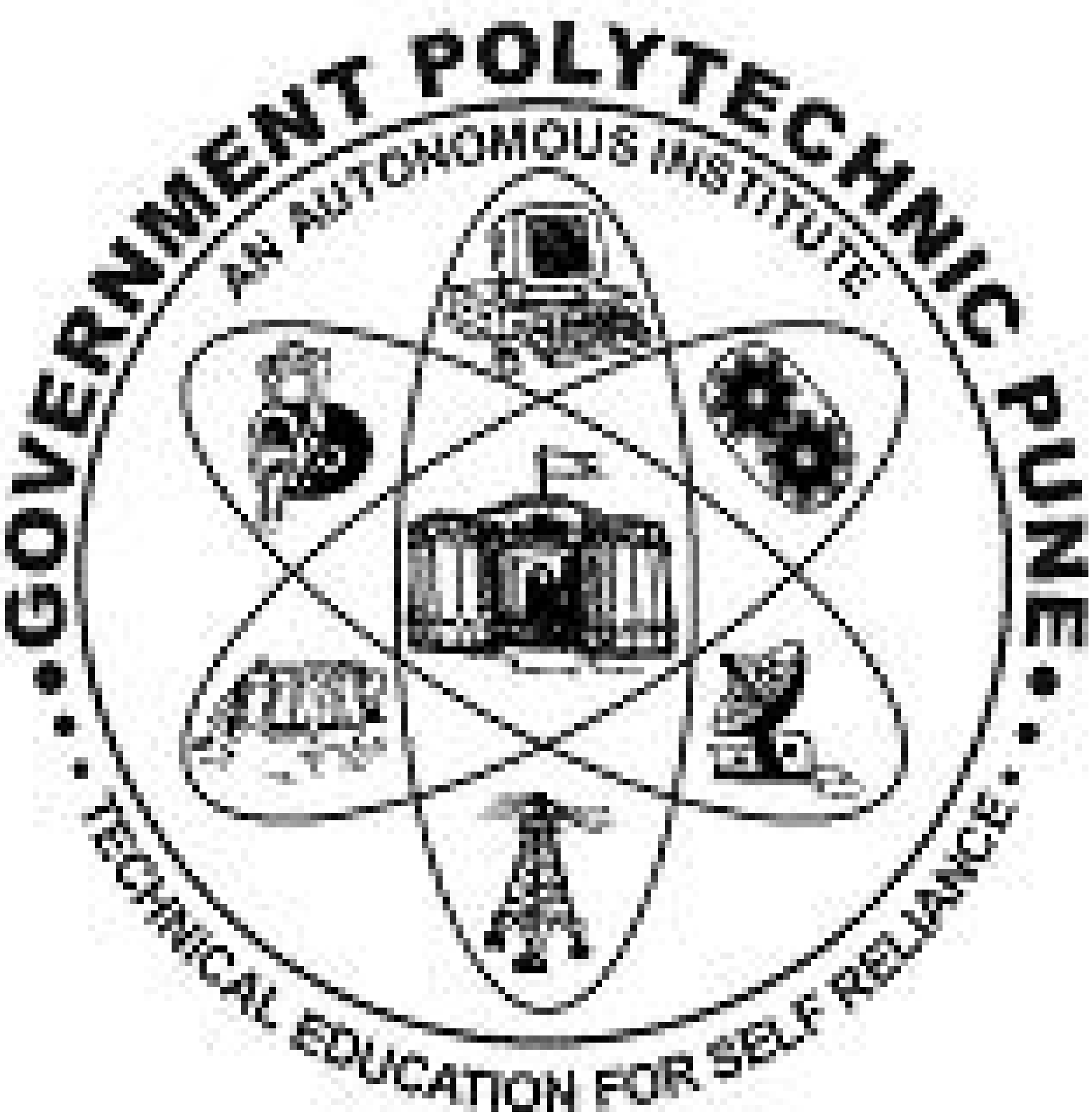
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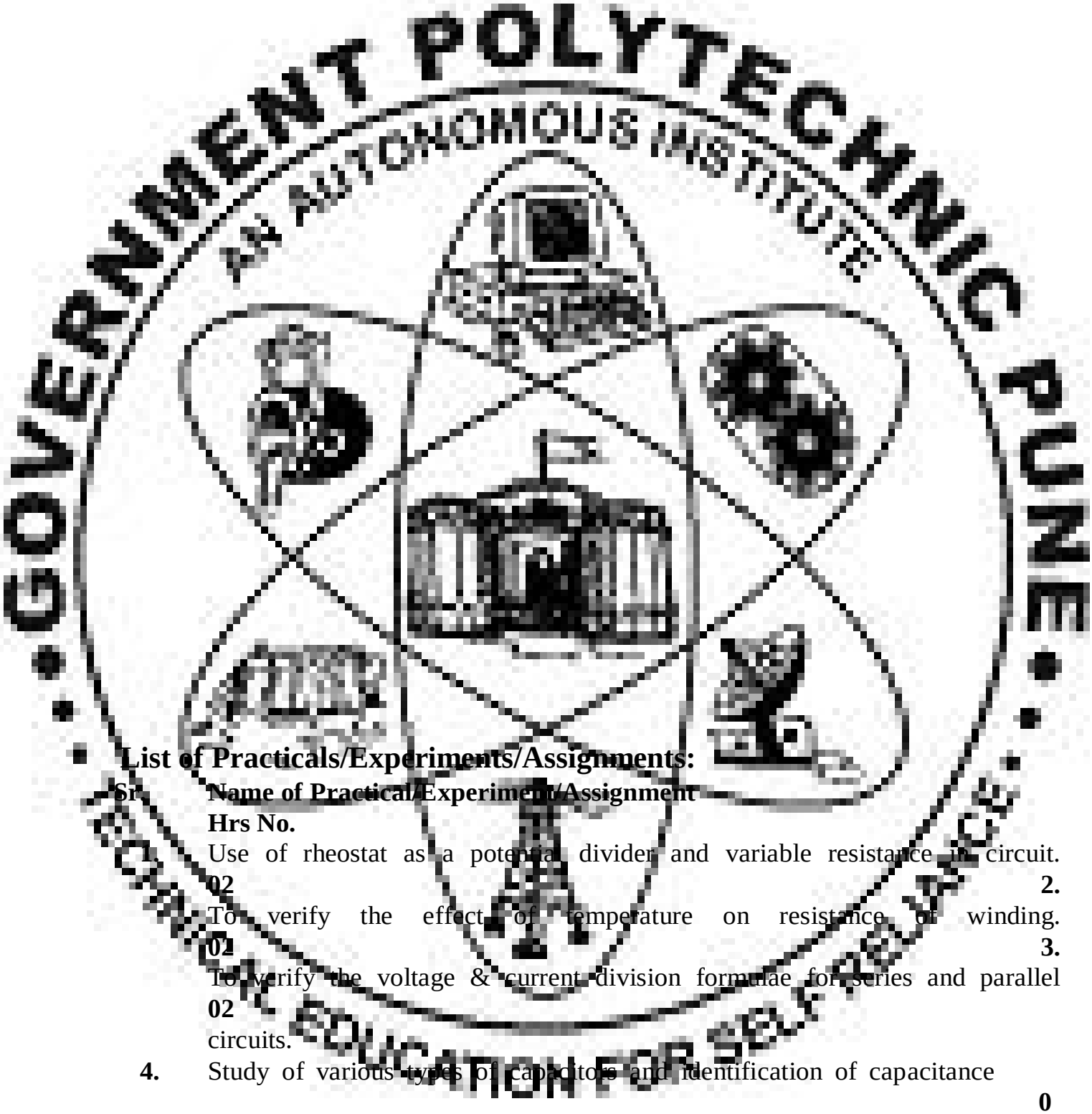

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Use of rheostat as a potential divider and variable resistance in circuit.	02
2.	To verify the effect of temperature on resistance of winding.	02
3.	To verify the voltage & current division formulae for series and parallel circuits.	02
4.	Study of various types of capacitors and identification of capacitance value using colour code and its verification using LCR meter.	04

OVERNMENT POLYTECHNIC, PUNE (An Autonomous Institute of Govt. of Maharashtra)

PP: It stands for professional Practices. It is compulsory to all students & they must complete in a group of 4-5 students for different loads.

Instructional Strategy:

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Text Books:

Sr. No	Author	Title	Publication
1	B.L. Theraja	Electrical Technology Vol. I	S. Chand Publication, Delhi
2	V.N. Mittle	Basic Electrical Engineering	Tata McGraw Hill Publishing Company Ltd., New Dlhi.

Reference Books:

Learning Resources: Books, Models, Charts and Drawings & Audio/ visual CDS

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	D. C. Circuits	02	04	04	10
2.	Energy conversion	02	02	08	12
3.	Electrostatics	02	04	06	12
4.	Electromagnetism:	02	04	06	12
5.	Electromagnetic induction	02	04	06	12
6.	A.C. Fundamentals	02	04	04	10
7.	Battery	04	04	04	12
	Total	**16**	**26**	**38**	**80**

(Prof. K.M.Kakade)	**(Prof. S. B. Kulkarni)**	**(Prof. D.A.Katare)**
Prepared By	**Secretary, PBOS**	**Chairman, PBOS**

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in EE / ET
Programme Code : 02/03/16/17
Name of Course : Fundamentals of Electronics Engineering
Course Code : ET 261

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests , each of 60 minutes	3 hrs.	3 hrs.	--	--
Marks	**20**	**80**	**50**	--	

Course Rationale:

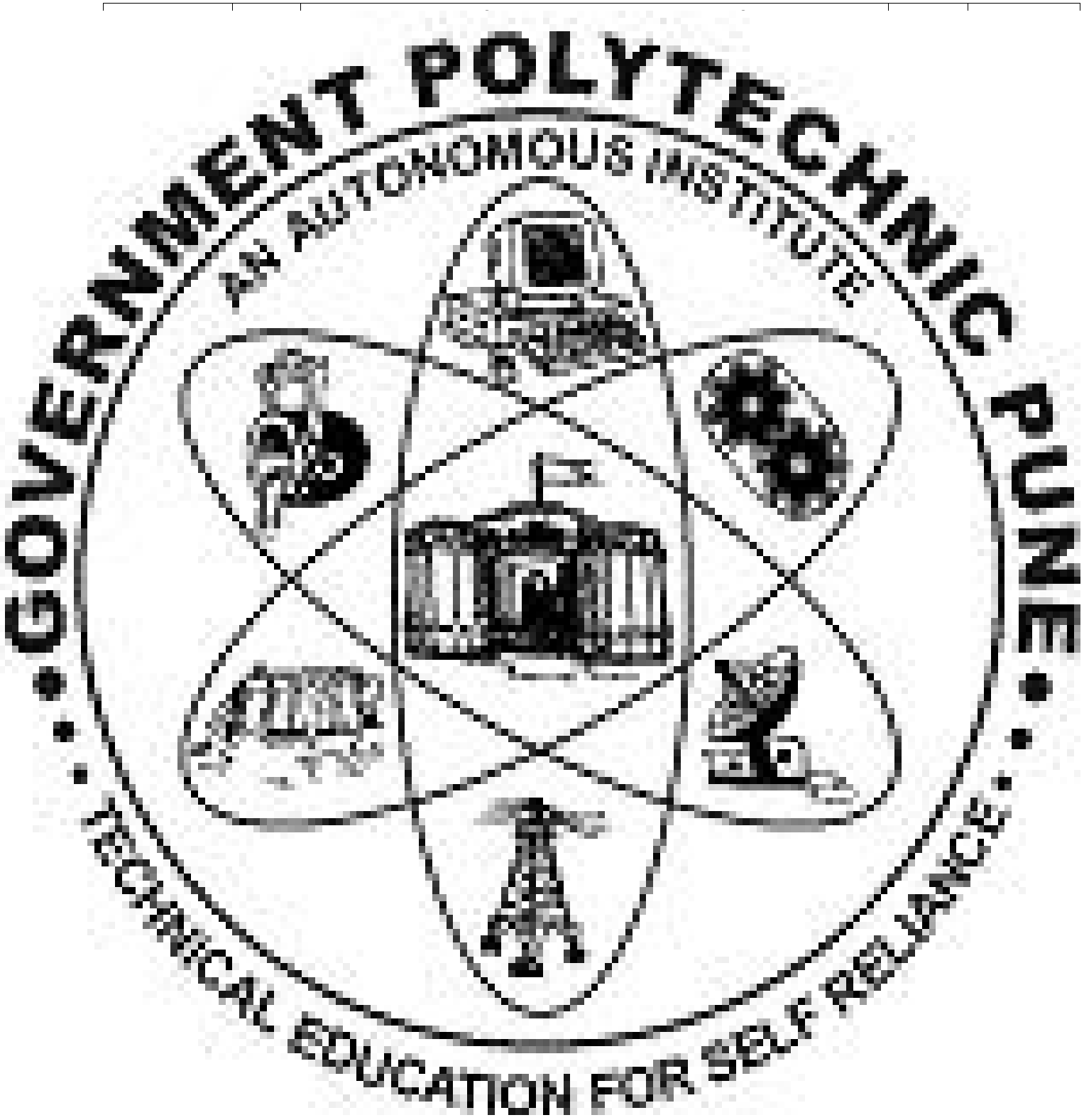
This course will be useful to understand the construction, working and applications of semiconductor devices and circuits.

Course Objectives:

After studying this course, the student will be able to
Describe the formation of PN junction.
Draw the characteristics of basic components like diode, transistor etc.
Draw and describe the basic circuits of rectifier, filter, regulator and amplifiers.
Know voltage amplifiers.
Read the data sheets of diode and transistors
Explain construction, working, characteristics and applications of semiconductor devices and circuits.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Semiconductor devices**		
	Concept & principles of electronics devices,		
1.1	**Rectifying diode** : Review of P-type and N-type semiconductor PN junction ,Barrier voltage, depletion region ,Junction capacitance ,Forward biased & reversed biased junction Diode symbol , forward & reverse Characteristics of PN junction diode Specifications :- Forward voltage drop , Reverse saturation current, maximum forward current , power dissipation , package view of diodes of different power ratings (to be shown during practical hours)	**08**	**14**
1.2	**Zener diode** construction, symbol , , circuit diagram for characteristics (forward &reversed) Avalanche & zener breakdown ***Specifications:-*** Zener voltage , power dissipation , break over current, dynamic resistance & maximum reverse current (to be shown during practical hours)		
1.3	**Optical Diodes** LED, IRLED, photo diode, LDR and laser diode, Symbol, operating principle & applications of each.		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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Forward & Reverse characteristics of diode (1N4001, BY127, 1N4007)	02
2.	Forward & Reverse characteristics of Zener diode	02
3.	Study of Rectifiers a] Half wave b] Full wave (Center tapped & Bridge) (Waveforms, AC (r.m.s.) voltage at input, AC (r.m.s.) voltage at out put , D.C. output voltage, Ripple factor, PIV.)	02
4.	Study of filter circuits. a] Capacitor Filter b] Inductor filter. (Using rectifier circuits. Measurement of Vac, Vdc)	02
5.	Input & output characteristics of transistor in CE mode. (Measurement of β, β D.C. & R0)	02
6.	Input & output characteristics of transistor in CB mode. (Measurement of α, α D.C. & R0)	02
7.	Characteristics of FET. (Measurement of rd & gm.)	02
8.	Characteristics of UJT. (To Find out intrinsic stand-off ratio .η, Vp, Vv, Ip & Iv)	02
9.	Characteristics of Phototransistor.	02
10.	Plot Frequency response & band width of negative feedback amplifier (Verification of band-width With & without Feedback.)	02
11.	Study of Colpitt's oscillator (To Plot & Measure the frequency of Oscillation)	02
12.	Study of Hartley oscillator (To Plot & Measure the frequency of Oscillation)	02
13.	Study of RC Phase shift oscillator (To Plot & Measure the frequency of Oscillation)	02
14.	Study of RC Wein Bridge oscillator (To Plot & Measure the frequency of Oscillation)	02
15.	Study of Two stage RC coupled amplifier Frequency response (To plot the frequency response on Semi-Log Paper & find Band-width).	02
16.	Find load and line regulation of series and shunt regulator.	02
	Total	**32**

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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1	Semiconductor devices.	Classroom teaching and laboratory work.
2	Rectfires and Filters	Classroom teaching and laboratory work.
3	Transistors	Classroom teaching and laboratory work.
4	Biasing of BJT	Classroom teaching and laboratory work.
5	Small Signal Amplifiers	Classroom teaching and laboratory work.
6	Regulated power supply	Classroom teaching and laboratory work.
7	Feedback Amplifires and Oscillators	Classroom teaching and laboratory work.

Text Books:

Sr. No	Author	Title	Publication
5.	Albert Malvi	Basic Electronics.	Tata McGraw Hill
6.	J.S Katre.	Basic Electronics.	Tech-Max.
7.	B.L.Theraja.	Basic Electronics.	S.Chand.
8.	N.N.Bhargava, D.C. Kulashreshtha, S.C. Gupta - TTTI	Basic Electronics & Linear Circuits	Tata McGraw Hill
9.	Grob Bernard	Basic Electronics	Tata McGraw Hill
10.	David J. Bell	Electronics Devices & Circuits	Prentice Hall of India

Reference Books:

Sr. No	Author	Title	Publication
7.	Mottershed	Electronics Devices and Circuits	Prentice Hall of India
8.	Milmann Halkies	Electronics Devices and Circuits.	Tata McGraw Hill

Learning Resources: Reference Books, Data Manual

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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Semiconductor devices.	06	06	02	14
2.	Rectifiers and Filters	04	04	02	10
3.	Transistors	06	04	02	12
4.	Biasing of BJT	06	04	02	12
5.	Small Signal Amplifiers	06	04	02	12
6.	Regulated power supply	04	02	02	08
7.	Feedback Amplifires and Oscillators	06	04	02	12
	Total	**38**	**28**	**14**	**80**

(Prof.R.M. Adgaonkar)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

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Programme : Diploma in EE / ET / CM / IT
Programme Code : 02 / 03 / 05 / 07/16/17
Name of Course : Graphics Skills & Auto CAD
Course Code : ME261

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination Theory	Practical	Oral	Termwork
Duration	---	---	---		---
Marks	---	---	50	---	50

Course Rationale:

Engineering drawing is the graphical language. It is used by engineers, designers, planners, supervisors and also the workers to express their thoughts, ideas and concepts. The expression by drawing is very accurate, precise and brief. At a glance one can understand detailed description of any part to be manufactured or a dam to be built or an electric circuit to be used. For all technicians through understanding of principles of engineering drawing (Graphic Skills) is essential.

Course Objectives:

After studying this course, the student will be able to

Draw various engineering curves.
Incorporate Indian Standards in drawings.
Sketch various orthographic and isometric views.
Draw all different views from given components vis-à-vis.

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Draw free hand sketches.
Have hands on experience on AutoCAD.
Understand use of AutoCAD in 2D drawing.
Convert 2D drawing into AutoCAD drawing

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs.	Weightage
	SECTION-I		
1.	**Introduction of Drawing Instruments, Lines, Letters etc.** 1.1 Use of different drawing equipments. 1.2 Types of letters. 1.3 Conventions of lines. 1.4 Scale.	02	--
2.	**Curve and Tangential Exercises** 2.1 Geometrical constructions and tangential exercises. 2.2 To draw an ellipse by concentric circle method. 2.3 To draw a parabola by : i) Directrix-focus method. 2.4 To draw a hyperbola by : i) Directrix focus method.	04	--
3.	**Orthographic Projections** 3.1 Introduction to orthographic projections, first and third angle method of projection. Conversion of simple pictorial view. Dimensioning technique.	10	--
4.	**Sectional Orthographic Projections** 4.1 Introduction, converting the given pictorial view into sectional views.	06	--
5.	**Isometric Views** 5.1 Isometric scale and isometric views of simple objects. 5.2 Isometric views of rectangular, cylindrical objects, slots on sloping surface.	08	--
6.	**Free Hand Sketches** 6.1 Free hand sketches of respective branches	02	--

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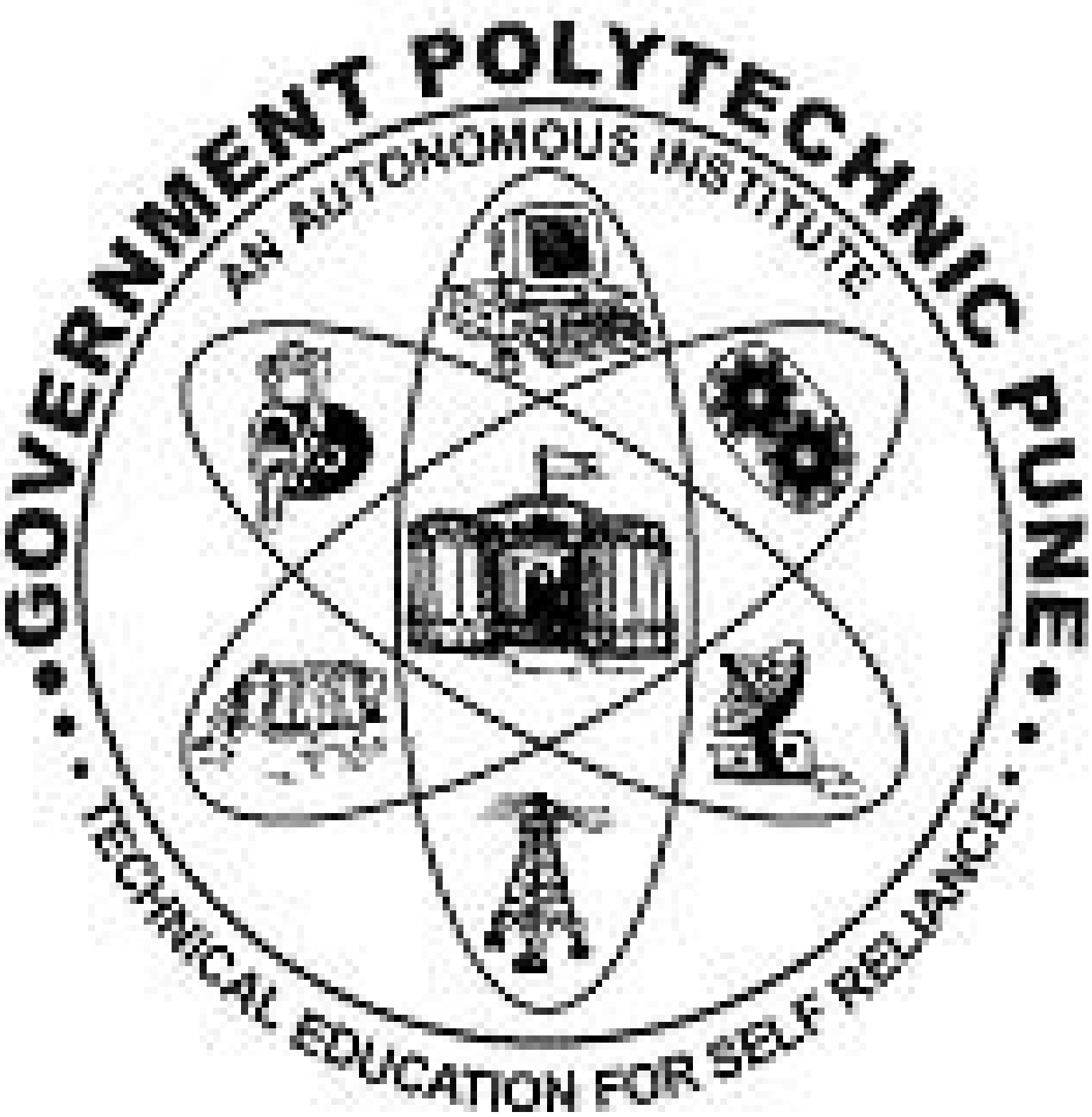
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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs.
	SECTION - I	
	5 sheets on topics covered in the syllabus.	
1.	Line letters and numbers. (Sheet No. 1)	**02**
2.	Engineering curves and tangential exercises. (Sheet No. 2)	**04**
3.	Orthographic projection. (Sheet No. 3)	**10**
4.	Sectional views(Sheet No. 3)	**06**
5.	One sheet Isometric projection(Sheet No. 4)	**08**
6.	Free hand sketches. (Sheet No. 5)	**02**
	Total	**32**

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Note: 1) Th-2 & PR-2 for Graphic Skills, Th-0 & PR-2 for Intro to CAD
2) Term work evaluation on Graphic skill & Practical evaluation on AutoCAD

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION-I	
1.	Curves and tangential exercises	Demonstrations and classroom teaching.
2.	Orthographic projection	Use of models and classroom teaching.
3.	Sectional views	Use of models, transparencies and classroom teaching.
4.	Missing views	Classroom teaching, self study and assignments.
5.	Isometric views	Classroom teaching and use of models.
6.	Free hand sketches	Self study, assignments.
	SECTION -II	
7.	Introduction	Classroom teaching and Computer Lab. teaching
8.	Initial Setting And Drawing Aids	
9.	Basic 2D Commands	
10.	Dimensioning	
11.	Layer & Line Properties	
12.	Blocks And Attributes	
13.	Hatching	

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Text Books:

Sr. No	Author	Title	Publication
1.	N.D. Bhatt	Elementary Engg. Drawing (Including plan and solid geometry)	Charotar Publication, Anand.
2.	Mali, Choudhary	Engineering Drawing	Vrinda Prakashan, Jalgaon
3.	K. Venugopal	Engineering Drawing and Graphics + AutoCAD	New Age International Publishers.

Reference Books:

Sr. No	Author	Title	Publication
1.	N.D. Bhatt	Geometrical and Machine Drawing	Charotar Publication, Anand.
2.	--	I.S.C.6 Latest version	B.I.S.
3.	Curriculum Development Centre, TTTI, Bhopal.	A Workbook in Engineering Drawing	Somaiyya Publication Pvt. ltd., Mumbai
4.	--	SP 46 – 1988	B.I.S.
5.	G.R. Nagpal	Machine Drawing	--

Learning Resources: Video cassettes No. 122, 123 of G.P.P. Library

(Prof. M. R. Mundhe)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

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Programme : Diploma in EE
Programme Code : 02/16
Name of Course : Workshop Practice
Course Code : WS265

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	--	--	--	--	--
Marks	--	--	--	--	**50**

Course Rationale:

To make the students conversant with use of various workshop tools used in Welding, Sheet metal, Carpentry & Plumbing shops.

Course Objectives:

After studying this course, the student will be able to

- Interpret the assigned job drawing.
- Identify various tools used in different shops of Work shop.
- Select appropriate tool set to perform a specific job.
- Acquire skills to use various tools.
- Take care and maintain the tools.
- Wires and cable joints.
- Soldering of electrical components.
- Testing of tubes.

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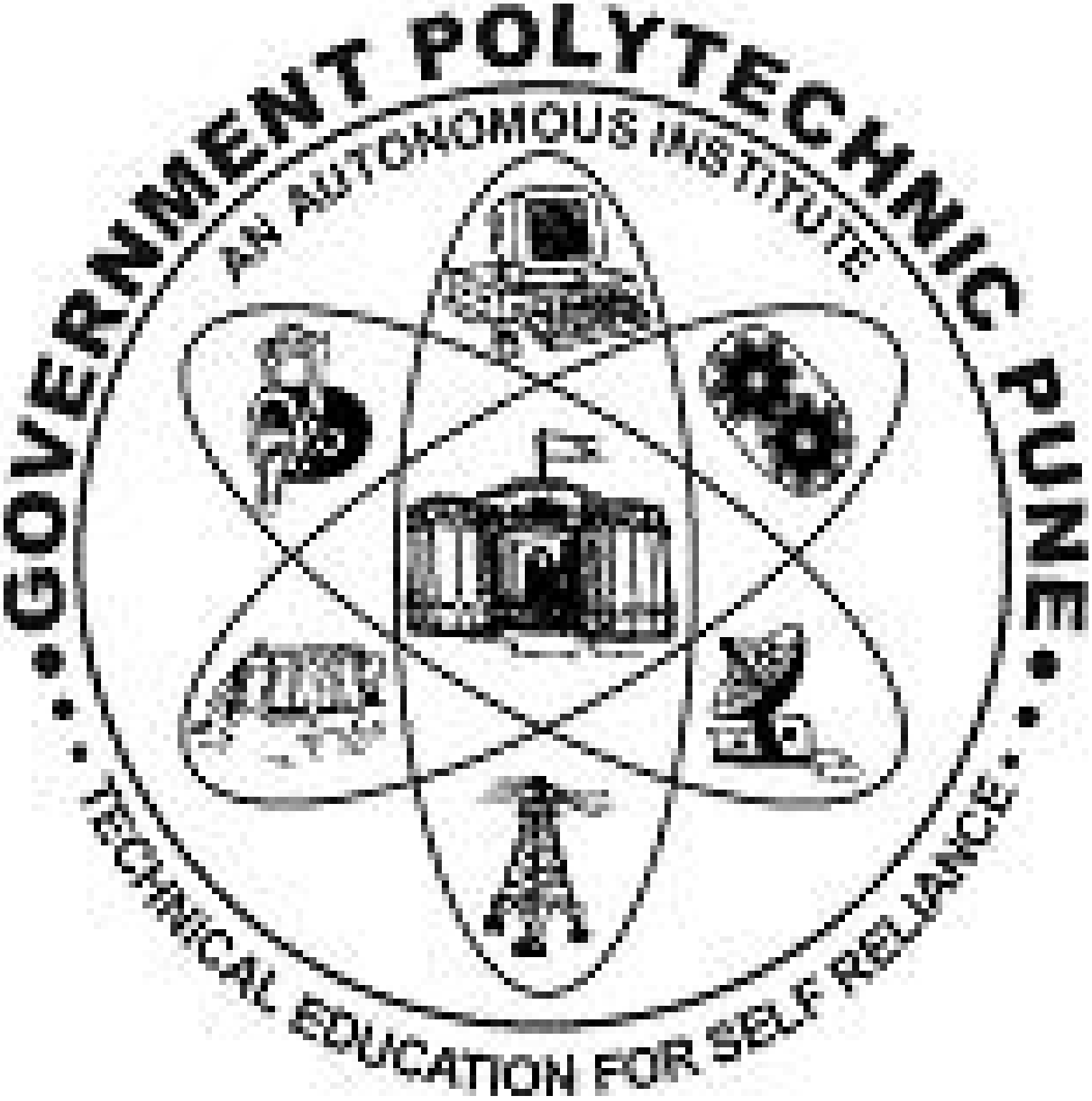
Course Content:



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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
	SECTION – I : Workshop Department	
1.	One useful welding Job involving welding joints.	**08**
2.	One useful carpentry job involving carpentry joints and wood turning	**08**
3.	One job in plumbing of pipe threading and pipe joints.	**08**
4.	One job in Sheet metal	**08**
	SECTION – II : Electrical Portion	
5.	Testing of D.C. supply / A.C. single phase and Three phase supply by different methods.	**04**
6.	Wires, Joints and cable termination by using different tools (Demonstration of wiring tools).	**08**
7.	Testing Florissant tube and its accessories.	**04**
8.	Soldering of electrical and electronic component on general purpose PCB.	**06**
9.	Assembly of computer system.	**10**
	Total	**64**

Note : Journal writing and submission on above given topics.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Welding	Explanation, Demonstration, exhibition of Models/samples pieces.
2.	Carpentry	Explanation, Demonstration, exhibition of Models/samples pieces.
3.	Plumbing	Explanation, Demonstration, exhibition of Models/samples pieces.
4.	Sheet metal	Explanation, Demonstration, exhibition of Models/samples pieces.

Text Books:

Sr. No	Author	Title	Publication
1.	Mali and Chan	Elements of electrical and mechanical technology(Mechanical technology portion)	Nirali and Pragati Prakashan

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Reference Books:

Sr. No	Author	Title	Publication
1.	S. K. Hajara Choudhari A. K. Hajara houdhari	Elements of workshop technology – Vol. I	Media promoters and Publishers Pvt. Ltd., Mumbai-7
2.	V. Kapoor	Workshop practice Manual	Dhanpat Rai and sons, New Delhi – 32
3.	B. S. Raghuwanshi	A course in workshop technology Vol-I	Dhanpat Rai and sons, New Delhi – 32.

Learning Resources: Demonstration kit, charts, models/sample pieces and books. Demonstration kit, charts, models/sample pieces and books.

Specification Table:

(Prof. Hamid Zaheer & Prof.K.M.Kakade) Prepared By | **(Prof. S. B. Kulkarni) Secretary, PBOS** | **(Prof. D.A.Katare) Chairman, PBOS**

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Programme : Diploma in CE/EE / ET/ ME/MT/ CM / IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Environmental Science
Course Code : AU 361

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Theory	Semester End Examination Practical	Oral	Termwork
Duration	Two progress tests of 60 min. Duration	3 hours	---		---
Marks	20	80	---	---	---

Course Rationale:

This course has been introduced to make young engineers aware of the relation between society and environment; the global environmental issues, etc. To motivate them for environmental management and to adopt sustainable development practices.

Course Objectives:

Harmony between society and environment.
Understand global environmental issues.
Understand environmental pollution and remedial measures.
Select environmental management practices.
Adopt the sustainable development strategies in career.

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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Introduction**		
	1.1 Society and environment, Indian traditions, customs and culture,	**04**	**08**
	1.2 Role of festivals in protecting environment.		
	1.3 Impact of population on environment.		
	Developments and Environment		
	2.1 Agriculture and Industry as major sectors of development.		
	2.2 Impact of development on environment – changing pattern of land use, land reclamation, deforestation, resource depletion, environmental degradation.	**06**	**6**
	2.3 Role of society in sustainable development – public awareness through education, campaigns, etc., public participation in decision making.		
	2.4 Causes of lack of environmental awareness, measures to increase public awareness.		
3.	**Environmental Pollution**		
	3.1 Causes, effects and measures to reduce – air pollution, water pollution, soil pollution, sound pollution.	**06**	**10**
	3.2 Pollution due to radioactive causes, consequences including human diseases.		
	3.3 The price of civilization.		
4.	**Global Environmental Issues**		
	4.1 Ozone layer depletion and its effects.		
	Greenhouse effect – global warming climate changes, 4.2 their effects on human, agriculture, animals, plants.	**06**	**16**
	Disasters - Natural (droughts, floods, earthquakes, 4.3 cyclones, landslides, avalanches, Tsunamis). Manmade (industrial, technological, atomic). Their impact on environment, prevention and control.		

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
1.	Group Discussion. & Assignment on Developments and Environment	02
2.	Group Discussion Assignment. Articles collection from newspapers, internet on Environmental Pollution.	02
3.	Assignment, Articles collection from newspapers, internet on Global Environmental Issues.	04
4.	Assignment on Global Environmental Issues	04
5.	Assignment on Environmental Management	04
	Total	**16**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction	Class room teaching
2.	Developments and Environment	Class room teaching, Group Discussion.

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Text Books:

Sr. No	Author	Title	Publication
1.	Environmental Engineering	A. Kamala	Tata Mc Graw Hill, New Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	Environmental Engineering.	TTTI Madras Chennai	Tata Mc Graw Hill, New Delhi

Learning Resources: Internet, Daily News papers, Environmental magazines

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction	04	04	---	08
2.	Developments and Environment	10	06	--	16
3.	Environmental Pollution	04	06	06	16
4.	Global environmental issues	04	06	06	16
5.	Environmental Management.	04	04	04	12
6.	Sustainable Development	04	04	04	12
	Total	**30**	**30**	**20**	**80**

(Prof. R.H.Dhorje)	(Prof. S. B. Kulkarni)	(Prof. D.A.Katare)
Prepared By	**Secretary, PBOS**	**Chairman, PBOS**

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Programme : Diploma in CE/EE/ ET/ ME/MT/ CM/ IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Community Development
Course Code : ZCU 302

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests of 60 min. Duration	3 Hrs	---	---	---
Marks	20	80	--	---	---

Course Rationale:

The course has been introduced to make young Engineers especially aware of the present status of Villages &to motivate them to make improvement in villages when they start their Engineering carrier.

Course Objectives:

Able to understand present situation in villages and realize the gravity of the village development.
Able to make survey of villages, collect the data, analyze it and identify the area of development.
Able to identify the available natural resources and how they can be utilized for betterment of villages.
Able to collect the useful information for starting probable new industries in villages.
Able to guide villagers in building low cost durable houses taking in to considerations weather conditions of that area.

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Able to guide villagers for development good habits regarding health and hygiene.
Motivated to bring about all round development of villages.

Course Content:

Chapter No	Name of Topic/Sub topic	Hrs	Weightage
1.	**Introduction** 1.1 Present status of rural and urban community. 1.2 Necessity of community development. 1.3 Identifying needs of community, Ways to develop community.	**02**	**04**
2.	**Human Power Development:** 2.1 Present scenario of Human power in India, 2.2 Socio economic survey to ascertain requirements of human requirements. 2.3 Methodology for training the human power 2.4 Wage employment and self employment, 2.5 Support from financial institutions for self employment.	**04**	**08**
3.	**Appropriate Technology and Technology Transfer** 3.1 Technological development of India, Additional needs of community due to technology development 3.2 Classification of rural industries, 3.3 Areas of appropriate technology, 3.4 Use of locally available materials, 3.5 Methods of transfer of technology, Project reports preparation.	**04**	**12**
4.	**Industrialization** 4.1 Present status of rural traditional industries,	**04**	**12**

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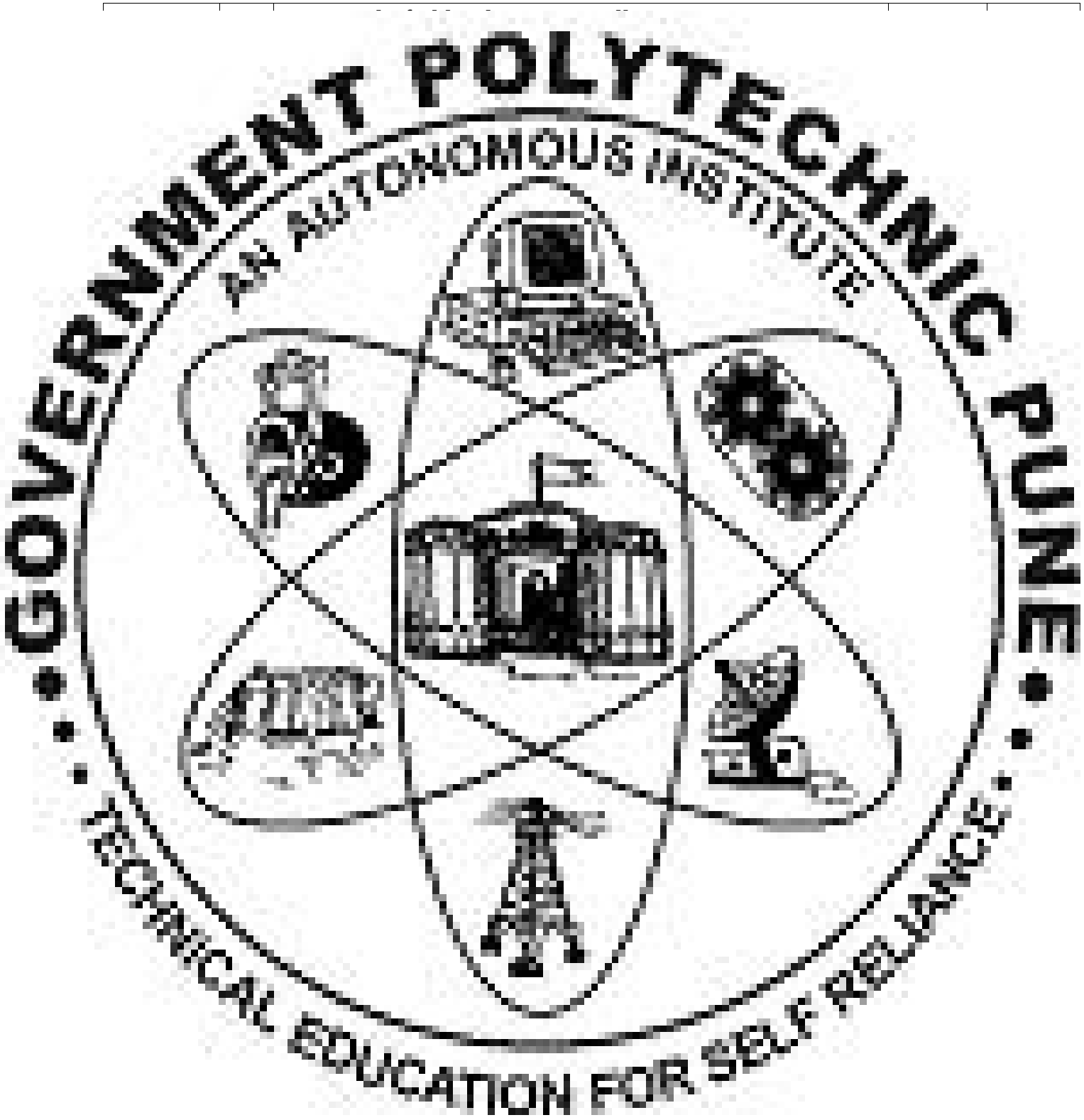
GOVERNMENT POLYTECHNIC PUNE
AN AUTONOMOUS INSTITUTE
TECHNICAL EDUCATION FOR SELF RELIANCE

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Assignment on manpower development	02
2.	Assignment on appropriate Technology and technology transfer.	02
3.	Assignment on renewal of old industries in villages	04
4.	Assignment on Non-conventional energy sources.	04
5.	Assignment on Waste Management	04
	Total	**16**

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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction	Class rooms teaching
2.	Man power developments	Class rooms teaching, data collection
3.	Appropriate technology & technology transfer	Class rooms teaching
4.	Industrialization	Class rooms teaching
5.	Non-conventional energy sources	Class rooms teaching
6.	Community services	Class rooms teaching
7.	Developments	Class rooms teaching

Text Books:

Sr. No	Author	Title	Publication
1.	Katay Sing	Rural Development Principles, Policies and management.	---
2.	S.P. Sukhatme	Solar Energy	---
3.	G.P. Rai	Non-Conventional Sources of Energy	---
4.	Debendra K. Das	Dynamics of rural development perspectives	Deep & Deep Publications Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	T.T.T.I. Madras	Environmental Engg.	Tata McGraw Hill Publishing Co. Ltd. New Delhi

Learning Resources: Nil

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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction	02	04	--	06
2.	Man-power development	04	04	--	08
3.	Appropriate technology & its transfer	04	04	04	12
4.	Industrialization	06	04	04	14
5.	Non-conventional Energy Sources	08	06	06	20
6.	Community Services	06	04	--	10
7.	Developments	06	04	--	10
	Total	**36**	**30**	**14**	**80**

(Prof. R. H. Dhorje)
Prepared By

(Prof. S. S. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

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Programme : Diploma in CE/EE/ET/ME/MT/CM/IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Renewable & Sustainable Energy Management
Course Code : AU 363

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination: Theory	Practical	Oral	Term work
Duration	Two class tests of 60 Min. Duration	3 Hrs	---	---	---
Marks	20	80	---	---	---

Course Rationale:

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

Course Objectives:

Know the National scene of energy production, utilization, consumption and reserves.
Appreciate the need for non-conventional energy sources.
Understand relative advantages and disadvantages of various non-conventional energy sources.
Develop awareness for effective utilization of alternative energy sources.

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Identify different components of solar energy and wind energy sources.

Identify and analyze biomass plant.

Identify and apply energy conservation techniques for commonly used Power absorbing and generating devices.

Apply principles of energy conservation and energy management techniques

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Review of conventional sources of energy** Types of conventional energy sources availability, important plant in India, India's production and reserves for fossil fuels, waterpower, nuclear power, need for non-conventional energy sources, Environmental impact of various energy sources.	04	06
2.	**Solar Energy** Principle of conversion of solar energy into heat and electricity, solar radiation. Solar radiations at earth's surface, Solar radiation geometry- declination, hour Angle, altitude angle, incident angle, zenith angle, solar azimuth angle.		
	Applications of Solar energy- construction and working of typical flat plate Collector, solar concentrating collectors and their applications, advantages and limitations. Space heating and cooling, photovoltaic electric conversion, Solar distillation, Solar cooking and furnace, Solar pumping and Green house, Agriculture and industrial process heat.	06	16

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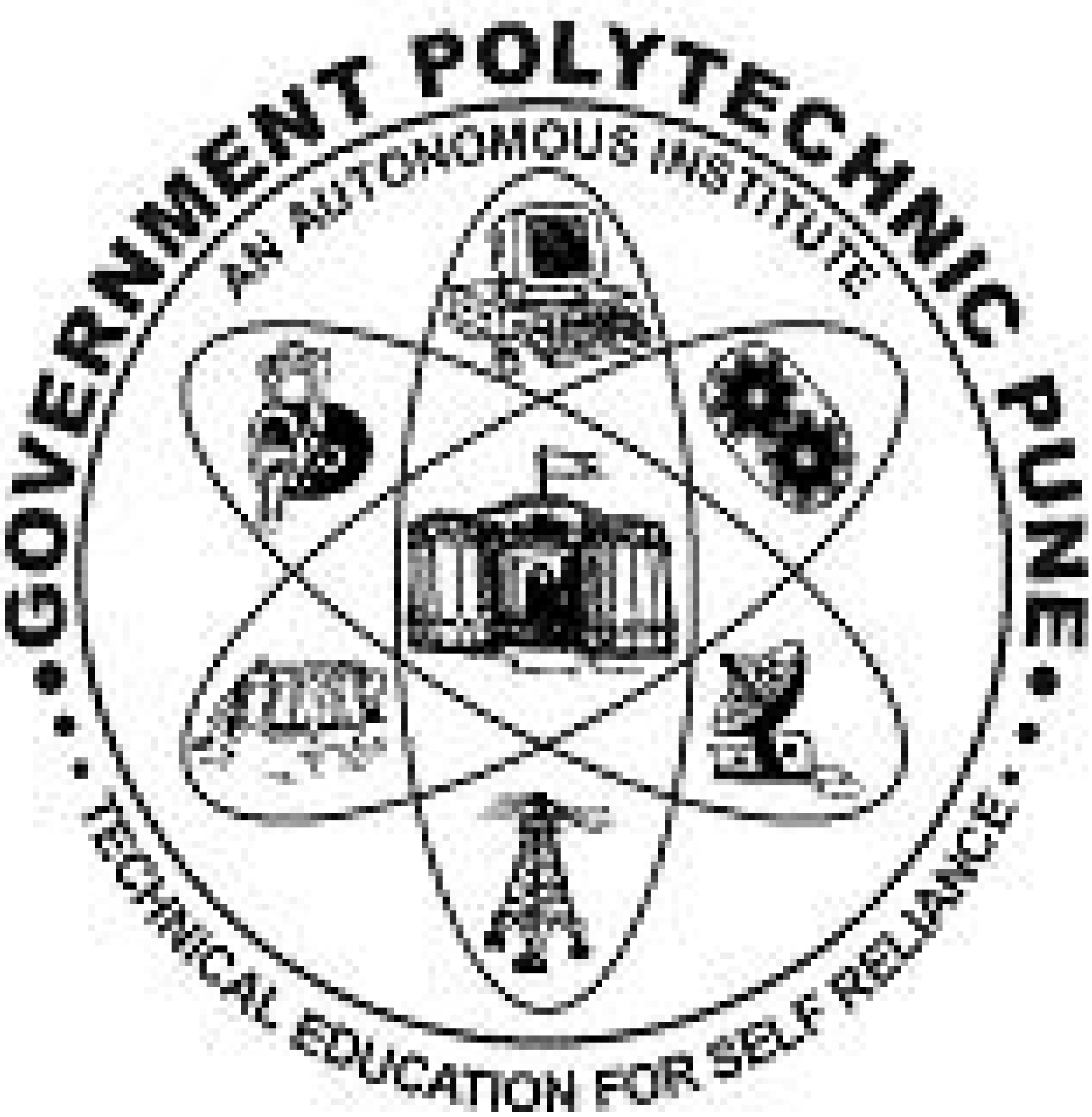
GOVERNMENT POLYTECHNIC PUNE
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TECHNICAL EDUCATION FOR SELF RELIANCE

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical / Experiment/Assignment	Hrs
1.	To collect information about global and Indian energy market	04
2.	One field visit to be conducted to demonstrate application of Solar Energy	04
3.	One field visit to be conducted to Wind Mill	04
4.	To visit a biomass/ biogas plant of municipal waste or elsewhere.	04
5.	Perform energy audit for workshop/Office/Home/SSI unit.	04
	Total	60

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Review of conventional sources of energy	Classroom teaching and Internet browsing
2.	Solar Energy	Classroom teaching and field visits, use of charts
3.	Wind Energy	Classroom teaching, field visit & use of charts
4.	Energy From Biomass	Classroom teaching, field visit & use of charts
5.	Geothermal Energy	Classroom teaching and Internet browsing
6.	Tidal Energy	Classroom teaching and Internet browsing
7.	Energy Conservation	Classroom teaching
8.	Energy Conservation Techniques	Classroom teaching and case study

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Text Books:

Sr. No	Author	Title	Publication
1.	Non-conventional energy resources	Dr B.H.Khan	Tata McGraw Hill
2.	Non-conventional Energy Resources	G. D. Rai	Khanna publication

Reference Books:

Learning Resources: Charts of solar water heater and cooker, Models of solar water heater and cooker, Photovoltaic cells etc., video cassette no.131, 365 of G.P.P. library

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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Review of conventional sources of energy	06	--	--	06
2.	Solar Energy	02	06	08	16
3.	Wind Energy	04	04	04	12
4.	Energy From Biomass	04	04	04	12
5.	Geothermal Energy	06	--	--	06
6.	Tidal Energy	06	--	--	06
7.	Energy Conservation	02	04	02	08
8.	Energy Conservation Techniques	04	04	06	14
	Total	**34**	**22**	**24**	**80**

(Prof.K.M.Kakade)
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(Prof. D.A.Katare)
Chairman, PBOS

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Programme : Diploma in CE/EE/ET/ME/MT/CM/IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Engineering Economics
Course Code : AU364

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination Theory	Practical	Oral	Term work
Duration	Two class tests of 60 min. Duration	3 Hrs	---		---
Marks	20	80	---	---	---

Course Rationale:

Diploma Engineers working in middle level management are no longer confined to the role of professional technicians. They often have to take business decisions, for which they are required to apply economic concepts, logic, tools of analysis and economic theories as they advance in their carrier. It is for this reason that diploma students are required to posses some working knowledge of economic concepts, economic policy of our country, also the effects of globalization, GATT, WTO etc.

Course Objectives:

Various concepts, applications, contribution of Micro Economics and macro economics to engineering business decisions.
Consumer demand, market demand, supply and production.
Prices and cost - Break even analysis, price decisions.
Concept of National income.
Inflation, Deflation and unemployment.
Money and Banking, New economic environment.

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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Introduction to Economics**		
1.1	Engineering – Economics – Definition, Objectives, Importance	**04**	**10**
1.2	Business Economics – General concepts on micro & macro economics, Categories of Economy – Market economy , Command economy , Mixed economy.		
2.	**Demand Analysis**		
2.1	Consumer demand, utility, total and marginal utility, law of diminishing, cardinal and ordinal utility.	**07**	**20**
2.2	Law of demand, Determinants of Demand, Elasticity of demand, Factors governing the elasticity of demand		
2.3	Demand forecasting, necessity, techniques, methods		
3.	**Supply, Production and Cost analysis**		
3.1	Law of supply, Supply factors, Supply function, Equilibrium of demand and supply	**06**	**14**
3.2	Theory of production, Laws of production		
3.3	Cost concepts, Elements of costs, Preparation of cost sheet, Segregation of costs into fixed and variable costs. Break-even analysis-Linear approach (Simple numerical problems to be solved)		
4.	**Time value of money**		
4.1	Simple and compound interest	**08**	**16**
4.2	Cash flow diagram Principle of economic equivalence. Evaluation of engineering projects – Present worth method, Future worth method, Annual worth method, internal rate of return method, Cost-benefit analysis in public projects.		
4.3	Depreciation policy, Depreciation of capital assets, Causes of depreciation, Straight line method and declining balance method		

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/ Experiment/ Assignment	Hrs
1.	Assignment on Engineering costs and estimates – fixed, variable, break even	02
2.	Assignment on Cash Flows, compounding, and time value of money	02
3.	Assignment on Nominal and effective rates, compounding periods, spreadsheets	02
4.	Assignment on Depreciation	02
5.	Assignment on Replacement analysis	02
6.	Assignment on Inflation & Min. rate of return	02
	Total	**16**

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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction to Economics	Lecture method, discussion
2.	**Demand Analysis**	Lecture method, Assignment, surveys, case study, discussion
3.	Supply, Production and Cost analysis	Lecture method, Assignment, surveys, case study, discussion
4.	Time value of money	Lecture method, Assignment, surveys, case study, discussion
5.	National income and inflation	Lecture method, Literature survey, discussion.
6.	Finance, money and banking and New economic environment	Lecture method, visits, journals, review, discussion.

Text Books:

Sr. No	Author	Title	Publication
1.	D.N. Dwivedi and Abhishek Dwived	Engineering Economics	Vikas publishing House Pvt. Ltd., New Delhi,
2.	Maheshwari	Managerial Economics (2nd Ed.)	Prentice Hall of India Pvt. Ltd. New Delhi

Reference Books:

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Learning Resources: Books, Journals, and Reports etc.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction to Economics	04	04	--	08
2A.	Consumer Behaviour and Analysis	04	04	02	10
2B.	Market demand & elasticities and Fore casting	02	04	04	10
3.	Supply Production and cost analysis	06	04	04	14
4.	Time value of money	06	06	04	16
5.	National Income and Inflation	04	04	--	08
6.	Finance, Money and Banking and New economic environment	06	04	02	12
	Total	**32**	**32**	**16**	**80**

(Prof. B.Prasad)
Prepared By

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Programme : Diploma in CE/EE/E&TC/ME/MT/CM/IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Industrial Psychology
Course Code : AU 365

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Theory	Practical	Oral	Term work
Duration	**Two class tests of 60 min Duration**	**3 Hrs**	**---**	**---**	**---**
Marks	**20**	**80**	**---**	**---**	**---**

Course Rationale:

The overall purpose of the course is to acquaint with the major sub-areas within Industrial Psychology such as personality and temperament, intro on industrial psychology, psychology of management, impact of work environment upon the psychology of people in a workplace, psychology to recruitment, psychological testing, motivation influences work productivity & psychological disorders or abnormalities

Course Objectives:

Maintain harmony among workers of various departments.
Understand needs and requirements of workers.
Extract maximum work with full cooperation and optimum efforts.
Proper assigning of the job as per workers capability.
Able to improve work culture of the organization, thus improving job satisfaction of the workers.

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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weigh tage
1.	**The Practice of Industrial Psychology**		
	1.1 Definition, objectives, scope, Principles, practices and problems,	**02**	**04**
	1.2 Methods and techniques		
2.	**Understanding the Employee's Thinking**		
	2.1 Sensation and Perception, Thinking and Day Dreaming, Gestalt Approach, Unconscious and Conscious Psychic Elements,	**06**	**14**
	2.2 Explaining Behaviour, Knowledge of Brain Processes, Personal Interpretation of a Given Situation, Instinct.		
3.	**Personality & Temperament**		
	3.1 Mental & immature temperaments (e.g. Sanguine, Melancholic, Choleric, Phlegmatic), emotional types, fear, intelligence, knowledge, deviation, etc	**04**	**08**
4.	**Personnel Management**		
	4.1 Recruitment and selection, Psychological testing, Performance appraisal, training and development	**04**	**10**
5.	**Organizational Psychology**		
	5.1 Leadership, Motivation, job satisfaction and job involvement,	**06**	**14**
	5.2 Maslow's model of self actualisation, Security, Money, Ambition, Companionship, Social reinforcement, Labour wastage, etc		
6.	**Work Psychology**		
	6.1 Working conditions, Noise, Space, Light, Temperature, Speed of Work, etc. Accidents, Breakages, Fatigue etc. Safety, violence, and health in the workplace, Stress	**04**	**10**
7.	**Recruitment**		
	7.1 Ways of seeking applicants, types of interview, ways of selecting staff.	**04**	**10**

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical / Experiment/Assignment	Hrs
1.	Assignment on Identifying similarities and differences that occur in the way different employees perceive their workplace.	02
2.	Assignment on the effect of personality and temperament upon industrial psychology.	02
3.	Assignment on Identifying applications for psychological testing in industrial management.	02
4.	Assignment on Identifying ways that the work environment might impact upon the psychology of people in a workplace.	02
5.	Assignment on the application of psychology to recruitment.	04
6.	Assignment on the impact of social factors upon work productivity.	02
7.	Assignment on the significance of psychological disorders or abnormalities in a workplace.	02
	Total	**16**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	The practice of Industrial Organizational psychology	Lecture method, Assignment discussion
2.	Characteristics of work place	Lecture method, visit short report
3.	Development of Human Resources	Lecture method, case study visit
4.	Selection, psychological testing and training	Lecture method, visit demonstration
5.	Engineering psychology	Lecture method, discussion, visit case study
6.	Consumer Psychology	Lecture method, discussion, assignment case study

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Text Books:

Sr. No	Author	Title	Publication
1.	Thomas Harrel.	Industrial Psychology	
2.	K.K. Ahuja	Industrial management and organizational behaviour	Khanna Publications
3.	R.D. Agarwal	Organization & Management	
4.	O.P. Khanna , Lal	Production Technology Vol. I, II	Dhanpat Rai and sons

Reference Books:

Learning Resources:

Books, Journals, and Reports etc.

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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	The Practice of Industrial Psychology	04		--	04
2.	Understanding the Employee's Thinking	06	06	02	14
3.	Personality & Temperament	04	04		08
4.	Personnel Management	06	04	--	10
5.	Organizational Psychology	06	04	04	14
6.	Work Psychology	04	04	02	10
7.	Recruitment		06	04	10
8.	Social Considerations	06	04	--	10
	Total	**36**	**32**	**12**	**80**

(Prof. B.Prasad)
Prepared By

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Programme : Diploma in EE/ET/CM/IT
Programme Code : 02/03/06/07/16/17
Name of Course : Engineering Mathematics III
Course Code : SC362

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**02**	**32**
Practical	**01**	**16**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Termwork
Duration	Two class tests, each of 60 Min. duration	03 hrs	---	---	---
Marks	**20**	**80**	---	---	---

Course Rationale:

The student shall learn various techniques in integration and differential equations and use these techniques to their related Engineering problems.

Course Objectives:

- Apply the definition of integration as inverse of differentiation to solve Problems.
- Students will be able to apply various methods of integration..
- To apply mathematical principle to solve engineering problems.
- To draw and come to a valid conclusion.
- To locate the exceptional and critical points in an engineering system.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
1.	**Application of Integration**			
	1.1	Mean value and RMS value of the functions.	**04**	**08**
	1.2	Area under the curve and area between two curves.		
	1.3	Volume of solid of revolution.		
2.	**Differential Equations**			
	2.1	Definition, order and degree of differential equations.	**10**	**24**
	2.2	Formation of differential equations.		
	2.3	**Solution of differential equations** : (using following method) i) Variable separable, ii) Reducible to variable separable, iii) Homogeneous differential equations, iv) Exact diff. equations, v) Linear differential equations.		
3.	**Numerical Methods**			
	3.1	Solution of algebraic equations. Bisection method, Regulafalsi method and Newton – Raphson method.	**06**	**16**
	3.2	Solution of simultaneous equations containing 2 and 3 unknowns Gauss elimination method. Iterative methods- Gauss Seidal and Jacobi's method		
4.	**Complex Numbers**			
	4.1	Definition and algebra of a complex numbers.	**06**	**16**
	4.2	Geometrical representation, Argand's diagram, modulus and amplitude of a complex number. De Moivre's theorem (without proof), roots of complex number.		

5.	**Laplace Transforms**			
	5.1	Definition, Laplace Transforms of elementary functions, important properties of Laplace Transforms, Inverse of Laplace Transforms, Convolution Theorem and application of Laplace Transform for solving differential equations.	**06**	**16**
		Total	**12**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	**Name of Practical/Experiment/Assignment**	**Hr.**
1.	Application of Integration	02
2.	Differential Equations	04
3.	Numerical methods	04
4.	Complex Numbers	03
5.	Laplace Transforms	03
	Total	**16**

Instructional Strategy:

Sr. No.	**Topic**	**Instructional Strategy**
1.	Application of Integration	Classroom Teaching Method
2.	Differential Equations	Classroom Teaching Method
3.	Numerical methods	Classroom Teaching Method
4.	Complex Numbers	Classroom Teaching Method
5.	Laplace Transforms	Classroom Teaching Method

Text Books:

Sr. No	Author	Title	Publication
1.	P.N.Wartikar & J.N.Wrtikar	Engineering Mathematics I	Pune Vidyarthi Griha Prakashan, Pune
2.	Patel & Rawal	Applied Mathematics	Nirali Prakashan
3.	S.P.Deshpande	Applied Mathematics	Pune Vidyarthi Griha Prakashan,Pune
4.	G.V.Kumbhojkar	Applied Mathematics	Phadke Prakashan,Kolhapur

Reference Books:

Sr. No	Author	Title	Publication
1.	Grewal B.S.	Higher Engineering Mathematics	Khanna Publishers, New Delhi
2.	Vishwanath	Engineering Mathematics Vol.II	Satya Prakashan, New Delhi
3.	B.L.Agarwal	Basic Statistics	New Age International Publication
4.	H.K. Dass	Engineering Mathematics Part II	S. Chand & Co.Ltd. Delhi

Learning Resources:

Chalk Board

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Application of Integration	00	00	08	08
2.	Differential Equations	04	12	08	24
3.	Numerical Methods	04	04	08	16
4.	Complex Numbers	04	04	08	16
5.	Laplace Transforms	04	04	08	16
		Total 16	**24**	**40**	**80**

(Prof. R.A.Pawar)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in CE/EE/ET/ME/MT/CM / IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Development of Soft Skills - II
Course Code : NE 376

Teaching Scheme:

* NON EXAM.NON CREDIT COURSES (COMPULSORY) - B # Credits 0yet & above 180 credits

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	---	---	---	---	---
Marks	---	---	---	---	**25**

Course Rationale:

This course aims to make students aware of good interpersonal relations, Professionalism in etiquettes, importance of time management and importance of good health. The techniques such as role play, group discussions can be used effectively to demonstrate understanding emotions of persons in daily contact.

Course Objectives:

1. Develop better interpersonal relations among their peer group, subordinates and superiors and work effectively.
2. Display corporate etiquettes and professionalism while attending /answering phone calls. Plan time optimally/effectively in office & work as well for their personal growth.
3. Understand strengths and weaknesses of self.
4. Understand /feel emotions of persons (from office and family) in daily contact and take appropriate actions.

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Demonstrate habits for keeping good health by following good food habits and daily exercise.
Develop overall personality and be successful in his/her career.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
	Interpersonal Skills through Personal Development		
	1.1 Reducing conflict by preventing problems in the classroom.	**03**	--
	1.2 Interpersonal Skills through Self Development and change.		
2.	**Corporate Etiquettes & Professionalism**		
	2.1 Understanding Self		
	2.2 Polished personal habits		
	2.3 Basics & Etiquettes: a way of life	**03**	
	2.4 Personal Attire & Grooming		
	2.5 Cell phone manners		
3.	**Time Management**		
	3.1 Time management skills in groups for completion of project		
	3.2 Factors that lead to time loss and how they can be avoided	**03**	
	3.3 Time matrix & urgent versus Important jobs		
4.	**Managing Emotions**		
	4.1 To understand and identify emotions,		
	4.2 To know our preferences		
	4.3 Strength, weaknesses, opportunities and threats , Techniques of self control	**03**	--
	4.4 To get desirable response from others		
5.	**Health Management**		
	5.1 Importance of health management,		
	5.2 Relevance of it ,	**04**	--
	5.3 Tips to maintain good health		
		Total **16**	--

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
1.	Case studies to be discussed in a group and presentation of the same by group/group leader.	04
2.	Field exercises for the group of students.	02
3.	Role play by individual/group leader.	04
4.	Arranging Quizzes, puzzle- solving and educational games.	02
5.	Group discussions.	04
6.	Sharing of self -experiences in a group.	04
7.	Brain storming sessions	02
8.	Questionnaire -filling & discussing results of the same in a group.	04
9.	Live demonstrations on Yoga and other stress relieving techniques by professional persons.	04
	Total	**32**

Reference Books:

Sr. No	Author	Title	Publication
1.	Mr. Shiv Khera	Yoga	
2.	Mr Abdul Kalam	Wings of Fire	
3.	Mr Nirfarake	Prabhavi Vyaktimatwa.(Marathi)	
4.	Mr Iyyengar	YogaDipika	
5.	Mr. Anand Nadkarni	Tan-tanavache niyojan (Marathi)	
6.	Mr. Rajiv Sharangpani	Khusit raha ,Mast Jaga.(Marathi)	

Learning Resources: Video cassettes on 1. Effective Comminication 2. Group Discussions ,3. Corporate Etticates and professionalism.

(Prof. Smt.V.P.Ashwatpur)
Prepared By

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Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

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Programme : Diploma in CE/EE/ET/ME/ MT/CM /IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Development of Soft Skills – II
Course Code : NE 377

Teaching Scheme:

*NON-EXAM.NON CREDIT COURSES (COMPULSORY) - B # Credits over & above 180 credits

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	---	---	---	---	---
Marks	---	---	---	---	**25**

Course Rationale:

This course aims to make students aware of importance of goal setting , develop self study techniques , importance of ethics and value system , This also aims one to inculcate creative mind along with interest in using problem solving techniques while dealing with any work. It also emphasizes about importance of stress relieving techniques to be practiced for good health.

Course Objectives:

Understand importance of goal setting and strategies for setting one's goal.
Develop and practice self- study techniques.
Use and practice stress management techniques for good health
Use and practice problem solving skills.

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Understand importance of ethics and value system for positive interpersonal relations.
Develop overall personality and be successful in his/her career.

Course Content:

Chapter No	Name of Topic/Sub topic	Hrs	Weightage
1.	**Motivation & Goal Setting** **1.1** Importance of goal setting, **1.2** How to set SMART goals	02	--
2.	**Study Habits** Note taking, Methods of Learning, Memory Enhancement, self - Study Techniques, Techniques for effective Reading and Writing.	02	
3.	**Stress Management** Stresses in groups, how to control emotions, strategies to overcome stress, understanding importance of good health to avoid stress.	03	
4.	**Ethics & Motivation** What are ethics, how ethics help to ensure positive interpersonal relations, personal value system, and personal quality primer	03	--
5.	**Creativity** Definition of Creativity, Tips and ways to increase creativity, importance of creativity.	03	--
6.	**Problem Solving Techniques** Puzzles and technical quizzes to be organized to develop these skills.	03	--
	Total	16	--

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List of Practicals/Experiments/Assignments:

Sr. No.	Name of practical/Experiment/Assignment	Hrs
1.	Case studies to be discussed in a group and presentation of the same by group/group leader.	04
2.	Field exercises for the group of students.	02
3.	Role play by individual/group leader.	04
4.	Arranging Quizzes, puzzle solving and educational games.	02
5.	Group discussions.	04
6.	Sharing of self -experiences in a group.	04
7.	Brain storming sessions.	02
8.	Questionnaire -filling & discussing results of the same in a group.	04
9.	Live demonstrations on Yoga and other stress relieving techniques.	06
	Total	**32**

Reference Books:

Sr. No	Author	Title	Publication
1.	Mr. Shiv Khera	You can win	
2.	Mr Abdul Kalam	Wings of Fire	
3.	Mr.Nirfarake	Prabhavi Vyaktimatwa.(Marathi)	
4.	Mr.Iyyengar	YogaDipika	
5.	Mr. Anand Nadkarni	Tan tanavache niyojan (Marathi)	
6.	Mr. Rajiv Sharangpani	Khusit raha ,Mast Jaga.(Marathi)	

Learning Resources: Video cassettes on 1. Motivation & Goal Setting 2. Stress Management,3. Ethics & Motivation

(Prof. Smt.V.P.Ashwatpur)
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GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Electrical Material and Workshop
Course Code : EE 461

Teaching Scheme:

	Hours /Week	Total Hours
Theory	02	32
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	50	80	--		25

Course Rationale:

The knowledge of electrical engineering materials is essential for technicians. It will help him for selecting proper material for manufacturing of any electrical goods or to repair it. Similarly, basic knowledge of safety precautions, wiring accessories, tools, lamps and their circuits is also essential.
This course covers different types of materials used in the field of electrical engineering, their characteristics and applications. Safety precautions, different wiring accessories, cables, tools is also included in part B. this knowledge will help the student to understand other higher level courses.

Course Objectives:

- State the characteristics and applications of various materials used in the field of electrical engineering
- Select the material as per requirement
  Observe safety while working with electrical machines and equipment
- Use different tools for wiring
  State different type of lamps and prepare circuits for these lamps
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Note: Theory paper will be on Part A only. Term work evaluation will be on Part B only.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION – A			
1.	1.1	Introduction to Electrical Engineering Materials.		
	1.2	Classification of materials – conductor, insulator, semi-conductor, magnetic material	**02**	**04**
2.	**Conducting Material Properties**			
	2.1	Resistivity, effect of temperature, impurities, stress on resistivity of conductor. Requirements of High/Low conducting Material.	**02**	**08**
3.	**Conducting Materials**			
	3.1	Low resistive conductor copper, copper-zinc alloys, chromium-Copper alloy, chromium-Copper alloy Bronze, Reinforced copper,		
	3.2	Aluminum and aluminum alloys, steel-cored Aluminum,		
	3.3	Galvanized iron and steel, effect of carbon on steel.		
	3.4	Low resistance material-solders, contacts, classification of contact materials, important alloys for contacts in various electrical equipments, sintered material,		
	3.5	Materials of low conductivity.	**06**	**12**
	3.6	Materials used in making a. Precision electrical measuring instruments, b. Standard resistors, c. Resistance elements for rheostats and similar control devices, d. Carbon, construction of carbon elements depending on the requirements as per use.		
	3.7	Trade names of above materials, Code of practice,		
	3.8	Applications of conducting materials.		
	3.9	Use of IS for conducting materials.		
4.	**Super Conducting Materials**			
	4.1	Concept of super conducting Materials.	**02**	**06**

	4.2	Use of super conducting materials for various engineering Applications.		
5.	**Insulating Material Properties**			
	5.1	Electrical properties-Volume resistivity, break down voltage, dielectric strength/constants.	**04**	**08**
	5.2	Mechanical properties.		
	5.3	Thermal properties.		
	5.4	Chemical properties and physical properties,		
	5.5	Insulation Classes,		
	5.6	Review of Physics of Dielectrics, the dielectric as an electric field medium, polarization.		
	5.7	Electrical conductivity of gases, liquid, solid dielectrics.		
6.	**Insulating Materials**			
	6.1	Gases dielectrics-Air, Nitrogen, sulphur hexafluoride, Liquid dielectric of Petroleum insulating oil: a. Insulating oils for transformers and Switchgears, b. Solid insulating materials classification c. Fibrous materials, impregnating coating, d. Filling and bonding materials.	**04**	**12**
	6.2	Resins: Synthetic resins, oil, varnishes, impregnated fibrous material, Stock plastics, moulding compounds.		
	6.3	Electrical insulating films, Rubber, Mica and mica base materials.		
	6.4	Ceramic materials, porcelain, Glasses, Glass bonded mica, Classes of insulating materials and their temperature limits as per IS.		
	6.5	Trade names of above materials, Code of practice.		
	6.6	Applications of insulating materials.		
7.	**Magnetic Material Properties**			
	7.1	Introduction, Spontaneous magnetization curve, hysteresis loop, effect of temperature, frequency on magnetization, Curie-Weiss law.	**04**	**08**
	7.2	Concept of Magnetization.		

8.	**Magnetic Material**			
	8.1	Classification, Diamagnetic Materials, Paramagnetic Materials, Ferromagnetic Materials, ferrite materials. Soft and hard magnetic materials.	**04**	**08**
9.	**Material for Special Purpose**			
		Thermocouple, bimetallic, fuses Material, Varistors, thermostats, thermister, their properties and applications.	**02**	**08**
10.	**Principle, Procedure and Selection of Material**			
	10.1	Principle of selection of material for particular application.	**02**	**06**
	Part B (Workshop) ONLY FOR PRACTICALS			
11.	**General Safety Precautions and Tools**			
	11.1	General safety precautions and related safety rules, various tools required for electrical wiring and electrical work and their use.	To be studied in practical session.	
	11.2	Safety devices such as hand gloves, gumboot, mats tester, arms, panel, other safety materials are to be studied with their specifications, test as per IS, also permissible or withstand capacity of such material to specified voltage & current.		

12.	**Wires**		
	12.1	Introduction, Sizes of wires, Standard wires, Types of wires 1. Lead alloy sheathed wires 2. TRS and CTS wires 3. Weather proof wires 4. Flexible wires	To be studied in practical session.
13.	**Underground Cables and Installation**		
	13.1	Introduction, Cable installation.	To be studied in practical session.
	13.2	Underground cables, Types of 3-Phase cables, Cable laying, Filling compound in sleeve, Cable jointing and crimping.	
14.	**Wiring Accessories**		
	14.1	Purpose, technical specification, types & market sizes of following wiring accessories: 1. Switches 2. Lamp holders. 3. Ceiling roses 4. Mounting blocks 5. Socket outlets 6. Plugs. 7. Wooden boards of different sizes 8. Main switches (ICDP and ICTP) 9. Junction box. 10. Distribution fuse boards, **11.** Bus-bar for small power circuits.	To be studied in practical session.
15.	**Methods of Wiring**		
	15.1	Introduction, Methods of wiring and their accessories. 1. Cleat wiring 2. Casing-capping wiring 3. TRS wiring 4. Metal conduit wiring, PVC conduit wiring 5. Concealed wiring.	To be studied in practical session.
	15.2	Comparison of various wiring systems	

16.	**Different Wiring Connections**			
	16.1	Control of lamps from different places.	To be studied in practical session.	
	16.2	Stair case wiring& Godown wiring.		
17.	**Lights and Lighting Circuits**			
	17.1	Lamps used in houses 1. Incandescent lamp 2. Fluorescent tube light.	To be studied in practical session.	
	17.2	Lamps for street lighting 1. Sodium vapour lamp. 2. Mercury vapour lamp.		
	17.3	Lamps for decoration purpose.		
	17.4	Energy saving lamps.		
18.	18.1	Study of Home appliances such as automatic electric iron, heater, Geyser, bell, mixer etc. with their specification.	To be studied in practical session.	
		Total	**32**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of practical/Experiment/Assignment	Hrs
1.	**PP:** Collect at least three samples of each category of materials (such as conducting, insulating, magnetic). To be submitted along with T/W of W/S. Prepare report of source of collection, properties, and applications.	**04**
2.	Study the types & use various tools required for wiring, cable jointing and other electrical work.	**02**
3.	**PP:** Collect at least five samples of wires. Prepare report of source of collection, rating, and applications.	**04**
4.	**PP:** Collect at least one sample of cable. Prepare report of source of collection, rating, and applications.	**02**
5.	**PP:** Collect at least five samples of wiring accessories of different types. Prepare report of source of collection, rating, and applications	**04**
6.	Prepare simple wiring circuit for a) Casing –capping b) Metal conduit wiring c) PVC conduit wiring	**04**

	Methods wiring.	
7.	Prepare switch board for 2 ½ points Or extension board	**04**
8.	Prepare lighting circuit diagram for a) Single Fluorescent tube b) Sodium vapour lamp c) Mercury vapour lamp d) 2 or 3 CFLs in one fixture.	**04**
9.	Dismantling & assembly of following home appliances a) Automatic electric iron. b) Geyser. c) mixer	**04**
	Total	**32**

PP: It stands for professional Practices. It is compulsory for students & they must complete in a group of 4-5 students.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction to Electrical Engineering Materials	Lecture, discussion, Q/A
2.	Conducting Material Properties.	Lecture, discussion, Q/A
3.	Conducting Materials	Lecture, discussion, Q/A
4.	Super Conducting Materials	Lecture, Q/A, discussion
5.	Insulating Material Properties	Lecture, discussion,
6.	Insulating Materials	Q/A., discussion, lecture
7.	Magnetic Material Properties	Lecture, démonstration, Q/A
8.	Magnetic Material	Lecture, discussion
9.	Material for special purpose	Q/A., discussion, lecture
10	Principle and procedure and selection of material	Lecture, démonstration, Q/A

Text Books:

Sr. No	Author	Title	Publication
1.	S.L. Uppal	Electrical Wiring Estimating and Costing	Khanna Publication, Delhi
2.	Surjit Singh	Electrical Estimating & Costing	Dhanpat rai & co. Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	A.J. Dekker	Electrical Engineering materials	Prentice Hall of India Pvt. Ltd., Delhi.
2.	Indulkar	Electrical Engineering materials	S. Chand Publication, Delhi
3.	V.N. Mittle	Basic Electrical Engineering	Tata McGraw Hill Publishing Company Ltd., New Delhi.

Learning Resources: Books, Models, Material catalogs, Charts and Drawings.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction to Electrical Engineering Materials	02	02	00	04
2.	Conducting Material Properties.	04	04	00	08
3.	Conducting Materials	06	06	00	12
4.	Super Conducting Material	02	04	00	06
5.	Insulating Material Properties	04	04	00	08
6.	Insulating Materials	06	06	00	12
7.	Magnetic Material Properties	04	04	00	08
8.	Magnetic Material	04	04	00	08
9.	Material for special purpose	04	04	00	08
10.	Principle and procedure and selection of material	02	00	04	06
	Total	**38**	**38**	**04**	**80**

(Prof. Mrs. M.J. Bhandari)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : AC & DC Circuits
Course Code : EE462

Teaching Scheme:

	Hours / Week	Total Hours
Theory	04	04
Practical	02	02

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	03 Hrs.	--	--
Marks	20	80	50	--	--

Course Rationale:

Electrical engineer when works as a supervisor, he has to Solve / analyze working of electrical circuits. He has to carry out analysis of power systems under normal or fault conditions. For this purpose, basic understanding of A.C. circuits is required. This course intends to teach the student analysis of D.C. circuits using network theorems. It also covers the analysis of 1 phase, three phase circuit and transient analysis. This knowledge will help the student to understand other higher level courses.

Course Objectives:

- Understand the conversion of rectangular to polar & vice-versa.
- Understand the response of electrical parameters to A.C. source.
- Understand the electrical parameters of parallel A.C. circuits.
- Solve A.C. series and parallel circuits.
- Understand the terminology of polyphase circuits, connections of polyphase circuits.
- Solve balanced three phase circuits.
- Solve A.C. and D.C. circuits using theorems.
- Determine the transient response of simple D.C. circuits

Course Content:

Chapter No.		Name of Topic/Sub topic	Hrs	Weightage
1.	**Phasor Algebra (Review)**			
	1.1	Symbolic notation of electrical quantity,	**04**	**04**
	1.2	Significance of operator 'j',		
	1.3	Concept of polar and rectangular form of alternating quantity and their utility.		
	1.4	Conversion of polar to rectangular and vice versa. (Numericals),		
	1.5	Addition, subtraction, Multiplication and division of vector quantity.		
2.	**Single Phase A.C. Series Circuits**			
	2.1	Basic concept of A.C. Circuit	**12**	**16**
	2.2	Derivation of expression for current and power, phasor diagram, wave form of voltage and current for Pure resistance (R),Pure inductance (L),Pure capacitor (C).		
	2.3	Concept of inductive & capacitive reactance,		
	2.4	R-L, R-C, and R-L-C Series circuit, concept of Impedance, power factor, Calculation of current, power and power factor, Concept of Impedance triangle, concept of power triangle,		
	2.5	Resonance of series of R-L-C series circuit, derivation of resonant frequency		
	2.6	Quality factor of series resonance circuit.		
	2.7	Graphical representation, effect of frequency on R, XL, XC, & Z.		
	2.8	Numericals.		

3.	**Single Phase A.C. Parallel Circuits**			
	3.1	Concept of parallel circuit,		
	3.2	Concept of admittance, susceptance and conductance,		
	3.3	Use of admittance method, phasor method to solve parallel circuit		
	3.4	Calculation of current, power, power factor in R-L, R-C, R-L-C parallel circuits using rectangular and polar methods,	**10**	**12**
	3.5	Study of parallel resonance, quality factor, graphical representation,		
	3.6	Comparison of series and parallel resonance. Quality factor of parallel circuit.		
	3.7	Numericals.		
4.	**Poly-phase A.C. Circuits**			
	4.1	Advantages of 3 phase system over 1 phase system,		
	4.2	Principle of 3-phase emf generation and its wave form,		
	4.3	Concept of phase sequence and balanced load		
	4.4	Relation between phase and line current, phase and line voltage in Star connected and Delta connected balanced system,	**12**	**14**
	4.5	Calculation of current, power, power factor in a 3 phase balanced load (Numericals),		
	4.6	Concept of Unbalanced Load and simple numericals, Concept of symmetrical components		
5.	**D.C. / A.C. Circuits and Theorems**			
	5.1	Concept of Ideal and Practical voltage and current sources.	**22**	**28**
	5.2	Definitions- Source, Load, Unilateral and Bilateral circuits. Linear and Non Linear circuits**.**		

	5.3	Statement, Explanation and application of following laws and theorems for given DC/AC circuits and numericals. a) Kirchhoff's current law b) Kirchhoff's voltage law c) Mesh / Loop analysis d) Node Analysis e) Superposition Theorem f) Thevenin's Theorem g) Norton's Theorem h) Star Delta Transformation		
	5.4	Simple numericals.		
6.	**Transients (DC)**			
	6.1	Transients in R-L and R-C series circuit.		
	6.2	Concept of current growth and decay, time constant in R-L and R-C series circuits. (No derivation expressions only and simple numericals on it)	**4**	**6**
		Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	**Name of practical/Experiment/Assignment**	**Hrs**
1.	To observe the response of pure R, pure L and pure C on CRO	**04**
2.	To find resistance and inductance of choke coil.	**02**
3.	Draw a phasor diagram of R-L-C series circuit for following conditions, a) Lagging P.F. b) Leading P.F. c) Unity P.F.	**04**
4.	Draw a phasor diagram of R-L and R-C parallel circuit & determine P.F. circuit current, & power.	**04**
5.	Perform resonance of parallel circuit & determine P.F & circuit current.	**02**
6.	Verification of the relationship between line voltage and phase voltage and line current and phase current in case of star connection and Delta connection.	**04**

7.	Verification of KCL and KVL	**02**
8.	Verification of superposition Theorem	**02**
9.	Verification of Thevenin's Theorem	**02**
10.	Verification of Norton's Theorem	**02**
11.	Verification of Star – Delta transformation	**02**
12.	To plot charging and discharging curve of R-C series circuit	**02**
	Total	**32**

Instructional Strategy:

Sr. No	Topic	Instructional Strategy
1.	Phasor Algebra (Review)	Lecture, Model, Chalk Board technique
2.	Single Phase A.C. Series circuits	Lecture, Q/A technique
3.	Single Phase A.C. Parallel Circuits	Lecture, Q/A technique
4.	Polyphase A.C. Circuits-D.C./A.C.	Lecture Method, Q/A technique
5.	Circuits and Theorems (AC)	Lecture Method, Q/A, technique
6.	(DC)	Lecture Method, Q/A, technique

Text Books:

Sr. No	Author	Title	Publication
1.	B.L. Theraja	Electrical Technology Vol. I and II	S.Chand and Co., New Delhi
2.	V. N. Mittle	Basic Electrical Engineering	Tata McGraw Hill

Reference Books:

Sr. No	Author	Title	Publication
1.	Jain and Jain	ABC of Electrical Engineering	Dhanpat Rai Publishing Company
2.	Edward Hughes	Electrical Technology	Pearson Education.
3.	H.Cotton	Electrical Technology	CBC, Delhi

Learning Resources: Books, Models, Charts and Drawings

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Phasor Algebra (Review)	-	-	04	04
2.	A.C. Series circuits	04	06	06	16
3.	A.C. Parallel Circuits	03	03	06	12
4.	Polyphase Circuits	04	04	06	14
5.	D.C. & A.C. Circuits and Theorems	06	06	16	28
6.	Transients (DC)		02	02	06
	Total	**19**	**21**	**40**	**80**

(Prof. M.J. Bh[illegible] Mrs.A.N.Duraphe) Prepared By

(Prof. S. B. [illegible]) Secretary, PB[illegible]

(Prof. D.A.Katare) Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : DC Machine And Transformer
Course Code : EE463

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	04
Practical	02	02

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of One hour minutes.	03 Hrs.	03 Hrs.	--	--
Marks	20	80	50	--	--

Course Rationale:

This subject belongs to core technology group which intends to teach facts, concepts, principles & procedure for operation of electrical machines such as DC generators, DC motors and single & three phase transformers.
These machines are used for transmission, distribution & utilization systems. Knowledge gained by the students will be helpful in the study of technological subjects such as utilization of electrical energy, switchgear & protection, manufacturing processes & testing & maintenance of electrical machines
The knowledge & the skills obtained will be helpful in discharging duties such as Supervisor, controller & R & D technician.

Course Objectives:

- Know the constructional details & working principles of dc machines & transformers
  Understand working principle of d.c. machine and transformer.
- Evaluate the performance of dc motors & transformers by conducting various tests
  Know the starting methods & speed control methods of d.c. motors.
- Operate any machine properly
- Write the specifications of dc machines & transformers as per requirement
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Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
1.	**D.C. Machine**			
	1.1	Construction features different parts and their functions Type of armature winding lap and wave winding terms of related with armature winding	**08**	**10**
	1.2	D.C. Generator - working principle, E.M.F Equation.		
	1.3	Types of generator, characteristics of generators, voltage building up of self excited generator and applications of each type.		
	1.4	Concept of losses and efficiency with formula (Simple numericals on EMF Equation)		
2.	**DC Motor**			
	2.1	Working principle, back emf, power & torque, shaft torque equations (Numericals), characteristics and applications of each type	**12**	**14**
	2.2	Necessity of starter .Three point starter.		
	2.3	Speed control of d.c. series and shunt motor.		
	2.4	Armature Reaction and commutation in d.c. machine and their effect on the performance of machine.		
	2.5	Losses and efficiency of D.C. Motor		
	2.6	No load Test, Brake test Swinburn's test and		

calculation of efficiency (simple Numericals, On brake test , starting resistance)

3.	**Single Phase Transformer**			
	3.1	Introduction, construction and principle of operation, Types.		
	3.2	Concept of ideal Transformer, transformer on no load, phasor diagram and numericals.		
	3.3	Transformer on load, phasor diagram of loaded transformer.		
	3.4	Losses & equivalent circuit for finding performance of transformer.	**24**	**36**
	3.5	single phase transformer: direct loading & indirect method using O.C. and S.C. test.		
	3.6	All day efficiency, condition for efficiency.		
	3.7	Per unit resistance, per unit reactance, regulation of single phase transformer.		
	3.8	Auto transformer: comparison with two winding transformer, copper saving.		
	3.9	Numericals on all above sub –topics.		
4.	**Three Phase Transformer**			
	4.1	Introduction, comparison between bank of 3 single phase transformers and three phase transformer.		
	4.2	Three phase transformer: construction, all types of connections, voltage & current ratios.	**10**	**12**
	4.3	Concept of vector groups.		
	4.4	Numericals on with balanced load.		
5.	**Parallel Operation of Transformer**			
	5.1	Need of Parallel Operation of single phase transformer and three phase transformer.		
	5.2	Condition of Parallel Operation of single phase transformer and three phase transformer.	**10**	**08**
	5.3	Numericals on equal impedance, different KVA load sharing & phasor diagram.		
		Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	To identify the constructional parts of D. C. machine.	**02**
2.	To plot the O.C.C. of a given d. c. machine and to find critical resistance.	**02**
3.	To control the speed of d. c. shunt motor above and below normal speed.	**02**
4.	Performance of D.C.series motor by brake test.	**02**
5.	A) To identify the parts of d.c. three point motor starter. B) To reverse the direction of rotation of d.c. motor.	**02**
6.	Performing No load test on d.c. shunt motor and determination of performance as motor and generator.	**02**
7.	Visit to maintenance and repair workshop of a transformer and prepare a report.	**04**
8.	To carry out direct load test on single phase transformer and determination of efficiency and regulations.	**02**
9.	To perform O.C. and S.C. test on single phase transformer and calculate efficiency, regulation and draw equivalent circuit of transformer.	**02**
10.	To carry out polarity test on single phase transformer.	**02**
11.	**PP:** To compare single phase auto transformer and single phase two winding transformer by collecting literature from local dealers.	**02**
12.	To carry out different connections of three phase transformer and carry load test with delta /star connection. Calculate of voltage & current ratio.	**04**
13.	To observe the phase difference between primary & secondary voltage of 3-phase Transformer for various vector groups.	**04**
14.	Parallel operation of two single phase transformers load sharing with equal impedance and unequal impedance.	**02**
	Total	**34**

PP: It stands for professional Practices. It is compulsory to all students & they must complete in a group of 4-5 students.

Note: Minimum 12 practicals are to be performed & at least one from each topic.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	D.C. machine	Lecture method with B/B & PPT, Lab work Demonstration of machine parts.
2.	D.C. motor	Lecture method with B/B & PPT, Lab work Demonstration of machine parts.
3.	Single phase transformer	Lecture method with B/B & PPT, Lab work
4.	Three Phase Transformer.	Lecture method with B/B & PPT, Lab work ,Visit to industry/SS.
5.	Parallel Operation of Transformer.	Lecture method with B/B & PPT, Lab work

Text Books:

Sr. No	Author	Title	Publication
1.	B.L. Theraja	Electrical Technology Vol. II	S.Chand and Co., New Delhi
2.	Mehta	Principles of Electrical Machines	----------

Reference Books:

Sr. No	Author	Title	Publication
1.	E Hudges	Electrical Technology	
2.	H Corton	Electrical Technology	
3.	Daws	Course in Electrical Engineering	
4.	M.G. Jay	Direct Current Machine	
5.	Nagrath and Kothari	Electrical Machine.	
6.	J.B. Gupta	Electrical Machine.	

Learning Resources: Class room, Machine Laboratory, PPT presentation, Text books & reference books, Industrial Visit.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	D.C. Machine	04	04	04	12
2.	Single phase transformer	04	04	04	12
3.	DC Motor	12	12	12	36
4.	3 ϕ Transformer	04	04	04	12
5.	Parallel Operation of Transformers	04	02	02	08
	Total		**26**	**26**	**80**

(Prof. D.A.Kataré)
Prepared by

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Kataré)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Electrical Measurement & Instruments
Course Code : EE 464

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--		--
Marks	20	80	50	--	--

Course Rationale.

This subject is classified under core technology. The Diploma holder has to work as Technical supervisor, maintenance engineer, production engineer in industries, electrical power generation, transmission and distribution system, traction installation system, machine operation etc. For above job responsibilities he has to take the measurements of various electrical quantities power & energy for testing, monitoring, maintenance, and controlling the process. In addition to this he must know the calibration techniques and extension of meter ranges. Therefore Electrical Measurement skills are very important. Accuracy of measurement is one of the main parameters in industrial processes as ability of control depends upon ability to measure.

Course Objectives:

- Classify measuring instruments based on construction, principle of operation and quantity to be measured, types of errors.
- State the working principles and explain the constructional details of various electrical measuring instruments.
- Identify the measuring instruments used for measuring electrical quantities.
- State the utility of various instruments in practice.
- Select appropriate measuring instrument with range for measurement of various electrical quantities.
- Select and use range multiplier if required.
- Select appropriate instrument for measurement of power, energy.
- Calibrate various types of instruments as per IS.
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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Generalised Treatment**		
	1.1 Needs of measurement and Instruments.		
	1.2 Qualities of instruments: sensitivity, accuracy, precision, reliability, stability etc.		
	1.3 Classification of instruments based on : a) Units of percentage error. b) Principles of operation (or Electrical effect used) c) Nature of operation (or output) – indicating, recording and integrating type, essential torque of indicating instruments.	**04**	**06**
	1.4 Instruments class (), Standard and sub-standard instruments)		
	1.5 Types of errors		
	1.6 Different types of torque in Analog Instruments		
2.	**Ammeter and Voltmeter**		
	2.1 Review of construction & principle of Galvanometer (PMMC Type).		
	2.2 Ammeter and Voltmeter of MI, PMMC & dynamo type (construction , principle of demerits)	**06**	**10**

	2.3	Conversion of galvanometer to ammeter using shunt.		
	2.4	Conversion of galvanometer to voltmeter using multiplier.		
	2.5	Extension of range of Voltmeter and ammeter using multiplier & shunt respectively.		
	2.6	Calibration of Ammeter & voltmeter using potentiometer (Simple numericals)		
3.	**Measurement of resistance**			
	3.1	Classification of electrical resistance based on magnitude range as low, medium & high.		
	3.2	Methods used for measurement of each type of resistance a) Wheatstone's Bridge b) Kelvin's double Bridge c) Ohmmeter d) Megger d) Earth Tester e) Analog Multimeter f) Digital Multimeter	**06**	**12**
	3.3	Measurement of Inductance and capacitance a) Maxwell's Inductance Bridge a) Anderson Bridge c) Schering Bridge d) Precautions & limitations of A.C. bridge (No derivation & Phasor Diagram) only formula & simple numericals		
4.	**Instrument Transformer**			
	4.1	C.T. & P.T. – Construction, theories & requirement.		
	4.2	Terminology of CT & PT such as ratio, burden & phase angle.		
	4.3	Precautions to be taken in their use.	**06**	**10**
	4.4	Specification & Classes of C.T. & P.T.		
	4.5	Testing of instrument Transformers. (i.e. CT and PT)		
	4.6	Clamp on meter –construction & working.		
	Measurement of Power			
	5.1	Principle of operation, construction of dynamometer type wattmeter,		
	5.2	Error due to pressure coil connections.		
	5.3	Low P.F. Wattmeter (Electrodynamometer type) and its use.	**10**	**16**
	5.4	Calibration of wattmeter.		
	5.5	Construction and operation of poly phase watt-meter.		

	5.6	Power measurement active & reactive power in three phase circuits for balanced and unbalanced loads by using Two wattmeters,calculation of p.f. from watt meter readings, effect of p.f. on watt meter readings.(Simple numericals)		
	5.7	Measurement of active &reactive power in three phase balanced load by using one wattmeter method.		
	5.8	Measurement of power using C.T & P.T.		
6.	**Measurement of Electrical Energy**			
	6.1	Principle of operation & construction of single phase and three-phase induction type energy meter.		
	6.2	Errors and their correction.		
	6.3	Calibration of energy meter.	**09**	**14**
	6.4	Digital Energy meter and Tri-vector meter.		
	6.5	Testing of energy meter (induction and digital energy meters) as per I.S.		
7.	**Special Measuring Instruments**			
	7.1	Construction and working principle of single phase electrodynamometer type P.F. meter.		
	7.2	Construction & working principle of electrical resonance type p.f. meter.	**08**	**12**
	7.3	Weston type synchroscope.		
	7.4	D.C.R. Meter.		
	7.5	Phase sequence indicator-Static type and rotating type.		
	7.6	Frequency meter (Weston &Ferro dynamic type.)		
		Total	**49**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of practical/Experiment/Assignment	Hrs
1.	Disassemble the MI & PMMC type instruments & show the different parts of instruments. Also write functions & materials used for the same.	**04**
2.	a) Measurement of Resistance, Voltage, Current in A.C & D. C. Circuit by using digital multimeter. b) Measurement of A.C. Current by Clip-on ammeter (Tong Tester).	**04**
3.	Measurement of Medium resistance by Whetstone's bridge or Kelvin's double bridge.	**02**
4.	Measurement of Earth Resistance by Earth Tester.	**02**
5.	Measurement of Insulation Resistance by Megger.	**02**
6.	Measurement of Current and Voltages by Low range ammeter and voltmeter respectively by Using Current Transformer and potential Transformer.	**02**
7.	To carry out CT/PT testing w.r.t ratio, polarity, phase.	**02**
8.	Measurement of active and reactive power in three phase balanced load by single wattmeter method.	**02**
9.	Measurement of active and reactive power in three phase balanced load by two wattmeter method & observe the effect of Power Factor variation on Wattmeter reading.	**02**
10.	Calibration of Energy meter at various power factors & load as per IS with standard energy meter or wattmeter & stopwatch.	**02**
11.	Connection & calibration CT operated three phase electronic energy meter.(with CT & without CT)	**04**
12.	Measurement of power factor of single phase and three phase load by PF meter and verifying through I, V and P measurement.	**04**
13.	Measurement of Circuit Parameters by LCR meter.	**02**
14.	Observe the phase sequence of three phase circuit Using phase sequence Indicator.	**02**
	Total	**36**

Note: Minimum 12 practicals are to be performed & at least one from each topic.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Generalised Treatment	Lectures, Q. A. Techniques
2.	Ammeters and Voltmeters	Lectures, demonstration, laboratory work PPT presentation
3.	Measurement of resistance:	Lectures, demonstration, laboratory work PPT presentation
4.	Instrument Transformers	Lectures, demonstration, laboratory work PPT presentation
5.	Measurement of Power	Lectures, demonstration, laboratory work PPT presentation
6.	Measurement of Electrical Energy	Lectures, demonstration, laboratory work PPT presentation
7.	Special Measuring Instruments	Lectures, demonstration, laboratory work PPT presentation

Text Books:

Sr. No	Author	Title	Publication
1.	A.K. Sowhney	A Course in Electrical Engineering Measurement and Instrumentation	Dhanpat Rai and co. Pvt. Ltd. Delhi.

Reference Books:

Sr. No	Author	Title	Publication
1.	E.W. Golding and F.C. Widdis	Electrical Measurements and Measuring Instruments	Wheeler publishing , Allahabad.
2.	N.V. Suryanarayana	Electrical Measurements and Measuring Instruments.	Tata McGraw-Hill Publishing Company Ltd.

Learning Resources: : Class room teaching, Laboratory work, Reference books, Wikipedia for measurement concept, Animated clips for measurement technique, Web sites for techno-commercial information of measuring instruments.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Generalised Treatment	04	02	00	06
2.	Ammeters and Voltmeters	04	02	04	10
3.	Measurement of resistance:	04	04	04	12
4.	Instrument Transformers:	02	04	04	10
5.	Measurement of Power:	04	04	08	16
6.	Measurement of Electrical Energy	04	06	04	14
7.	Special Measuring Instruments	04	04	04	12
	Total	**26**	**26**	**28**	**80**

Prepared By **(Prof.K.M. Kakade & Prof. [illegible])** **Secretary, PBOS (Prof. S. B. Kulkarni)** **Chairman, PBOS (Prof. D.A.Katare)**

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Computer Applications in Electrical Engineering
Course Code : EE 465

Teaching Scheme:

	Hours /Week	Total Hours
Theory	--	--
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--		--
Marks	--	50		--	--

Course Rationale.

Simulations of different Electrical / Electronic Circuits is required in many fields and hence study of different packages like PSpice, Electronic Workbench or any other similar software is included in this course. It is also helpful for better understanding of various concepts already studied by the students in earlier courses.

Course Objectives:

- Understand the response of pure R, L & C parameters in A.C. Circuit.
- Understand the response of R-L & R-C parameters in A.C. Circuit.
- Understand the response of R-L -C series Circuit.
- Understand the response of resonance circuit.
- Understand the response of V-I Characteristics of Diode.
- Study the response of half wave and Full wave rectifier.

- Understand the Equivalent circuit of Single phase transformer.
  Understand the Equivalent circuit of DC generator.
- Understand the simulation of network theorems.
  Understand the response of Charging and discharging of capacitor through
- resistance.
-

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Demonstration of use of simulation software.	04
2.	Study the response of pure R, L & C ac circuits.	02
3.	Study the response of pure R-L & R-C series circuit.	04
4.	Study the response of pure R-L-C series circuit.	02
5.	Study the response of Series resonance.	02
6.	Study the response of Parallel resonance.	02
7.	Study the response of V-I characteristics of Diode.	02
8.	Study the response of half wave and full wave rectifier.	04
9.	Study the Equivalent circuit of single phase transformer.	02
10.	Study the Equivalent circuit of DC generator.	02
11.	Verification of Superposition theorem	02
12.	Verification of network Thevenin's theorem or Maximum Power Transfer Theorem.	02
13.	Study the Charging and discharging of capacitor through resistance.	02
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	For all practicals	Use any suitable simulation software

Reference Books:

Sr. No	Author	Title	Publication
1	B.L. Theraja	Electrical Technology Vol. I and II	S.Chand and Co., New Delhi

Learning Resources: Computer lab, Simulation software.

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Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Digital Electronics And Microprocessor
Course Code : EE 466

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of one hour.	03 Hrs.	--	--	--
Marks	20	80	--	--	--

Course Rationale:

Now a days application of digital circuits and microprocessors are extensively used in measurement and control applications in the field of electrical engineering and electrical power systems. So the digital electronics and microprocessor has been introduced as a subject in electrical engineering curriculum. This course covers digital circuits, logic gates Flip-flops,microprocessor8085,architecture, its instruction set, programming and applications. After completing this subject the student can write and execute programs for microprocessor based applications.

Course Objectives:

- Design simple logic circuit
- Assemble Logic circuits
- Test the logic circuit

- Observe logic circuits
- Describe architecture and operation of microprocessor 8085
- Design and develop microprocessor based systems
- Explain various applications of microcontrollers
- Develop assembly language programs using instruction set of 8085
- Describe architecture and operation of microprocessor 8085
- Develop assembly language programs using instruction set of Intel 8085/8085A

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
1.	**Introduction to Digital Techniques**			
	1.1	Digital signal and Digital Circuit.	08	12
	1.2	Advantages and Disadvantages of digital circuit.		
	1.3	Generation of Digital signal.		
	1.4	Number system- Introduction, decimal, binary, octal & hexadecimal.		
	1.5	Conversion of Decimal to Binary Number & vice-versa.		
	1.6	Decimal to Hex and vice versa.		
	1.7	Hex to binary and vice versa.		
	1.8	Octal to decimal and vice versa.		
	1.9	Octal to binary and vice versa.		
	1.10	BCD number system.		
	1.11	1's compliments and 2's compliment.		
	1.12	Addition and Subtraction of Binary number.		
2.	**Logic gates and Boolean Algebra**			
	2.1	Logical symbol, logical expression and truth table of AND, OR, NOT, NAND, NOR, EX-OR and EX-NOR gates.	08	16
	2.2	Universal gates – NAND, NOR Gates.		
	2.3	Logical circuit of basic gates using universal gates.		
	2.4	TTL and CMOS Logic gates IC's and their Pin configuration.		

	2.5	Boolean Algebra – Fundamental concept, Basic Laws of Boolean Algebra		
	2.6	Half-adder and Full - adder		
	2.7	Introduction to Flip-Flop :- RS Flip-Flop, J.K.Flip-Flop, T & D Flip-flop and their Field of applications of flip-flop		
	2.8	Introduction to Registers , shift to right and shift to left registers		
	2.9	Introduction to counter, up counter, down counter and decade counter		
3.	**Introduction to Microprocessor**			
	3.1	Microprocessor as Physical System, pin diagram & Pin configuration of Intel 8085 Microprocessor	**06**	**12**
	3.2	Architecture and organization of Intel 8085		
	3.3	Data bus, Control bus, CPU, ALU, accumulator		
	3.4	Programming model of Intel 8085		
4	**INTEL 8085 Assembly Language Programming**			
	4.1	Instructions of Intel 8085 Microprocessor.	**10**	**20**
	4.2	Addressing modes of 8085 Microprocessor.		
	4.3	Data movement instructions,PUSH and POP, increment & decrement instruction, Rotate and shift instruction,Arithmetic Instructions such as ADD,SUB		
	4.4	Compliment /decimal adjustment instruction		
	4.5	Logical instructions such as AND,OR & EX-OR instruction.		
	4.6	Branching instructions: - Jump&Call instructions, conditional Jump & conditional call instructions, Return instruction		
	4.7	Looping instructions Simple Programming on Addition, subtraction, multiplication, division, data movement, sorting, find largest/smallest number.		
5.	**Memories**			
	5.1	Semiconductor memories: RAM, ROM volatile and non-volatile RAM.	**02**	**04**
	5.2	Memory Map.		

6.	**Timing Diagram**			
	6.1	Timing diagram of fetch operation , read operation & right operation (with & without Wait states)	**04**	**06**
7.	**Interfacing the Microprocessor**			
	7.1	General purpose programmable devices IC's:8255, 8253, 8237& key board interfacing IC:8279	**10**	**10**
	7.2	Introduction to serial communication,S-232C standard.		
			Total 48	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Verification of Truth table of logic gates	**02**
2.	Verification of De Morgan's Theorem	**02**
3.	Verification of Truth Table of Flip-flops	**02**
4.	Study of A/D Converter	**02**
5.	Study of data sheets related to digital IC's	**04**
6.	Assembly Language programming for • 1's compliment • shift left operator • 8-bit addition of two numbers • 16-bit addition of two numbers • 8-bit subtraction of two numbers • Binary division • To find larger number • To find smaller number • To find largest number • To find smallest Number • To arrange numbers in ascending order • To arrange numbers in descending order.	**12**
7.	Study of 8255 PPI-IC	**04**
8.	Study of 8279 PPI-IC	**04**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction to Digital Technique	Class room teaching and laboratory work.
2.	Logic gates and Boolean Algebra	Class room teaching and laboratory work.
3.	Introduction to µP.	Class room teaching and laboratory work.
4.	INTEL 8085 Assembly Language Programming	Class room teaching and laboratory work.
5.	Memories	Class room teaching and laboratory work.
6.	Timing Diagram	Class room teaching and laboratory work.
7.	Interfacing the microprocessor	Class room teaching and laboratory work.

Text Books:

Sr. No	Author	Title	Publication
1.	Malvino	Principles of Digital Electronics	Tata Mcgraw Hill
2.	R.P.Jain	Digital Electronics	Tata Mcgraw Hill
3.	B.Ram	Microprocessor & Microcontroller	S.Chand

Reference Books:

Sr. No	Author	Title	Publication
1.	Pal Choudhary	Introduction to digital systems	Tata Mcgraw Hill
2.	Madhuri	Introduction to microprocessor	Tata Mcgraw Hill

Learning Resources: Class room & laboratory work, Reference books, Machine catalogs, Transparencies.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction to Digital Technique	04	02	06	12
2.	Logic gates and Boolean Algebra	04	06	06	16
3.	Introduction to µP	06	04	02	12
4.	INTEL 8085 Assembly Language Programming	06	10		20
5.	Memories	02	02	00	04
6.	Timing Diagram	02	04	00	06
7.	Interfacing the microprocessor	04	02	02	10
	Total	**26**	**28**	**26**	**80**

(Prof. J.G.Momin)
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Secretary, PBOS

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Chairman, PBOS

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Industrial Electronics
Course Code : EE 467

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	20	80	--	25	--

Course Rationale.

The course aims to prepare the technicians to carry out the responsibilities related to electronics control by using thyristors. A diploma holder employed in industry needs to operate, tests and maintain industrial controls. Power Electronics have already found an important place in Modern Technology and are now used in a great variety of high power products including heat control, light control, power control, motor controls, power supplies, vehicle, H.V.D.C. system etc.

Course Objectives:

- Describe principle of working of SCR.
  Describe construction, working and application of converter, invertors and cycloconverters.
- Realise the importance of electronic power control.
- Understand electronic control of drives.
-

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
1.	**Power Semi Conducting Devices**			
	1.1	Introduction to power semiconductor devices	**12**	**16**
	1.2	Thyristors family, V.I. characteristics of SCR, Two transistor model, SCR rating, Series and parallel operation of SCR		
	1.3	Introduction to different power semi conducting devices (w.r.t. structure, V-I characteristic, application) phase control thyristors, gate turn off thyristors, reverse conducting thyristors		
	1.4	TRIAC, DIAC, LASCR, etc.		
2.	**Turn On and Turn Off Methods**			
	2.1	Turn on by DC Gate Triggering , AC gate triggering pulse transistor triggering .	**08**	**12**
	2.2	SCR firing circuit using UJT , Turn on losses, Turn off methods – Line Commutation , forced Commutation class A,B,C,D,E, Their waveforms		
3.	**Controlled Rectifier**			
	3.1	Single phase half wave, full wave and half controlled bridge rectifier.	**08**	**12**
	3.2	Three phase half wave and full wave rectifier.		
	3.3	Basic principle of single phase ideal dual converters.		
4.	**Cycloconverters**			
	4.1	Basic principle of operation of cycloconverters, single phase to single phase, three phase to single phase, three phase to three phase , control circuit.	**06**	**08**
5.	**Choppers**			
	5.1	Principle of operation of choppers- step up, step down and Jone's chopper.	**06**	**08**
	5.2	Applications.		
6.	**Inverters**			
	6.1	Requirement of inverters, basic series and parallel inverters	**08**	**12**

	6.2	Three phase inverter applications		
	6.3	UPS, SMPS		
7.	**Electronic Power Control**			
	7.1	Schemes for DC motor speed control	**06**	**12**
	7.2	DC drives – single phase and three phase drives		
	7.3	Variable speed A.C. motor drives		
	7.4	Synchronous motor drives		
	7.5	Servo drives (use of SCR for above application is expected but not detailed circuitry)		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practicals/Experiment/Assignment	Hrs
1.	To identify SCR terminals and test SCR	**02**
2.	To plot VI characteristics of SCR	**02**
3.	Trace the given circuit of UJT relaxation oscillator and plot and analyze the output waveforms.	**04**
4.	To plot characteristics of firing angle Alpha Vs Vdc of converter	**02**
5.	Trace the given circuit of cycloconverter and plot & analyze the output waveforms.	**04**
6.	Trace the given circuit of chopper and plot & analyze the output waveforms.	**04**
7.	Trace the given circuit of parallel inverter and plot & analyze the output waveforms.	**04**
8.	Testing of UPS	**02**
9.	Trace the given circuit of thyristorised speed control of d.c. motor and analyze the results.	**04**
10.	Trace the given circuit of thyristorised a.c. motor drive and analyze the results.	**04**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Power semi conducting devices.	Lectures, Models
2.	Turn ON and Turn OFF method.	Lectures
3.	Controlled Rectifier.	Lectures, Transparencies
4.	Cyclo Converter	Lectures, OHP
5.	Choppers	Lectures, Lab. Demonstration
6.	Invertors	Lectures, OHP
7.	Electric power control	Lectures, Tutorials, actual models

Text Books:

Sr. No	Author	Title	Publication
1.	M.H. Rashid	Power Electronics Circuit Devices and Applications	Prentice Hall of India Pvt. New Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	Dr. M. Ramamurthy	Power Electronics	East West Press Pvt. Ltd.
2.	P.C. Sen M.D. Singh	Thyristors Drives SCR Lab. Manuals Power electronics	ATA MagrawHill New Delhi

Learning Resources: Handouts, Manuals, Data books etc

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Power semi conducting devices	06	06	04	16
2.	Turn ON and OFF method	06	06	00	12
3.	Controlled Rectifier	04	04	04	12
4.	Cycloconverter	04	04	02	08
5.	Choppers	00	04	04	08
6.	Invertors	04	04	04	12
7.	Electronic power control	00	06	06	12
	Total	**22**	**34**	**24**	**80**

(Prof. Mrs.M.H. Bilgi)
Prepared By

(Prof. S. B. Kalkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Generation And Transmission of Electrical Power
Course Code : EE468

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of One hour.	03 Hrs.	--	--	--
Marks	20	80	--	25	--

Course Rationale:

Generated electrical power has to pass through various stages before being utilized by the consumer.
Generation and transmission of electrical power is the heart of electrical power systems. It is necessary to understand the constructional details, working and performance of different power stations.
Diploma technicians have to deal with various aspects of transmission and distribution system. They should be well conversant with materials required and the methods employed for erection and maintenance of the same.

Course Objectives:

- Understand the layout and working of different power stations.
- Know the economics of power generation.
- Compare different power stations.
- Know transmission line supports and parameters for its performance.
- Understand interconnection of various power stations in the country.
- Know mechanical and electrical details of distribution system.
- Understand the performance of distribution system such as voltage drop calculations.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs.	Weightage
1.	**Generation**			
	1.1	General – Electrical power stations in Maharashtra with their types and capacities.	**10**	**16**
	1.2	Conventional and non-conventional power stations.		
	1.3	Study of Hydro-electric, thermal, diesel and nuclear power station with block diagram only, layout, working of main component from layout.		
	1.4	Hydro-electric power station- Main components and their functions only, Reservoir, Dam, Forebay, surge tank, penstock, turbine house, spill way, tailrace.		
	1.5	Thermal power station - Main components – Coal Handling, boiler, Air-preheater, economiser, superheater, steam turbine, condenser, cooling towers, ash handling, Draught system (I.D. and F.D.), electrostatic precipitator		
	1.6	Nuclear power station- Main components- Reactor, Heat exchanger condenser, turbine		

	1.7	Diesel power station- Main components – Engine ,fuel system, Air intake and lubrication, exhaust cooling and starting systems. Advantages and disadvantages and Comparison between above power stations		
2.	**Performance of Power Stations**			
	2.1	Factors affecting economics of power generation. Load curve, Load duration curve, demand factor, diversity factor, load factor, capacity factor utilization factor (Numericals).	**10**	**18**
	2.2	Importance of high load factor and diversity factor, choice of number and rating of units for given load curve and operation schedule (Numericals)		
	2.3	Base load and peak load power stations – their role, types, comparison.(Numericals)		
3.	**Interconnected Power System**			
	3.1	Concept of state and National grid	**04**	**06**
	3.2	Advantages and disadvantages of interconnected system.		
	3.3	Operation and control of interconnected power system.		
	3.4	Function of Load dispatch centre		
4.	**Transmission**			
	4.1	Comparison between A.C. and D.C. transmission systems	**08**	**14**
	4.2	Overhead line supports – poles, (RCC, Steel poles), towers (single circuit and double circuit), cross arm. Insulators (pin, suspension , shackle, strain type)		
	4.3	Causes of failure of insulators. Potential distribution over a string of disc insulator, string efficiency (Numericals up to 3 units)		
	4.4	Methods of improving string efficiency,types of conductors, bundled conductors, concept of sag (no numericals).		

	4.5	**Cable:** General construction of cable, classifications of cable, cable specifications, comparison between overhead lines & underground cable.		
5.	**Performance of Transmission Line**			
	5.1	Concept of transmission line parameters like R,L,C (no formulae or numericals)	**10**	**14**
	5.2	Skin effect, Transposition of 3-phase lines.		
	5.3	Concept of short, medium and long transmission line, and their equivalent circuits (nominal 'T' and 'TT' method (no numericals).		
	5.4	Efficiency and regulation of short transmission line (numericals).		
	5.5	Concept of Ferranti effect.		
	5.6	Corona – Formation of corona, advantages and disadvantages, methods of minimizing effects of corona		
6.	**Recent Trends in Power System**			
	6.1	Distributed power generation,	**06**	**10**
	6.2	Co – Generation, Captive power plant, Micro hydal, wind, solar hybrid power station.		
	6.3	Concept of power quality.		
	6.4	Harmonics: Causes effects of harmonics, remedies.		
	6.5	High Voltage Direct Current Transmission: Merits and demerits of H.V.D.C. transmission system, Layout and equipment used in H.V.D.C. converting station.		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	**PP:** Visit report on any two power plants & draw a single line diagram for the same.	**08**
2.	**PP:** Visit report on any one non-conventional power plant & draw a single line diagram for the same.	**04**
3.	Drawing sheet on schematic diagrams on different power plants.	**02**
4.	Drawing sheet On interconnected grid system of power supply of Maharashtra state.	**02**
5.	**PP:** Visit to load dispatch centre / E.H.V.sub-station.	**04**
6.	Drawing sheet on transmission line components & cable in proportional dimensions.	**02**
7.	Perform an experiment to calculate string efficiency.	**02**
8.	To perform an experiment to find efficiency and regulation of a short transmission line.	**02**
9.	**PP:** Visit to sugar industry & study co-generation plants & report writing.	**04**
10.	Study of D.G. set of your institute.	**02**
	Total	**32**

PP: It stands for professional Practices. It is compulsory to all students & they must complete in a group of 4-5 students.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Generation	Lectures, discussion, OHP
2.	Performance of Power Stations	Lectures, discussion, Problem solving
3.	Interconnected Power System	Lectures, discussion
4.	Transmission	Lectures, discussion, OHP, Problem solving
5.	Performance of Transmission Line	Lectures, discussion
6.	Recent trends in power systems	Lectures, discussion, visits

Text Books:

Sr. No	Author	Title	Publication
1.	V.K. Mehta	Principles of Power System	S. Chand and Co., Delhi.
2.	Soni,Gupta, Bhatnagar	Course of Electrical Power system	Dhanpat Rai and Son's. , Delhi.

Reference Books:

Sr. No	Author	Title	Publication
1.	S.L. Uppal	Electric Power	Khanna Publisher, Delhi.
2.	J.B.Gupta	Electrical technology	S.K.Kataria &Sons.

Learning Resources: Classroom teaching, Lab work, Text & reference Books, Industry visits.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Generation	06	06	04	16
2.	Performance of Power Stations	04	04	10	18
3.	Interconnected Power System	00	02	04	06
4.	Transmission	04	06	04	14
5.	Performance of Transmission Line	06	04	06	16
6.	Recent trends in power systems	06	04	00	10
		Total	**26**	**26**	**28**	**80**

(Prof. R.D. Pardeshi) Prepared By

(Prof. S. B. Kulkarni) Secretary, PBOS

(Prof. D.A.Katare) Chairman, PBOS

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Electrical Technician's skills
Course Code : EE469

Teaching Scheme:

	Hours / Week	Total Hours
Theory	--	--
Practical	02	02

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	--	--	--	--	--
Marks	--	--	--	25	25

Course Rationale:

The pass out diploma student works as a technician in industry. Being technician, he gets work done from electrician, wireman etc, but some time diploma holder has to work physically in worst situations. For such work, he must have hands on skills on electrical circuits & wiring. To enhance his technical ability & confidence, small practical exercises are required. This course covers these required skills through small practical exercises & group projects.

Course Objectives:

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T lop the skills of problem identification and problem solving. To

o develop lighting circuits for decorative purposes.

Connect & test the condition protective devices such as MCB, ELCB, single phase preventer & twin tube in circuit.

d

e Understand the concept used in tester.

Test an electric fan.

v To develop decorative lighting and door bells.

e

Understand the connection of Ammeter/ voltmeter using selector switch and cable terminations.

- Rewind/ wind a small transformer.
- Test electronics components.
- To assess his/ her house's electrical load & understand their electrical bills.

List of Practicals/Experiments/Assignments

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Demonstration, connection & tripping of MCB against overload & short circuit.	**02**
2.	Demonstration, connection & tripping of ELCB against leakage current.	**02**
3.	To dismantle electrical tester and observe its various parts and determine the reason why we don't get shock?	**02**
4.	Dismantling, testing of winding and assembly & testing of electric fan. Also reverse the direction of rotation	**02**
5.	Develop circuit for different types of door bells.	**02**
6.	Assessment of electrical load in your home & electrical bill calculation.	**02**
7.	Develop a circuit for measurement of voltage & current in three phase circuit by using single panel type voltmeter /Ammeter & selector switches.	**04**
8.	Test the conditions of electronic components such as resistors, capacitors, inductors, diode, transistors etc.	**02**
9.	Rewinding / winding of small transformer. (In group of 5 students)	**04**
10.	Prepare circuit diagram for twin Fluorescent tube light and study stroboscopic effect.	**02**
11.	Study and Testing of ignition system of four stroke petrol engine.	**04**
12.	Develop running light circuit for decoration purposes. (In group of 5 students).	**04**
13.	Develop a decorative series lamp set for 240 a.c.volts using 6 volts bulb & flasher. (In group of 5 students)	**04**
14.	Develop single phase preventer circuit using three relays or electronics system. (In group of 5 students).	**04**

15.	Study of termination of H.T. cable using: Bituminous compound & measure I.R., Epoxy resin Compound Trifurcating box	**02**
	Total	**42**

Note: The students should perform minimum 12 practicals from given list.

Learning Resources: Lab work, literature regarding electrical materials from market, Demonstration & use of components related to practicals.

(Prof. K.M. Kakade)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Basic Mechanical Engineering
Course Code : ME 466

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of One hour.	03 Hrs.	--	--	--
Marks	20	80	--		25

Course Rationale:

This subject is classified under core technology. The Diploma holder has to work as technical supervisor, maintenance engineer and production engineer in power generation, process industries, chemical industries, refrigeration and air conditioning plants, manufacturing industries etc. For the above job responsibilities he should have the basic understanding of the working of boilers, steam turbines , refrigeration and air conditioning systems, pumps, hydraulic circuits and manufacturing processes,In addition to this he must know
importance of these components in a particular application while carrying out his duties as a electrical technician when working in the industry. Therefore knowledge of Basic Mechanical engineering is very important for the Diploma Electrical engineer as he plays a key role in smooth functioning of a mechanical industry.

Course Objectives:

- Understand the construction and working of IC Engines, boilers, turbines and pumps.
- Understand the specifications of mechanical components and select the appropriate equipment.
- Understand the working of the basic refrigeration cycle and air conditioning systems.
- Understand the function of various components used in industrial hydraulic circuits.
- Know the various manufacturing processes.
- Know conventional machine tools, cutting tools used in the industry.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
1.	**Boilers**			
	1.1	Introduction, classification of boilers	**07**	**12**
	1.2	Fire Tube Boiler: Lancashire boiler, Cochron boiler, construction and working.		
	1.3	Water Tube Boiler: Babcock Wilcox boiler, construction and working		
	1.4	Comparison of Fire Tube and water Tube boilers		
	1.5	Boiler Mountings and Accessories: Definition and examples only		
	1.6	High pressure boilers: Lamount, Loeffler and Beson, construction and working		
2.	**Internal combustion engines**			
	2.1	Introduction, Classification of I/C engines, Understanding engine specifications	**07**	**12**
	2.2	Four stroke cycle for petrol and diesel engine		
	2.3	Definitions of Indicated power, Brake power and efficiencies		
	2.5	Trouble shooting of IC engines		

3.	**Refrigeration and Air conditioning**			
	3.1	Definition of refrigeration, definition of air conditioning, Applications of refrigeration and air-conditioning	**10**	**16**
	3.2	Concept of COP, Refrigerating effect, Unit of Refrigeration.		
	3.3	Basic Components of Vapor compression systems (VCC)		
	3.4	Construction and working of a Refrigerator, Water cooler and a Ice-plant,		
	3.5	Construction and working of a Window air conditioner and split air conditioner		
	3.6	Layout of a central air conditioning system		
	3.7	LP/HP control, thermostats, overload protectors, etc.		
	3.8	Refrigerants used in various applications, Environmental issues of present refrigerants		
4.	**Turbines**			
	4.1	**Hydraulic turbines**: Layout of hydroelectric plant	**07**	**12**
	4.2	Construction and working of a Pelton turbine and Francis turbine.		
	4.3	Formulae for work done, hydraulic eff., mechanical eff. and overall eff.		
	4.4	**Steam Turbines**: Layout of a steam power plant		
	4.5	Construction and working of a single stage impulse and reaction turbine		
5.	**Pumps**			
	5.1	Construction and working of a centrifugal Pump, type of casings, type of impellers, concept of priming	**10**	**16**
	5.3	Heads of a centrifugal pump, efficiencies of a pump		
	5.4	Simple numerical related to calculation of head, selection of a motor for the pump		
	5.5	Interpretation of performance characteristic curves (without referring to velocity diagram)		
	5.6	Specification of centrifugal pump, selection criterion		
	5.7	Construction and working of a submersible pump		

6.	**Hydraulic and Pneumatic Components**			
	6.1	Elements of a Hydraulic and Pneumatic circuits.		
	6.2	Oil reservoir.		
	6.3	Classification of Pumps, Classification of compressors, F.R.L. unit.		
	6.4	Pressure controls: Relief valve, Reducing valve Sequence valve.	**07**	**12**
	6.5	Direction controls: Check valve, 2/2, 3/2, 4/2 direction control valve.		
	6.6	Flow controls : Classification ,symbols and function.		
	6.7	Actuators: Classification, application.		
	6.8	Symbols used hydraulic and pneumatic circuits		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	**Name of Practical/Experiment/Assignment**	**Hrs**
1.	Demonstration of working of 2 stroke and 4 stroke Petrol and diesel Engine	**02**
2.	Trial on a Centrifugal Pump	**04**
3.	Trial on a Pelton Wheel / Francis Turbine.	**04**
4.	Construction and working of a Domestic Refrigerator	**02**
5.	Construction and working of a Window Air conditioner	**02**
6.	Construction and working of a Ice Plant	**02**
7.	Visit to a Process Industry / Milk Dairy to demonstrate the working of Boiler	**04**
8.	Demonstration of working of a simple Hydraulic circuit	**02**
9.	Demonstration and use of Lathe	**02**
10.	Demonstration and use of Shaping machine, planning machine	**02**
11.	Demonstration and use of drilling machine, grinding machine	**02**
12.	Demonstration and use of CNC machine	**04**
		32

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Boilers	Lectures, Q. A. Techniques
2.	Internal combustion Engines	Lectures, demonstration, laboratory work PPT présentation
3.	Refrigeration and Air Conditioning	Lectures, demonstration, laboratory work PPT présentation
4.	Turbines	Lectures, démonstration, laboratory work PPT présentation
5.	Pumps	Lectures, démonstration, laboratory work PPT présentation
6.	Hydraulic and Pneumatic Components	Lectures, demonstration, laboratory work PPT présentation

Text Books:

Sr. No	Author	Title	Publication
1.	R. K. Rajput	Basic Mechanical Engineering	Laxmi Publications, New delhi
2.	P.K. Chadrashekar	Fluid Mechanics (A Text Book of Hydraulics and Pneumatics)	Everest Publishing House, Pune

Reference Books:

Sr No	Author	Title	Publication
1.	Patel Karam chandani	Heat Engines	Acharya Publication ,Vadodara Gujarat
2.	Jagdishlal	Hydraulic Machinery	Metropolitan Book Ltd., Delhi.
3.	R.S. Khurmi	Hydraulics and Hydraulic Machinery	S.Chand and Co. Ltd., Delhi.
4.	Hajra and Chaudhary	Workshop Technology vol-II	Media Promoter Pvt. Ltd., Mumbai.

Learning Resources: : Class room teaching, Laboratory work, Reference books

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Boilers	04	04	04	12
2.	Internal combustion Engines	04	04	04	12
3.	Refrigeration and Air-Conditioning	04	08	04	16
4.	Turbines	04	04	04	12
5.	Pumps	04	08	04	16
6.	Hydraulic and Pneumatic Components	04	04	04	12
	Total	**24**	**32**	**24**	**80**

Prepared By **(Prof.A. V. Joshi & Prof. V. S. Sonawane)** **(Prof. S. B. Kulkarni) Secretary, PBOS** **(Prof. D.A.Katare) Chairman, PBOS**

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Distribution and Utilization of Electrical Power
Course Code : EE561

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	20	80	--	50	--

Course Rationale:

Electrical energy is the most widely used from of energy by human being. One important aspect of electrical system is utilization of electrical power. The detailed Knowledge of utilization in various areas e.g. heating, welding, processes, escalators, elevators is required. Now a days electric traction is being used more commonly. Hence it is necessary for students to know various forms of traction power supply arrangement, properties of traction motors etc. Hence related topics are included in this course.

Course Objectives:

- Understand applications of electrical energy such as heating and welding.
- Understand the importance of high power factor.
- State the methods of improving power factor.
- Compare various systems of traction.
- Explain the working of current collecting devices.
- Explain the working of various types of lamps.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weigh tage
	SECTION - I			
1.	**Power Supply and Distribution**			
	1.1	Primary and secondary distribution, types of distribution systems, Ring, Radial, etc., comparison between a.c. and d.c distribution system.	**09**	**15**
	1.2	Kelvin's law, Voltage drop calculation for feeder fed at one end.		
	1.3	Single phase and 3 phases 4 wire A.C system, Balanced only.(Numericals)		
	1.4	Economics of electrical power supply and utilization.		
	1.5	Tariff, types of tariff as per M.S.E.D.C.L. and MERC.		
	1.6	Causes of low power factor, Disadvantages of low power factor, Advantages of improved power factor.		
	1.7	Methods of improving power factor - By use of i) Static condenser, ii) Synchronous condensers. iii) Automatic p.f. improvement by) Phase advancers (Numericals)		
2.	**Electrical Drives**			
	2.1	Advantages of Electrical drives, characteristics of loads.	**05**	**10**
	2.2	Different types of mechanical loads.		
	2.3	Characteristic of different drives.		
	2.4	Selection of drives for particular applications.		
	2.5	Types of enclosures, Types of duty cycles, ratings of motor (Simple numericals on selection of motor).		
3.	**Electrical Heating and Welding**			
	3.1	Electric Heating, Principle, types and advantages, principles involving resistance heating.	**10**	**15**
	3.2	Classification and construction of resistance furnace and applications of them.		
	3.3	Requirement of material for heating element causes of failure of heating elements and its design (Numericals).		

	3.4	Arc furnace – Principles, construction and applications of direct, indirect arc furnace.		
	3.5	Principle of Induction Heating, construction and working of core type direct, vertical core, indirect core and coreless type Induction heating furnaces and their applications.		
	3.6	Principles of high frequency eddy current and dielectric heating advantages, disadvantages and applications.		
	3.7	Temperature control of furnaces/ovens.		
	3.8	Electric Welding – Principles of electric welding and working of different types of welding e.g. spot welding, butt welding, projection welding, seam welding, gas welding, MIG welding, [illegible] cutting, arc welding, plasma welding, comparison of arc welding with resistance welding.		
		SECTION – II		
4.	**Elevators**			
	4.1	Types of electric elevators, size and shape of elevator car, speed of elevator, location of elevator machine, types of elevator motors, power transmission gears, braking, and elevator motors.	**04**	**10**
	4.2	Safety in elevators, Bombay lift act.		
5.	**Electric Traction**			
	5.1	Introduction, Requirements of ideal traction system,		
	5.2	Electrical traction system in India.		
	5.3	Systems of Track Electrification- Description of various systems e.g. d.c. systems, 1 ph. low frequency a.c., 1 ph. high frequency a.c., 3 ph. a.c. and composite system	**20**	**30**
	5.4	25 KV A.C.,50 Hz Systems – Advantages and Disadvantages		
	5.5	Comparison between A.C. and D.C. system		
	5.6	Mechanics of train movement – Speed-time curve (Simple numericals).		

	5.7	Power supply arrangement: High voltage supply, constituents of supply system, sub station, feeding post, feeding and sectioning arrangement.		
	5.8	Protection system for A.C. traction.		
	5.9	Overhead equipment (OHE) – catenary construction, OHE supporting structure, current collection system, conductor rail system, current collection gear for OHE collection, pantograph collector.		
	5.10	Traction Motors – Suitability of motors for traction – D.C. series, A.C. series, 1 ph. repulsion motor, 3 phase I.M., linear I.M.		
	5.11	Traction motor control: D.C. series motor control, series/parallel control, speed control by field weakening. (Simple numericals).		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Case study on electrical wiring system for (I) L.T. consumer (II) H.T. consumer as per M.E.R.C rules.	**02**
2.	To find the p.f. of 3 phase Induction Motor by direct loading. i) Without capacitor Bank ii) With capacitor Bank.	**02**
3.	**PP**: Visit to a medium size manufacturing industry and observe the heating procedure- write report, draw the plant layout state the principles of heating.	**06**
4.	**PP**: Visit to study the welding process – other details as(3) and list out the specifications of welding machines, welding rods etc.	**06**
5.	**PP**: Visit to lift installation site.	**04**
6.	**PP**: Visit to traction substation a.c./d.c. and draw single line diagram of s/s using Auto Cad and write a report on visit.	**06**

7.	**PP**: Visit to electric/diesel loco-shed and draw block diagram of locomotive. Also study the speed control of locomotive.	**06**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION – I	
1.	Power Supply and Distribution	Lectures, discussion, OHP
2.	Electrical Drives	Lectures, discussion, Problem solving
3.	Electrical Heating and welding	Lectures, discussion, visit.
	SECTION – II	
4.	Elevators	Lectures, discussion, OHP, visits
5.	Electric Traction	Lectures, discussion, visits

Text Books:

Sr. No	Author	Title	Publication
1.	H. Pratap	Modern Electric traction	Dhanpat Rai and sons
2.	Soni, Gupta, Bhatnagar	A course in Electrical Power	Dhanpat Rai and sons

Reference Books:

Sr. No	Author	Title	Publication
1.	S.L. Uppal	A course in Electrical power	Dhanpat Rai and sons
2.	V. K. Mehta	Principles of power systems	S. Chand and Co.
3.	----------	MSRC booklet.	----------

Learning Resources: Handouts, Charts, Line diagrams available from Khadaki Traction substation, Traction motor control circuits available from Pune Locoshed. www.indianrailway.com

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
SECTION – I					
1.	Power Supply and Distribution	04	05	06	15
2.	Electrical Drives	02	04	04	10
3.	Electrical Heating and welding	04	06	05	15
SECTION – II					
4.	Elevators	02	04	04	10
5.	Electric Traction	08	10	12	30
	Total	**20**	**29**	**31**	**80**

(Prof. Mrs. M. H. Bilgi)
Prepared By

(Prof. S. P. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : A.C. Machines
Course Code : EE 562

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--		--
Marks	20	80	50	--	--

Course Rationale:

This subject is classified under core technology group. It is intended to teach the students facts, concepts, principles and operation and testing of Electrical machine such as induction motor, alternator, synchronous motor, the student will be able to analyze the characteristics parameter and major performance of these machines.
These machines are used in all types of manufacturing industries and for generation to electricity. Most of the machines used in industry are induction motor. The knowledge gained by the student is useful in the study of subjects such switchgear & protection utilization of electrical power, testing and maintenance of electrical equipments and in their project work.
The knowledge and skills gained will be help full discharging duties of electrical supervisor, maintenance engineer, quality control engineers etc.

Course Objectives:

- To know the constructional details and working principle of various types of A.C. machine.
- Understand the operation, characteristics & performance of A.C. machines.
- Understand the starting A.C. machines.
- Operate given machine properly.
- Select motor of proper rating for particular use.
- Use the knowledge for testing of machine.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
	SECTION - I		
1.	**Three Phase Induction Motor**	**10**	**16**
	1.1 Construction of three phase induction motor.		
	1.2 Production of rotating magnetic field. Principle of operation/working of I.M.		
	1.3 Concept of slip, frequency of rotor induced emf,, rotor current(Numericals)		
	1.4 Equation of rotor induced emf , current , frequency , reactance and impedance under steady and running condition.		
	1.5 Torque equation of three phase induction motor.		
	1.6 Starting and running torque of squirrel cage and slip ring induction motor.		
	1.7 Condition for maximum and starting torque, Torque slip characteristics of three phase induction motor, Effect of change in rotor circuit resistance on torque-slip characteristics, Effect of change in supply voltage on torque-slip Characteristics.		
	1.8 Measurement of slip by a) Actual speed measurement b) Stroboscopic method c) Galvanometer method		

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2.	**Performance of Tree Phase Induction Motor**			
	2.1	Speed control of three phase induction motor by a) Pole changing method b) frequency control method c) By stator voltage control d) Rotor resistance method e) PWM technique		
	2.2	Power stages in I.M. (Numericals)		
	2.3	Circle diagram from no load test & blocked rotor test, plot maximum quantities on circle diagram O/P & I/P Torque (Numericals)		
	2.4	Application of three phase Induction Motor, I.M. as short-circuited transformer phasor diagram of I.M., Equivalent circuit of three phase I.M.	10	16
	2.5	Starting of three phase I.M. by a. D.O.L.Starter b. Star/ delta starter c. Auto transformer starter d. Rotor resistance starter. e. Soft Starters		
	2.6	Double squirrel case Induction Motor: construction, characteristics of inner and outer and combined characteristics, Applications		
3.	**Single Phase Motors**			
	3.1	Introduction, double field revolving theory, types of single phase I.M.		
	3.2	Split phasing principle& starting of I. Resistance start I.M. II. Capacitor Start run I.M. III. Double value capacitor Induction motor. IV. Shaded pole motor	04	08
	3.3	Torque- slip characteristics of above single phase I.M.		
	3.4	Applications of above motors.		

SECTION – II				
4.	**Three Phase Alternator**			
	4.1	Definition and construction of three phase Alternator, a) Armature b) Rotor- smooth cylindrical & projected type		
	4.2	Advantages of stationary armature construction		
	4.3	Derivation of e.m.f. equation of Alternator which includes a) Chording factor b) Distribution factor.		
	4.4	Factors affecting the terminal voltage of Alternator a) Armature resistive drop b) Leakage reactance drop c) Armature reaction at various power factors & concept of Synchronous Impedance.	**16**	**28**
	4.5	Regulation of three phase Alternator by a) Direct loading b) Synchronous impedance method c) mmf method (Numericals on all above)		
	4.6	Parallel operation of alternators, Synchronizing by 1) All dark method 2) One dark and two bright lamps 3) Synchroscope.		
	4.7	Effect of change in excitation, effects of change in input power (steam supply)		
	4.8	Numericals on load sharing.		
5.	**Synchronous Motor**			
	5.1	Principle of operation, method of starting, concept of load angle, machine angle of synchronous motor on load with constant excitation, effect of excitation at constant load, V curve and inverted V curve.	**08**	**12**
	5.2	Hunting and phase swinging, Applications, Comparison. (Simple Numericals)		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practicals/Experiment/Assignment	Hrs
1.	To identify the various parts of three phase I.M. a) Squirrel cage b) Slip ring	**04**
2.	To determine the slip of three phase I.M. by a)Direct speed measurement b) Stroboscopic method c) Galvanometer Method	**04**
3.	Demonstration of rotating magnetic field.	**02**
4.	Perform load test on three phase I.M.	**02**
5.	Speed control of three phase slip ring I.M. by rotor rheostatic control.	**02**
6.	Speed control of three phase I.M. by pole changing method.	**02**
7.	To performs No load test and blocked rotor test on three phase I.M. and draw circle diagram and determine its performance.	**02**
8.	a) Reduced Voltage running up test. b) To reverse the direction of rotation to three phase I.M.	**02**
9.	Speed control of I.M. by PWM technique.	**02**
10.	a) No load test on single phase I.M. b) To reverse the direction of rotation of single Phase I.M.	**02**
11.	Identify various parts of synchronous machine.	**02**
12.	To determine regulation of alternator by direct loading a) At Unity p.f. b) At lag P.F.	**04**
13.	To determine regulation of three phase alternator by synchronous impedance method at various power factor.	**02**
14.	To determine regulation of three phase alternator by mmf method.	**02**
15.	By suing D.C. shunt motor alternator set, observe the effect of excitation and speed variation on induced emf and plot O.C.C. of the given alternator.	**02**
16.	To plot curve and inverted V curve of synchronous motor.	**02**
	Total	**38**

Note: Any 12 practicals are to be conducted & at least 1 from each chapter.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Three phase I.M.	Class Room Teaching, Lab work, PPT, Industry visit, Animated clips for working of motor other information from web site.
2.	Single Phase I.M.	Class Room Teaching, Lab work, PPT, Industry visit, Animated clips for working of motor other information from web site.
3	Three Phase Alternator	Class Room Teaching, Lab work, PPT, Animated clips for working of motor other information from web site. Visit to institute D.G. set.
4.	Three phase I.M.	Class Room Teaching, Lab work, PPT, Animated clips for working of motor other information from web site.

Text Books:

Sr. No	Author	Title	Publication
1.	B.L.Theraja	Electrical Technology Vol.II	S. Chand & Sns.
2.	S.K.Bhattacharya	Electrical Machine	

Reference Books:

Sr. No	Author	Title	Publication
1.	J. B. Gupta	Electrical Machine.	
3.	C.L.Daws	Performance & design of alternating current machine	
4.	M.G.Say	Direct Current Machine	
5.	Nagrath and Kothari	Electrical Machine.	

Learning Resources:

Class room teaching, Lab work & magazines, animated clip for principle A.C. Machines from website, PPT presentation Text books & reference books, Industrial Visit.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Three phase I.M.: constructions & characteristics	04	04	08	16
2.	Performance of three phase induction motor.	04	04	08	16
3.	Single Phase I.M.	04	02	02	08
4.	Three Phase Alternator	06	06	16	28
5.	Synchronous motor	04	04	04	12
	Total	**20**	**20**	**40**	**80**

Prepared By (Prof. D.A.Katare) **(Prof. S. R. Kulkarni) Secretary, PBOS** **(Prof. D.A.Katare) Chairman, PBOS**

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Industrial Controls & Control panel design.
Course Code : EE563

Teaching Scheme:

	Hours / Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of One hour.	03 Hrs.	--	--	--
Marks	20	80	--	50	--

Course Rationale:

The aim of this course is to develop the technician to carry out the responsibilities in the industries related to industrial control. Diploma holder employed in industry needs to operate, test and maintain the industrial drives, its power control and hydraulic and pneumatic control systems. He also develops, test and install industrial control panels used for industrial drives. It is very essential for him to know the electrical logic, input devices, control supply, control devices, hydraulic and pneumatic control systems and designing control circuits.
This course covers electrical controls of drives, hydraulic and pneumatic control circuits and developments of control circuit using control components and control panel design, selection of switchgear, wiring, testing and installation of control panels. This will enable him to work as technician / engineer in industry or to get self employed.

Course Objectives:

- Understand the different types of sensor outputs.
- Know the basic sensor types and understand application issues.

- Identify various components of hydraulic & pneumatic systems.
- Know the working principle of various components used for hydraulic & pneumatic systems.
- Be aware of various actuators available.
- Design and read the electromagnetic control circuit.
- Understand hydraulics & pneumatics control circuits.
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- Read and interpret the drawings showing different hydraulic and pneumatic circuits.
- Design simple hydraulic and pneumatic circuits.
- Select suitable switchgear and design the control panel.
- Carry out wiring, installation and testing of control panels.
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Course Content:

Chapter No.		Name of Topic/Sub topic	Hrs	Weightage
		SECTION – I		
1	**Electrical Controls**			
	1.1	General idea of control, introduction to magnetic control, Industrial applications.	**13**	**20**
	1.2	Introduction of electrical power circuits and control circuit, contacts, types of contacts, current capacity of contacts.		
	1.3	Input devices or control elements: - a) Manual control switches: – push buttons, foot switch, selector switch, Rotary Switches. b) Pilot switches: – Limit switches, proximity switches (Constructions, working principles, applications, types, specifications & connections), temperature actuated switches, level control switches, pressure sensing switches, Overload sensing switch.		

	1.4	Output devices: – a) Electrically actuated devices: - electromagnetic relay, Reed relay, relay cards, Timers, counters. Control circuits using relays, timers & counters. b) Contactor, Solenoid (a.c. & d.c.) actuated valves, pilot lamps (indicating lights), annunciators, LEDS& LCDS.		
	1.5	Control Voltage Supply: – Control transformer, power supply.		
	1.6	Symbols in power circuit and control circuit of above I/O devices.		
	1.7	Basic rules to design control circuit.		
	1.8	Design of simple various control circuits using above pilot devices such as limit switches, float switches etc. (e.g. conveyer belt, shaping machine, lift, hoist, water level controller, compressor controller etc.)		
2.	**Pneumatic Control System**			
	2.1	Principles of hydraulic & Pneumatic: General layout of oil hydraulic & Pneumatic systems, qualities of working medium, Merits and limitations of oil in hydraulic systems.		
	2.2	**Components of Pneumatic System** *(Only function, symbolic representation, control circuit, no constructional details required)* i. Compressor: its accessories & control circuit. ii. FRL Unit: - Air filter, regulators, and lubricators. iii. Pneumatic power elements: - Air cylinder, special air cylinders, multiple position cylinder, tandem cylinder, cushioning, diaphragm cylinder, rotary cylinders, and rodless cylinder. iv. Control of pneumatic power :– Pneumatic control devices/ valves - shut off valves, check valves ,flow control valves, proportional control valve, sequence valve, direction control valves, types of actuations of valves. v. Pneumatic control circuit:-pneumatic circuit such as Speed control circuits, sequencing circuits.	**06**	**10**

3.	**Hydraulic Control System**			
	3.1	(Only function, symbolic representation in control circuit, no constructional details required.) Hydraulic components: - accumulator, fitters, seals, interconnection of various elements.		
	3.2	Types of pumps used in hydraulic power system.		
	3.3	Control devices in hydraulic system: - pressure control valves, flow control valves, direction control valves, and proportional servo valves.	**05**	**10**
	3.4	Hydraulic control circuits such as Bleed off circuit.		
	3.5	Sequencing circuit, control of Milling machine, Shaper machine, and Motion synchronization circuit.		
	3.6	Comparison between electrical, hydraulic and pneumatic control systems, their merits and demerits.		
		SECTION – II		
4.	**Control Panel Circuits.**			
	4.1	What is control panel? Types of panel such as MCC panel, PLC panel, capacitor panel, Power control panel etc. Need of control panel.		
	4.2	Design of power & control circuit of motor using D.O.L. starter, auto transformer starter, star delta starter.	**08**	**14**
	4.3	Design control circuit of interdependence control circuit, sequential operation, interlocking.		
	4.4	Forward /reverse direction of motor, plugging stopping of motor, dynamic braking.		
	4.5	Circuit analysis, control circuit reading and interpretation.		
5	**Selection of control panel components & Design**			
	5.1	Selection of Push buttons, illuminated PB, indicating lamps, hooter, mimic, Contactor, Thermal overload relay, Air circuit breaker, MCCB,MPCB, MCB, ACB, Fuses, Timers, Panel meters, SFU, Isolators, Connectors. Use of standard tables and charts of above components in view of panel design.	**07**	**12**

	5.2	Design and drawing of Control Cabinet for fabrication, rigidity and enclosure materiel, dimensions of control cabinets, preferred heights for locating displays, controls, electrical devices, Overall control panel dimensions by considering incoming feeder, bus bar etc. Ventilation & clearance in control panel. Cutting, bending, welding, painting and powder coating of panel.		
6	**Panel Wiring & Testing**			
	6.1	Standards for wire identification, Guidelines for power and control circuit panel wiring, Selection of wires for control circuits, colour of wires, size of lugs w.r.t. current capacity & materials, Crimping, etc. Guidelines for numbering wires (ferrules). Cable identification, labeling for cable, cable numbering, Cable selection. Methods of wiring for power circuit. Colour codes for push button and indicators.		
	6.2	**Testing and Commissioning of Control Panel:** Testing of Control Panel, Physical & Logical check of control panel, Functional & operational testing, Testing of protective devices by artificial fault creation, testing of Indicating instruments & lamps, H.V. Testing, Megger testing, Commissioning of Control panel, Panel earthing,	**09**	**14**
	6.3	**Troubleshooting in control circuits:** Trouble spots, general procedure for troubleshooting, maintenance and repairs of panel boards and accessories.		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Drawing sheet on symbols of power and control devices.	**02**
2.	Drawing sheet on Input devices and output devices.	**02**
3.	Demonstration & use NO/NC contacts in control circuit of different input devices.	**02**

4.	Demonstration & use NO/NC contacts in control circuit of different output devices.	**02**
5.	Develop control circuit for to & fro motion of motor by using limit switches. Or Develop control circuit for automatic compressor using pressure switches.	**02**
6.	Demonstration of pneumatic system components & their use in control circuits.	**02**
7.	Development of pneumatic control circuit for sequencing operation.	**02**
8.	Demonstration of hydraulic system components & their use in control circuits.	**02**
9.	Development of hydraulic control circuit for up/ down motion operation.	**02**
10.	Develop of D.O.L. starter.	**02**
11.	Develop of Star- delta starter.	**02**
12.	Develop control circuit for forward – reverse operation of motor.	**02**
13.	**PP**: Collect the catalog of control panel components & determine the data in view of control panel design such mechanical dimensions, mounting etc.	**04**
14.	**PP**: Visit to control panel manufacturing industry and prepare report on different activities performed during panel manufacturing.	**06**
	Total	**34**

Note: Any 12 practicals are to be conducted & at least 3 from each chapter.

PP: It stands for professional Practices. It is compulsory to all students & they must complete in a group of 4-5 students.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Electrical controls	Lecture methods, PPT presentation, Demonstration, Laboratory work.
2.	Pneumatic Control System	Lecture methods, PPT presentation, Demonstration, Laboratory work.
3.	Hydraulic control system.	Lecture methods, PPT presentation, Demonstration, Laboratory work.
4.	Control Panel circuits	Lecture methods, PPT presentation, reference catalog, industrial visit.

5.	Selection of Control Panel Wiring Components & design.	Lecture methods, Laboratory work, respective I.S. & industrial visit.
6.	Panel Wiring & Testing	Industrial visit.

Text Books:

Sr. No	Author	Title	Publication
1.	S.K. Bhattachrya Brijinder Singh	Control of Electrical Machines	New Age International Publishers.
2.	Chandrsekhar	Hydraulic & Pneumatic power	

Reference Books:

Sr. No	Author	Title	Publication
1.	U. S. Eswa	Electrical Motor Control System	TMH, New Delhi
2.	Kenneth B. Rexford	Electrical Control for Machines	Delmar Pub. Inc.
3.	S.K.Mujudar	Pneumatic Systems Principles & Maintenance	Tata McGraw Hills
4.	S.K.Mujudar	Hydraulic Systems Principles & Maintenance	Tata McGraw Hills

Learning Resources: Class room teaching, Laboratory work, Industry visits, Images, animated clips &technical specifications from relevant web sites, Reference books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Electrical controls	08	06	06	20
2.	Pneumatic Control System	02	04	04	10
3.	Hydraulic control system.	02	04	04	10
4.	Control Panel circuits	04	06	04	14
5.	Selection of Control Panel Wiring Components & design.	04	04	04	12
6.	Panel Wiring & Testing	04	02	04	10
		Total	**28**	**22**	**30**	**80**

(Prof. K.M. Kakade)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Switchgear and Protection
Course Code : EE 564

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	20	80	--	--	--

Course Rationale:

Presently electrical power system is growing fast due to increasing industries, needs, population .A diploma pass out may have to work in the field of generation, transmission distribution ,maintenance, testing .So the student must know about the switchgear& protection. It is expected that the knowledge of facts , concepts principles and procedural aspects of switchgear and protection system must be known to the students .it will ultimately help the students in discharging their duties such as technicians , engineer in power house , substation , testing service sectors.

Course Objectives:

- Understand the normal & abnormal conditions of power system and determine short circuit current & short circuit KVA.
- State effects of abnormal conditions on the operation power system.

- Understand the circuit interrupting devices for L.T. & H.T. circuit, their working principle, interlocking mechanism, selection and ratings.
  Understand the principles, operation of relay & switchgears.
- To read & develop a single line diagram of power system. Understand the abnormal conditions in operation of alternator, transformer, motor & transmission lines.
- To select proper protection scheme for above equipments against abnormalities.
  Understand the lightening phenomenon, its effect on power system.
- To select proper protection scheme against the overvoltage in power system.
  To identify the faults and repair the switchgears.
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Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION – I			
1.	**Fundamentals of Protection**			
	1.1	Necessity and functions of protective system, primary and back up protection.	**04**	**06**
	1.2	Normal & abnormal conditions, type of faults and their causes.		
	1.3	Short circuit calculations (Numericals on faults only), use of current limiting reactors & their arrangements.		
2.	**Circuit Interrupting Devices**			
	2.1	Rewirable fuse, HRC fuse: Construction, types, working & characteristics, selection and applications.	**06**	**10**
	2.2	Isolators vertical break, horizontal break, and pantograph type		
	2.3	Arc formation process.		
	2.4	Methods of arc interruption, terms related to arc quenching, restriking voltage recovery voltage etc sequence of operation & interlocking CB, isolator & earthing switch.		

3.	**Circuit Breakers**			
	3.1	LT Circuit Breaker , Air circuit breaker (ACB) , Miniature Circuit Breaker (MCB) , Moulded Case Circuit CB (MCCB) Earth leakage circuit breaker (ELCB) selection of LT switchgear, i.e. LT CB'S selection and rating of Circuit Breaker , Numericals on C.B. rating.	**07**	**12**
	3.2	Maintenance & trouble shooting of LV switchgear like MCCB, MCB, ELCB & contactors.		
	3.3	H.T. Circuit Breaker, classification, construction, specification and applications of H.T. circuit breakers such as Minimum Oil Circuit Breaker (MOCB), Sulpher Hexa fluoride (SF6) C. B. & Vacuum Circuit Breaker,		
4.	**Protective Relay**			
	4.1	Introduction, function & single line diagram of protective relay system.	**07**	**12**
	4.2	Relay terminology.		
	4.3	Classification of relays based on principle of operation, application, construction, times of operation, adjustment, setting.		
	4.4	Characteristics, working principle & application of following relays: Electromagnetic relay, induction relay with directional elements, thermal relay, and static relay.		
	4.5	Time-current characteristic, static over current relay, microprocessor based over current relay.		
		SECTION – II		
5.	**Protection of Alternator**			
	5.1	Abnormalities and faults.	**06**	**10**
	5.2	Differential protection, biased differential Protection, Protection against prime mover failure, field failure and unbalanced load, restricted earth fault protection, over current, earth fault, inter turn fault, negative phase sequence, over heating protection & Reverse power protection.		

6.	**Protection of Transformer**			
	6.1	Abnormalities & faults,	**06**	**08**
	6.2	Differential protection, earth faults, interturn, restricted		
	6.3	earth fault, over heating protection.		
	6.4	Simple Numericals on differential protection.		
	6.5	Buchholz relay.		
7.	**Protection of Induction Motor and Neutral Earthing**			
	7.1	Protection of I.M.: Abnormalities and faults, short circuit, over load protection, single phasing.	**03**	**06**
	7.2	Neutral Earthling: Introduction and importance, method of earthling, substation earthling.		
8.	**Protection of Bus bar & Transmission Line**			
	8.1	Abnormalities & Faults.	**05**	**08**
	8.2	Distance Relay principle, static, microprocessor based.		
	8.3	Differential Relay.		
	8.4	Differential Relay (Simple Numerical on Relay Setting).		
	8.5	Bus bar protection.		
	8.6	Transmission line protection: Current, distance, pilot wire protection.		
9.	**Over Voltage Protection**			
	9.1	Causes of over voltage: Lightning Phenomenon & over voltage due to lightening.	**04**	**08**
	9.2	Protection of transmission line and substation from direct stroke.		
	9.3	Types of lighting arresters 1) Rod Gap 2) Horn Gap 3) Expulsion 4) Thyrite Type 5) Zno Type		
	9.4	Principle & operation of surge absorbers		
	9.5	Protection against traveling wave		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
	SECTION – I	
1.	To plot operating current-time characteristics of fuse.	**02**
2.	**PP:** Visit to L & T Switchgear Training Centre and write visit report comprising function, working, operation, testing & maintenance of MCB, ELCB, MCCB and Contactor.	**06**
3.	Drawing sheet on circuit breakers – MCB, ELCB, SF6 Circuit Breaker and Vacuum Circuit Breaker.	**02**
4.	Setting of thermal overload relay and plot the characteristics of thermal overload relay.	**02**
5.	Drawing sheet on Relays – Electromagnetic Relays (Any Two), Induction Relay with directional elements, Thermal Relay, Buchholz Relay.	**02**
6.	Test and plot characteristics of earth faults & over current relay.	**02**
	SECTION – II	
7.	Drawing sheet on Protection Schemes of Alternator in AutoCAD: - biased differential Protection, restricted earth fault, unbalanced load	**04**
8.	Drawing sheet on Protection Schemes of Transformer in AutoCAD: - biased differential Protection, earth fault.	**02**
9.	Connect DOL starter & single phase preventer in I.M. circuit and check operation for single phasing, overload & short-circuit faults.	**02**
10.	**PP:** Visit to high voltage substation & draw single line diagram of substation. State function & technical specification of equipments used therein.	**06**
11.	Drawing Sheet on Lightening Arresters – Rod Gap, Horn Gap, Expulsion Type, Thyrite Type, Zno type	**02**
	Total	**32**

PP: It stands for professional Practices. It is compulsory to all students & they must complete in a group of 4-5 students for different loads.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION – I	
1.	Fundamentals of protection.	Lecture, discussion
2.	Circuit Interrupting Devices.	Lecture, PPT, Q/A, industrial visits
3.	Circuit Breakers	Lecture, industrial visit, PPT.
4.	Protective Relays	Lecture, discussion
	SECTION – II	
5.	Protection of Alternator.	Lecture, models, PPT, industrial visits.
6.	Protection of Transformer.	Lecture, PPT, industrial visits.
7.	Protection of Induction Motor and Neutral earthing.	Lecture, PPT, industrial visits.
8.	Protection of Bus bar & Transmission Line	Lecture, PPT, industrial visit.
9.	Over Voltage Protection	Lecture, PPT, industrial visit.

Text Books:

Sr. No	Author		Publication
1.	V.K.Mehta	Principles of power system	S. Chand & co New Delhi.
2.	Badriram & Vishwwakarma	Power system protection & switch gear	TMH New Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	Sunil S. Rao	Switchgear and protection	Khanna Publishers,Delhi.
2.	S.L.Uppal	A course in Electrical Power	Khanna Publications Delhi
3.	Mason C.R.	The art and science of protective relay.	

Learning Resources:

Class room lecture, animated images or static images from web site, Industrial visits, and Reference books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION – I				
1.	Fundamentals of protection	02	04	00	06
2.	Circuit Interrupting Devices	02	02	06	10
3.	Circuit Breakers	04	04	04	12
4.	Protective Relays	04	04	04	12
	SECTION – II				
5.	Protection of Alternator.	02	02	06	10
6.	Protection of Transformer	02	02	04	08
7.	Protection of Induction Motor & Neutral earthing	02	02	02	06
8.	Protection of Bus bar & Transmission Line	02	02	04	08
9.	Over Voltage Protection	02	02	04	08
	Total	**22**	**24**	**34**	**80**

(Prof. D. A. Katare & Prof J.G. Momin)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Electrical Wiring and Estimation
Course Code : EE 565

Teaching Scheme:

	Hours /Week	Total Hours
Theory	03	48
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of one hour.	03 Hrs.	--	--	--
Marks	20	80	--	--	--

Course Rationale:

The diploma holder of electrical engineering generally works on residential, commercial and industrial electrical installation or he may become entrepreneur in field of contracting or electrical installation after some experience. In the above field, he has to supervise the site, manage the right materials at right time at site. He also works as estimator in above field. To fulfill the above requirement, he has to select the proper residential, commercial and industrial wiring accessories and materials, prepare their estimates with their costs. He must know the general procedures for such installation, estimation and costing, he can apply these procedures in different situations and for different purposes.
The topics covered in this course are general illumination, general principle of estimation, service connections, earthing, residential wiring, commercial, industrial wiring and quotation & tender.

Course Objectives:

- Design general illumination scheme for residential, commercial & industrial complex.
- Understand the purpose & procedure of estimation.
- Design electrical installation & draw electrical drawing in AutoCAD for residential, commercial & industrial installation.
- Prepare estimates for wiring residential, commercial & industrial installations along with illumination schemes and required sketches.
- Prepare estimates for H.T., L.T. line and 11KV/415V substation.
- Determine materials and specifications required for electrical installations.
- Understand the procedure of procure project materials through quotations and tenders.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
	SECTION –II		
1.	**Illumination**		
	1.1 Introduction, terms used in illumination such as glare, co-efficient of utilization, distribution factor, Space to height ratio etc, laws of illumination.		
	1.2 Sources of light – Fluorescent tube, CFL, halogen lamps, Mercury vapour lamps ,Sodium vapour lamp, Neon tubes, Comparison among lamps.		
	1.3 Types of lighting schemes.	**08**	**12**
	1.4 Design considerations of good lighting scheme such as standard illumination level for different applications, selection of luminaries, size of room, mounting height, condition of use.		
	1.5 Design of lighting schemes – residential, commercial, industrial purposes and street lighting. (Numericals)		
2.	**Elements of Material Estimating and Costing**		
	2.1 Purpose of estimating and costing		
	2.2 Qualities of good estimator	**02**	**04**
	2.3 Essential elements of estimating and costing		

3.	**Residential Installation**			
	3.1	Review of wiring accessories in view of its purpose and specifications.		
	3.2	Requirement of electrical installations such as civil plan, customer requirement and I.E. rules.		
	3.3	Design of domestic installation – General guidelines for residential installations, electrical plan layout, single line diagram, schematic wiring diagram, distribution of load as per I. E. rules, size of wires, selection of wires and other relevant material including bus bar, fuse, switches, M.C.B. and E.L.C.B., material schedule.	08	14
	3.4	Estimation and costing of residential electrical installation. (Numericals)		
	3.5	Service connections & its type, I.E. rules for service connections, material schedule for different type's service connections. (Numericals).		
	3.6	Earthing and its type, Indian Standard specifications regarding earthing of electrical installations, prepare material schedule for earthing. (Item, specifications, qty, rate and total amount) I.E. rules for earthing (Numericals)		
4.	**Electrical Installation for commercial Building**			
	4.1	Supply system and load distribution, design consideration of electrical installation for commercial building.	06	10
	4.2	Estimation & costing of electrical installation for commercial buildings. (Numericals)		
	4.3	Testing of residential, commercial installation.		

SECTION – II				
5.	**Industrial Installation**			
	5.1	Power wiring for motors & generators etc, supply distribution in power wiring.	**07**	**12**
	5.2	Guidelines for industrial wiring.		
	5.3	Design consideration for electrical installation in small industries – Motor current, selection and size of cable, size of conduit, fuse rating, selection of starter, distribution board, main switch and other relevant materials,		
	5.4	Design of industrial installation – plan layout, single line diagram, wiring diagram, material schedule, Estimation and costing of industrial wiring. (Numericals)		
6.	**Overhead and underground distribution lines (Feeders)**			
	6.1	Review distribution line components in various systems specifications, Materials used in H.T. (11KV) and L.T (415V) distribution lines.	**07**	**12**
	6.2	Design considerations of overhead distribution lines /feeder.		
	6.3	Estimation and costing of overhead distribution lines / feeder (Numericals)		
	6.4	Underground cables (H.T. & L.T.) Design consideration of underground cables, Underground cable for street lighting. Estimation and costing of underground cable feeder. (Numericals)		
7.	**Substation**			
	7.1	Types of substations – pole-mounted substations & indoor substations.	**06**	**10**
	7.2	Estimation and costing of substations. (Numericals)		
8.	**Tender and Quotation**			
	8.1	Definition, different terms such as earnest money, security deposit, warranty period, work contract tax, contract agreement, scope of work.	**04**	**06**
	8.2	Quotation – requisition, call of quotation, opening of quotation, comparative statement, purchase order.		

	8.3	Tender – procedure to prepare tender document, floating of tender, terms and conditions, filling of tender, (Item wise/tender wise), e-tendering.		
	8.4	Difference between quotation and tender.		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Measurement of illumination of existing office or commercial complex and redesign illumination scheme for office or commercial complex as per standards.	**04**
2.	Design illumination scheme for street lighting	**02**
3.	**PP:** 3. Collect catalog of wiring accessories & protective devices and determine information for estimation of electrical installation.	**02**
4.	Estimation & costing of electrical installation for 1/2 BHK flat.	**02**
5.	Study of service connection for residential building and prepare material schedule as per I.E. rules.	**02**
6.	a: Estimation of material required for installation of a 1.5 ton window air –conditioner. b: Estimation & costing of electrical installation for commercial complex such as institute's classroom etc.	**04**
7.	Estimation & costing of electrical installation for a workshop (Light and power).	**04**
8.	Estimation & costing of electrical H.T. Or L.T. overhead feeder.	**04**
9.	Estimation & costing of electrical H.T. Or L.T. underground cable feeder.	**04**
10.	**PP**. : Case study – To prepare quotation, call quotation, make comparative statement etc. OR Collect tender notice from newspaper, study tender document and fill tender form.	**04**
	Total	**32**

Note: For completing term work, necessary layouts /single line diagrams / design drawing must be drawn in AutoCAD.

PP: It stands for professional Practices. It is compulsory to all students & they must complete in a group of 4-5 students for different materials or projects.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Illumination	Lecture methods, assignments, Laboratory work, numericals.
2.	Elements of Estimating and costing	Lecture methods.
3.	Residential Installation	PPT presentation, Lecture methods, assignments, numericals & site visit.
4.	Electrical Installation for commercial building.	PPT presentation, Lecture methods, assignments, numericals & site visit.
5.	Industrial Installation	PPT presentation, Lecture methods, assignments, numericals & site visit.
6.	Overhead and underground distribution lines(feeders)	PPT presentation, Lecture methods, assignments, numericals & site visit.
7.	Substation	PPT presentation, Lecture methods, assignments & site visit.
8.	Tender and quotation	PPT presentation, Lecture methods, case study.

Text Books:

Sr. No	Author	Title	Publication
1	Surjit Singh	Electrical Estimating & Costing	Dhanpat rai & co. Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	K.B. Raina & S.K. Battacharya	Electrical Design Estimating & Costing	New age international Pub.
2.	----------	Tender documents. E-tendering	Any Big organisation such as railway/

			PMC/PCMC.
3.	----------	PWD hand book, Rate Contract Book.	

Learning Resources: Lamp manufacture's website from India, Visit to residential or industrial installation site, Visit to substation & feeder site PWD DSR, Market survey for electrical materials, Reference books

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Illumination	02	04	06	12
2.	Elements of Estimating and costing.	02	02	00	04
3.	Residential Installation	02	04	08	14
4.	Electrical Installation for commercial building.	02	02	06	10
5.	Industrial Installation.	02	02	08	12
6.	Overhead and underground distribution lines (feeders)	02	02	08	12
7.	Substation.	02	02	06	10
8.	Tender and Quotation.	04	02	00	6
		Total	**18**	**20**	**42**	**80**

(Prof. K. M. Kakade)
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Chairman, PBOS

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Instrumentation and Control
Course Code : EE 566

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**03**	**48**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Termwork
Duration	Two class tests each of 60 minutes	03 Hrs.	--	--	--
Marks	20	80	--	25	--

Course Rationale:

An Electrical Engineer many times requires to work in maintenance department. He is required to handle the various electronic instruments to measure various quantities like pressure, temperature, viscosity, displacement etc. It is necessary to make him aware about various instruments. In this subject, the study of various transducers needed for the measurements of various physical parameters, their types and display system with interfacing circuit needed in instrumentation systems is incorporated.

Course Objectives:

- Understand various transducers available for measurement of temp, displacement, pressure, strain, volume, flow etc.
- State the characteristics / properties of above transducers.
  To select the relevant transducer for measurement of physical quantity.
- Understand the signal conditioning.
-

- Develop the complete measurement system for measurement of various quantities
- Use of various display systems suitable for measurement system.
- Understand the control system concept & types of control system.
- Identify the control system components.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION – I			
1.	**Introduction**			
	1.1	Block diagram of instrumentation and control system,	**02**	**04**
	1.2	Steady state and transient response of instrumentation system.		
2.	**Transducer**			
	2.1	Definition, classification of transducer, Transduction principle, types of transducers such as Resistive, Inductive, Capacitive, active, passive, etc.,	**03**	**04**
	2.2	Selection of transducer.		
3.	**Process Measurement**			
	3.1	Flow – orifice plate, venturimeter, flow nozzle, pitot tube, rotameter, turbine, electromagnetic flowmeter, vortex and laget type flowmeter, positive displacement type flowmeter, ultrasonic flowmeter, mass flowmeter.	**06**	**10**
	3.2	Measurement of gas flow.		
4.	**Temperature Measurement**			
	4.1	Temperature scales, thermocouples, Resistance temperature detector (Pt100, & Pt1000) thermister & pyrometers.	**03**	**06**
5.	**Level Measurement**			
	5.1	Float type, hydrostatic, pressure type, use of D.P. transmitters for level measurement.	**05**	**08**
	5.2	Resistance, conductivity, capacitance, ultrasonic and nucleonic type level measurement, level switches.		

6.	**Pressure Measurement**			
	6.1	Pressure gauges, pirani gauge, elastic elements, bourdon tube, bellows, diaphragm, capsule, Manometers.	**05**	**08**
	6.2	Strain gauges, Inductive, Capacitive, potentiometer type transducers for pressure measurement.		
	6.3	Pressure switches.		
	SECTION – II			
7.	**Other Measurements**			
	7.1	M.C. Level Gauge, Measurement of PH, conductivity, density, speed, humidity, vibrations, viscosity, displacement, strain, acceleration.	**04**	**06**
8.	**Instrumentation Amplifiers and Signal Conditioning**			
	8.1	Instrumentation amplifier, Isolation amplifier, signal conditioning, signal processing circuits (A/D).	**07**	**12**
	8.2	Data acquisition system, signal conditioning, 8 input, single channel and multi channel data acquisition system.		
9.	**Display systems and recording instruments**			
	9.1	Segment and dot matrix display system, X-Y recorder.	**05**	**08**
	9.2	Recorders for voltage, frequency, kWh, kVAh, KVARh in sub station or power station.		
	9.3	Telemetry – working with block diagram.		
10.	**Control Systems**			
	10.1	Concept of control system, types of control system such as open loop & closed loop.	**08**	**14**
	10.2	Concept of automation, advantages of automation,		
	10.3	Control circuit components, development of block diagram of control system (e.g. level control, temperature control etc.) and identify its component such as error detector, controller, actuator, process etc.		

	10.4	Actuator – a.c. and d.c. servomotor (no derivation of transfer function), solenoid coil, stepper motor, synchros, valves.		
	10.5	Mode of control system – ON/OFF, concept of P, PI, PID control.		
		Total	**48**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1	Study of photosensitive relay.	02
2	Study of venturimeter.	02
3.	Calibration of temperature indicator.	02
4	To plot the characteristics of RTD.	02
5	To plot the characteristics of thermister.	02
6	To plot the characteristics of thermocouple.	02
7.	Measurement of displacement using LVDT.	02
8.	Measurement of PH value.	02
9.	Level measurement by capacitive transducers.	02
10	Study of strain gauges and measuring circuits.	02
11.	Design, build and test instrumentation amplifier.	04
12.	Study of various display systems.	02
13.	Demonstration & use of control system components.	04
14.	Demonstration of water level controller.	02
15.	Study of P, PI, and PID controller and plot its response.	04
	Total	**36**

Note: Any 12 practicals are to be conducted & at least 1 from each chapter.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION – I	
1.	Introduction	Class room Teaching
2.	Transducers	Class room teaching, laboratory work
3.	Process measurement	Class room teaching, Laboratory work, Industrial visit.
4.	Temperature Measurement	Class room teaching, Laboratory work, Industrial visit.
5.	Level Measurement	Class room teaching, Industrial visit.
6.	Pressure Measurement	Class room teaching, Laboratory work, Industrial visit.
	SECTION – II	
7.	Other Measurement	Class room teaching, Laboratory work, Industrial visit.
8.	Instrumentation Amplifier, Signal conditioning	Class room teaching, Laboratory work, Industrial visit.
9.	Display System and Recording Instruments	Class room teaching, Industrial visit.
10.	Control Systems	Class room teaching, , Industrial visit.

Text Books:

Sr. No	Author	Title	Publication
1.	A.K.Sawhney	Electrical Measurement & instrumentation system	Khanna Pub.
2.	J.G. Joshi	Instrumentation	

Reference Books:

Sr. No	Author	Title	Publication
1.	Malvino	Instrumentation	TMH, Delhi
2.	Rangan, Mani, Sarma	Instrumentation devices and system	TMH, Delhi

Learning Resources:

Reference Manuals, Handbooks, Service manuals of instruments, Handouts, Reference books, Techno-commercial information of sensors & transducer from web site.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION – I				
1.	Introduction	02	02	-	04
2.	Transducers	02	-	02	04
3.	Process measurement	04	02	04	10
4.	Temperature Measurement	02	00	04	06
5.	Level Measurement	02	02	04	08
6.	Pressure Measurement	02	02	04	08
	SECTION – I				
7.	Other Measurement	02	00	04	06
8.	Instrumentation Amplifier and Signal conditioning	02	06	04	12
9.	Display System and recording Instruments	02	04	02	08
10.	Control System	04	06	04	14
	Total	**22**	**24**	**34**	**80**

(Prof. K. M. Kakade, Prof. R.D. Pardeshi)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Installation, Testing & Maintenance of Electrical Equipments.
Course Code : EE 567

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**02**	**32**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 30 minutes.	03 Hrs.	--	--	--
Marks	20	100	--	25	--

Course Rationale:

This is technology level subject with application in Industry, commercial, public utility departments such as PWD, Irrigation, MSEB, water supply & sewage board etc. After studying this subject student will be able to inspect, test, install & commission electrical machines as per IS and International standards. He / She shall carry out routine & preventive maintenance of electrical machines & possesses knowledge of Indian Electricity Act, safety rules, safety of machines & persons, prevention of accident. This will help him to initiate total productive maintenance.

Course Objectives:

- Test single phase, three phase transformer, DC & AC machine as per IS
- Identify / Locate common troubles in electrical machines & switch gear
- Plan & carry out routine & preventive maintenance

- Install LV switchgear & maintain it.
- Ascertain the condition of insulation & revarnishing if necessary
- Initiate total productive maintenance
- Awareness and safety measures.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION – I			
1.	**Introduction**			
	1.1	Objectives of testing significance of I.S.S. concept of tolerance, routine tests, type tests, special tests,	04	08
	1.2	Methods of testing a) Direct b) Indirect, c) Co-operative.		
	1.3	Concept of routine, preventive & breakdown maintenance, advantages of preventive maintenance, procedure for developing preventive maintenance schedule, factors affecting preventive maintenance schedule.		
	1.4	Introduction to total productive maintenance.		
2.	**Testing, maintenance & troubleshooting of rotating machines**			
	2.1	Type tests, routine tests & special tests of 1- & 3 phase Induction motors.	09	16
	2.2	Routine, Preventive, & breakdown maintenance of 1 -& 3 phase induction motors as per IS 9004:1992		
	2.3	Troubleshooting of 1 Ø & 3		
	2.4	Maintenance of alternator & synchronous machines as per IS 4884-1968.		
3	**Testing , maintenance & troubleshooting of Transformers**			
	3.1	1 List type test, routine test & special test as per I.S. 2026-1981	07	16

	3.2	Procedure for conducting following tests: I. Measurement of winding resistance. II. No load losses & no load current, III. Impedance voltage, load losses, IV. Insulation resistance. V. Induced over voltage withstand test. VI. Separate source voltage withstand test. Impulse voltage withstand test.		
	3.3	Prepare trouble shooting chart for single and three phase transformer.		
		SECTION – II		
4.	**Testing & maintenance of Insulation:**			
	4.1	Classification of insulating materials as per I.S. 3504(part III) 1994.		
	4.2	Factors affecting life of insulating materials, measurement of insulation resistance & polarization index, condition of insulation.		
	4.3	Methods of measuring temperature of internal parts of windings/machine, applying the correction factor when the machine is hot.		
	4.4	Properties of good transformer oil, list the agents which contaminate the insulating oil,		
	4.5	Understand the procedure of following tests on oil as per I.S. 1692-1978 a) acidity test b) [illegible] test c) crackle test e) flash point test. Filtration of insulating oil, care of electrical equipments (insulation) during the period of inactivity.	**08**	**16**
	4.6	Methods of cleaning the insulation covered with loose, dry dust, sticky dirt, & oily viscous films, procedure for cleaning, washing & drying of insulation & revarnishing.		
	4.7	Methods of internal heating & vacuum impregnation.		

5.	**Installation**			
	5.1	Factors involved in designing the machine foundation.	**04**	**12**
	5.2	Requirement of different dimension of foundation for static & rotating machines, procedure for leveling & alignment of two shafts of directly & indirectly coupled drives, effects of misalignment.		
	5.3	Installation of rotating machines as per I.S. 900-1992.		
	5.4	Maintenance & trouble shooting of batteries.		
6.	**Safety & Prevention of Accidents**			
	6.1	Definition of terminology used in safety; safety, hazard, accident, major accident hazard, responsibility, authority, accountability, monitoring.		
	6.2	I.E. Act & Statutory regulations for safety of persons & equipments working with electrical installation, Do's & dont's for substation operators as per Indian IS.		
	6.3	Meaning & causes of electrical accidents, factors on which severity of shock depends.	**00**	**12**
	6.4	Procedure for treating the person who has received an electric shock, Methods of providing artificial respiration.		
	6.5	Precautions to be taken to avoid fire due to electrical reasons, chemistry of fire, fire triangle, type of selection of fire extinguisher as per type of fire and operation of fire extinguishers		
		Total	**42**	**80**

***Note:** The students may learn Chapter No.6 through the presentation of students themselves in front of practical batch mates.*

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Visit to DG Set and prepare maintenance scheduled of it.	**02**
2.	Draw circuit diagram, select appropriate meters, and connect it to perform routine tests on single phase Induction motor.	**02**
3.	As per the given circuit diagram perform routine test on three phase Induction motor & calculate the different parameters.	**02**
4.	Determination of HP rating of unknown rating motor by carrying appropriate test.	**02**
5.	Testing of condition of Silica gel & recondition it, if required.	**02**
6.	Testing of Single phase & three phase autotransformer as per I.S.	**04**
7.	Prepare trouble shooting chart for single and three phase motors.	**02**
8.	Observe & carry out weekly & yearly maintenance of motor in your workshop & prepare its report.	**02**
9.	**PP:** Collect the relevant IS Code books for testing of rotating machines, transformer and insulating materials.	**02**
10.	Testing of a) Dielectric test of transformer oil. b) Acidity, flash over, cracking & breakdown test.	**04**
11.	Use of following tools a) Bearing puller, b) Filler gauge, c) dial indicator, d) spirit level e) growler.	**02**
12.	Testing of residential / commercial installation & determination earth resistance, insulation resistance, continuity test.	**04**
13.	Use of various devices & tools for loading & unloading, lifting, carrying heavy equipment	**02**
14.	Chart for all the electrical safety measures in substation.	**02**
15.	Demonstration of fire extinguishers or film show for the fire fighting.	**02**
	Total	**36**

Note: Any 12 practicals are to be conducted & at least 1 from each chapter.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Testing objective types of maintenance	Class room teaching and laboratory work.
2.	Testing, maintenance & troubleshooting of rotating machine	Class room teaching and laboratory work.
3.	Testing, maintenance & troubleshooting of Transformer	Class room teaching and laboratory work.
4.	Testing & maintenance of Instrument	Class room teaching and laboratory work.
5.	Installation	Class room teaching and laboratory work.
6.	Safety & prevention of accident	Class room teaching and laboratory work.

Text Books:

Sr. No	Author	Title	Publication
1.	B.P. Patil	Testing, installation, Maintenance of Electrical Equipments	Vrinda Publication.
2.	B.V.S. Rao	Operation and maintenance of electrical Machine Vol.-I	Khanna Pub. New Dehli.
3.	B.V.S. Rao	Operation and maintenance of electrical Machine Vol.-II	Khanna Pub. New Dehli.

Reference Books:

Sr. No	Author	Title	Publication
1.	B.L. Theraja	Electrical Technology Vol. I and II	S. Chand & Sons.
2.	C.J.Hubert	Preventative Maintenance Hand Book & journals.	
3.	M.G. Jay	Performance of AC machine.	
4.	M.A.Chaudhary	Electrical Engineering	Nirali Pub.
5.	Kulkarni	Industrial Safety	

Learning Resources: Teaching-Learning process in class-room, Laboratory work, ISI codes for standards.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Testing objective types of maintenance	04	02	02	08
2.	Testing, maintenance & troubleshooting of rotating machine	04	04	08	16
3.	Testing, maintenance & troubleshooting of Transformer	04	04	08	16
4.	Testing & maintenance of insulation	04		06	16
5.	Installation	04	04	04	12
6.	Safety & prevention of accident	04	04	04	12
		Total	**24**	**32**	**80**

(Prof. Mrs. A.N. Duraphe)
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Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Project and Seminar in In-House / Industry
Course Code : EE568

Teaching Scheme:

	Hours / Week	Total Hours
Theory	--	128
Practical	08	128

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	--	--	--	03	--
Marks	25	--	--	25	50

*** Note**: Term work - 25 marks for internal assessment + 25 marks for project work

Course Rationale:

Project work includes a range of design processes, computing courses, industrial projects, builds and test projects. For a technician knowledge of scientific problem solving and application of this knowledge to real life situations is very important. Project and Seminar helps him to develop this competency. It further helps him to develop professional skills such as market survey, making presentations and report writing. The ability to carry out practical work and to present the results is obviously a key skill for all engineers to develop.

Course Objectives:

- To develop the skill of problem identification and problem solving.
- To develop the skill of searching information required for problem solving from number of sources.
- To develop presentation and report writing skills.

Course Content:

Chapter No.	Activities /Topics	Hrs	Weightage
1.	Form project batches & allot project guide to each batch. (5-6 students per batch).	**02**	
2.	Each project batch should select topic / problem / work by consulting the guide & / or industry. Topic / Problem / work should be approved by Head of department. Each project batch should prepare action plan of project activities & submit the same to respective guide, it will be part of project.	**10**	
3.	The Topic / Problem / work can be from the field of Electrical engineering. The project may be of the following fields or nature. • Manufacturing / Fabrication of a prototype unit. • Improvement of the existing equipment / process using recent technology. • Energy audit / use of renewable energy sources. • Electronic / microprocessor / microcontroller based control of electrical machines, systems etc. • Industrial Automation (PLC/ HMI / SCADA) fields. • Software development for solution of problems. • Illumination Scheme for Hospital / Shopping Mall / Cinema Theatre / Commercial Complex / Educational Institute /Industrial Complex by using illumination design software. • Design of Rural Electrification Scheme for small Village, Colony. • Electrical Installation of electrical equipments.	**68**	**50 oral + 25 P.A.**
4.	**Seminar:** Seminar should be based on detailed study of any topic related to engineering field. This topic must be on his/ her project or out of the curriculum.	**24**	**25 Sem.**

5.	**Format for the Project Report:** • The student should submit a detailed report based on his/her project work. It should include relevant circuit diagrams, graphs, specification sheets etc. The Project report should have, • Project work approval sheet in the form of a certificate, duly signed, should be included. • The report should be neatly typed on white "A-4 size paper. The typing should be of normal spacing and only on one side of the paper. Font – Times new roman, size – Title – 14, Text – 12 • The format of the text of the report should be as follows a) Index b) Synopsis or abstract c) Analytical and experimental work done d) Conclusions e) Bibliography • The total number of typed pages should be about 50 to 100.	24	**25** **T.W.**
		Total	**128**

(Prof. K.M. Kakade)
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Chairman, PBOS

Programme : Diploma in CE/EE/ET/ ME/MT/CM/IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Principles of Management
Course Code : MA661

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination		
		Theory	Practical	Oral	Termwork
Duration	Two class tests of 60 Minutes	03 Hrs.	---	---	---
Marks	20	80	---	---	---

Course Rationale:

This subject deals with the evolution of manager with respect to different approaches of management such as project planning, strategic planning, corporate planning, long range planning, decision making & creative problem solving. It also deals with the impact of computers and information technology in innovation and organizational design and planning.

Course Objectives:

After studying this course, the student will be able to

Understand the managerial roll & skills.
Understand the evolution of management thought and different approaches to management.
Assimilate the concept of project planning, strategic planning, corporate planning & long range planning.
Visualize the impact of computers in organization.
Visualize the impact of information Technology in organizational communication

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& leadership.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weight -age
1.	**Principles & Functional Aspects of Management**		
	1.1 Management – Definition, Principles of Management, Functions of Management-Planning ,Organizing, Leading ,Controlling, Authority , Decision making Organization charts, Leadership, Organizational structure, Budgeting, Problem solving ,Group dynamics and team functions, Conflict resolution, Communication ,Change, Organizational theory	08	16
2.	**Forms of ownership**		
	2.1 Types of ownership, individual ownership, partnership, joint stock companies, co-operative organization, Government undertakings (State ownership), their relative advantages and disadvantages.	04	08
3	**Financial Management**		
	3.1 Financial Management- Objectives & Functions 3.2 Capital Generation & Management- Types of Capitals, sources of raising Capital 3.3 Budgets and accounts- Types of Budgets, Production Budget, Labour Budget, Introduction to Profit & Loss Account, Balance Sheet (only concepts) 3.4 Introduction to – Excise Tax, Service Tax, Income Tax, VAT, Custom Duty	08	12
4.	**Human Resource Management**		
	4.1 Personnel Management - Introduction, Definition, Functions 4.2 Staffing- Introduction to HR Planning, Recruitment Procedure, Personnel Training & Development 4.3 Types of training- Induction, Skill Enhancement, 4.4 Leadership & Motivation- Maslow's Theory of Motivation. 4.5 Safety Management- Causes of accident, Safety precautions, industrial hygiene	08	12

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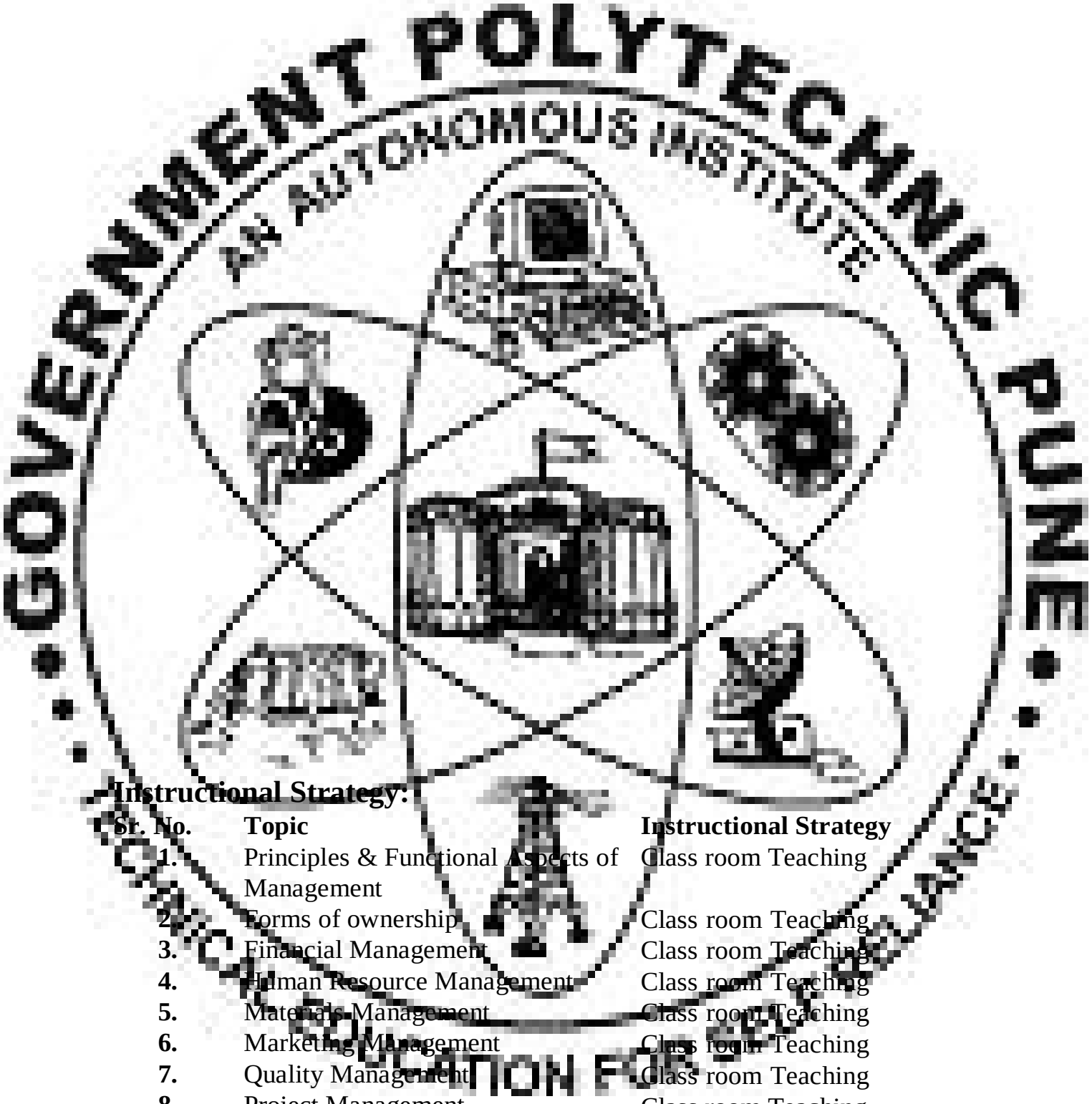
	4.6	Introduction to Factory Act, ESI Act, Workmen		



Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Principles & Functional Aspects of Management	Class room Teaching
2.	Forms of ownership	Class room Teaching
3.	Financial Management	Class room Teaching
4.	Human Resource Management	Class room Teaching
5.	Materials Management	Class room Teaching
6.	Marketing Management	Class room Teaching
7.	Quality Management	Class room Teaching
8.	Project Management	Class room Teaching

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Text Books:

Sr. No	Author	Title	Publication
1.	Koontz	Prescribed Text Essentials of Management	Tata McGraw Hill
2.	Saxena	Principles & Practices of Management	Tata McGraw Hill

Reference Books:

Sr. No	Author	Title	Publication
1.	Hannagan.	Management Concepts & Practices	--
2.	Bovee and Schatzman,	Business Communication	Pearson Education
3.	V. S. Rao.	Management Text & Case	Excel
4.	S.A.Sherlekar & V.A. Sherlekar,	Modern Business Organization & Management	Himalaya Publications
5.	O.P.Khanna,	Industrial Organization and Management	Dhanpat Rai and Sons
6.	Banga and Sharma,	Industrial Organization and Management	Khanna Publications
7.	--	Essentials of Management	Tata Mc Graw Hill
8.	--	Principles of practice of Management	Tata Mc Graw Hill

Learning Resources: OHP, LCD, Projector, and Transference, White board.

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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Principles & Functional Aspects of Management	05	05	02	16
2.	Forms of ownership	05	05	02	08
3.	Financial Management	05	05	02	12
4.	Human Resource Management	05	05	02	12
5.	Materials Management	05	05	02	12
6.	Marketing Management	04	04	04	12
7.	Quality Management	03	02	03	08
8.	Project Management	--	--	--	--
	Total	**32**	**31**	**17**	**80**

(Prof. Dr. S. B. Nikam)
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Programme : Diploma in CE/ EE/ET/ME/MT/CM/ IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Entrepreneurship Development
Course Code : MA662

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Theory	Semester End Examination Practical	Oral	Termwork
Duration	**Two class tests of 1 Hour Minutes**	**03 Hrs.**	**---**		**---**
Marks	**20**	**80**	**---**	**---**	**---**

Course Rationale:

To make the students aware of entrepreneurship as one of the career options and hence to teach them the various aspects of starting a enterprise.

Course Objectives:

After studying this course, the student will be able to

- SWOT analysis.
- Business Environment scanning and opportunity scanning. (Search)
- Market assessment.
- Project formulation.
- Identification of product / Technology / Equipment
- Financial Sources.
- Sales and Marketing
- Reasons of failure of entrepreneurs.

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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weigh-tage
1.	**Entrepreneurship Awareness** Entrepreneurship – need, scope & philosophy. Definition of a entrepreneur, attributes & characteristic. Intrapreneuring & Entrepreneurship. Need Analysis: Human Need, SWOT Analysis, goal setting, business environment, emerging trends, Information & collection techniques, opportunities.	08	10
2.	**Starting & Identification of Project** Product and services, demand availability & resource requirement. Market survey techniques – Identification of market, marketing trends, market survey techniques, agencies & organizations to be contacted. Product, suppliers of plant, equipment & raw material technology.	08	14
3.	**Preparation of Project report business plan** Structure of project report, purpose of project report. Working & fixed capital, financial institutions, procedures & Norms for financing feasibility criteria, project planning, time management, legal formalities, municipal by laws. Safety considerations, plant layout commissioning of plant & equipment, trial production, quality assurance.	10	16
4.	**Information & support systems** Information needed & their sources. Information related to Project Information related to procedures & formalities. Support systems a) Small scale business planning Requirements b) Govt. & financial Agencies, Formalities. Role of Central Government and State Government in promoting Entrepreneurship, introduction to various incentives ,, subsidies and grants – Export Oriented Units – fiscal and tax concession available.	10	16

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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Entrepreneurship Awareness	Lecture, market survey, workshops, interviews.
2.	Starting & Identification of Project	
3.	Preparation of Project report/ business plan.	
4.	Information & support systems	
5.	Management of Enterprises	
6.	Why do entrepreneurs fail?	

Text Books:

Sr. No	Author	Title	Publication
1.	S. Saini, B.S. Rathore	Entrepreneurship – Theory & Practice	

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Reference Books:

Sr. No	Author	Title	Publication
1.	Vasant Dsai, Pragati Desai	Entrepreneurial development Vol. I	
2.	Vasant Dsai, Pragati Desai	Entrepreneurial development Vol. II	
3.	Vasant Dsai, Pragati Desai	Entrepreneurial development Vol. III	
4.	Colombo Staff College, Manila	Entrepreneurship Development Plan	TMH, New Delhi
5.	Jerald Greenberg, Robert A. Baron/ Carol A. Sales/ Franc[illegible]en / Verlag (1999)	Behaviour in organizations, Pearson Education.	Tata Mcgraw Hill.
6.	The winning edge, corporate creativity.	Pradip N. Kandwalla	Tata Mcgraw Hill.(2005)
7.	John L. Colley, Jacqueline L. Doyle,	Corporate Governance	Tata Mcgraw Hill. (2003)
8.	Timpe, Dale A	Creativ[illegible]	M/s. Jaico Publishing House, New Delhi.
			Tata Mcgraw Hill. (2005)

Learning Resources: Books, Articles, Case studies

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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Entrepreneurship Awareness	02	06	02	10
2	Starting & Identification of Project.	04	06	04	14
3.	Preparation of Project report business plan.	03	10	03	16
4	Information & support systems.	04	08	04	16
5	Management of Enterprises.	04	06	02	12
6	Why do entrepreneurs fail.	04	04	04	12
	Total	**21**	**40**	**19**	**80**

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Programme	**:**	**Diploma in CE/ EE/ ET/ ME/ MT/ CM/ IT**
Programme Code	**:**	**01/02/03/04/05/06/07/15/16/17/18/19**
Name of Course	**:**	**Project Management**
Course Code	**:**	**MA663**

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Termwork
Duration	Two class tests, each of 60 Min. duration	**03 Hrs.**	---	---	---
Marks	**20**	**80**	---	---	---

Course Rationale:

In all projects, huge financial investments are made. It is therefore necessary to manage all the resources for effective project implementation. A Diploma technician has to acquire this knowledge as per the job requirements.

Course Objectives:

After studying this course, the student will be able to

- Appreciate the importance of planning, scheduling, and controlling resources.
- Calculate project durations
- Understand the importance of cost – time analysis

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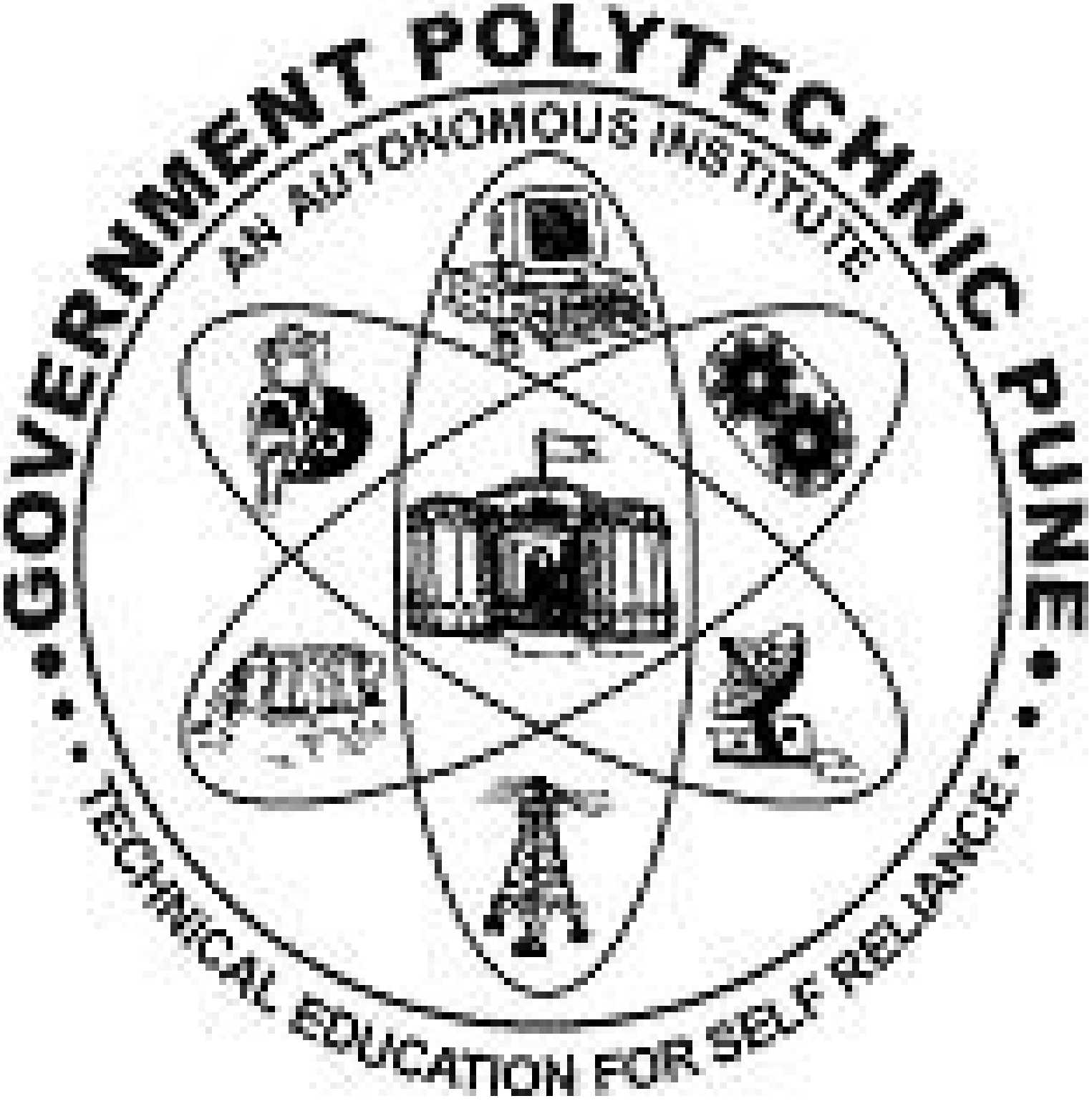
Course Content:



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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction	Class room teaching
2.	Organizing for project management	Class room teaching
3.	Project planning	Class room teaching
4.	Fundamental scheduling procedures	Class room teaching
5.	Cost – time analysis in network planning	Class room teaching
6.	Use of computers in project Management	Class room teaching
7.	Introduction to important laws	Class room teaching
8.	Safety in execution of works	Class room teaching

Text Books:

Sr. No	Author	Title	Publication
1.	M Spinner	Elements of Project Management	Prentice Hall Englewood Cliffs, New Jersey
2.	Victor G. Hajek	Project Engineering	McGraw – Hill Book Company

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Reference Books:

Sr. No	Author	Title	Publication
1.	Chris Hendrickson and Tung Au	Project Management for Construction	Prentice Hall Englewood Cliffs, New Jersey
2.		Bare Laws	

Teaching Resources: Computer software, OHP, LCD, Projector, and Transference, PPTS, White board

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction	04	04	---	08
2.	Organizing for Project Management	04	04	04	12
3.	Project Planning	04	06	02	12
4.	Fundamental scheduling procedures	02	02	12	16
5.	Cost – time analysis in network planning	04	04	--	08
6.	Use of computer in project management	04	04	04	08
7.	Introduction to important laws	04	04	---	08
8.	Safety in execution of works	--	04	04	08
	Total	**26**	**28**	**26**	**80**

(Prof. R. H. Dhorje)
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Programme : Diploma in CE/ EE/ ET/ ME/ MT/ CM/ IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Materials Management
Course Code : MA664

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination: Theory	Practical	Oral	Termwork
Duration	**Two class tests of 60 Minutes**	**03 Hrs.**	**---**		**---**
Marks	**20**	**80**	**---**	**---**	**---**

Course Rationale:

This course deals with management of materials. Smooth running of any industry depends upon the interdepartmental relations and planning for execution of work jointly. Efficiency of production department also depends upon the availability of raw material of required quality and quantity. Therefore there should be proper co-ordination between production department, production planning, stores department and purchase department. Incorrect materials planning can also lead to higher inventories & high cost.

Course Objectives:

After studying this course, the student will be able to

To know the importance of materials and inventory management
To know the different aspects of buying procedure and price forecasting.
To acquaint with latest techniques in materials management

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To know procedure for giving requisition of materials along with specifications
To know different features of negotiation technique and management of obsolete and scrap materials.

Course Content:

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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Importance of Materials Management	Class room teaching
2.	Inventory Management	Class room teaching
3.	Buying procedure	Class room teaching
4.	Price forecasting	Class room teaching
5.	Latest Techniques in Materials Management	Class room teaching
6.	Management of obsolete, scrap material	Class room teaching

Text Books:

Sr. No	Author	Title	Publication
1.	Ammer Deans S.	Materials Management	R.D. Irwin Hllions
2.	P. Gopalkrishan and M. Sundaresan	Materials Management An Integrated approach	Prentice – Hall of India Pvt. Ltd. New Delhi
3.	M.M. Shah	An integrated concept of Materials Management	Tata McGraw Hill Publisher Co. Ltd. New Delhi

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Reference Books:

Sr. No	Author	Title	Publication
1.	P.G. Menon	Materials Management	
2.	A Dey	Materials Management	Academic Publishers
3.	Dobler D.W. and Lee L	Purchasing and Materials Management	---
4.	Brandy C.S.	Materials Handbook	

Learning Resources: OHP, LCD, Projector, and Transference, White board

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Importance of Materials Management	06	06	04	16
2.	Inventory Management	06	06	04	16
3.	Buying procedure	06	06	04	16
4.	Price forecasting	--	06	04	10
5.	Latest techniques in Materials Management	02	04	04	10
6.	Management of obsolete and scrap materials	06	06	--	12
	Total	**26**	**34**	**20**	**80**

(Prof.R.H.Dhorje)
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Programme : Diploma in CE/EE / ET/ ME/MT/ CM / IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Supervisory Management
Course Code : MA66

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination: Theory	Practical	Oral	Term work
Duration	Two class tests, each of duration 60 Min.	03 Hrs	---		---
Marks	20	80	---	---	---

Course Rationale:

The diploma holders are intended to work as a supervisor in the industry. He has to perform a versatile role in the activities of an industry. He has to coordinate his subordinates and the higher personals.
The students are required to understand to function as a supervisor. He should be able to plan, organize, and direct the subordinates to achieve better results within time for a task assigned to him.

Course Objectives:

Know the basic duties of a supervisor.
Plan a particular job by splitting the whole job into pieces and monitoring each step.
Understand human behaviors, identify skills, utilize skills, and observe safety of workers.
Achieve better overall efficiency and utilize maximum capacity of machineries.

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Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weigh tage
1.	**Introduction**		
	1.1 Management of a job. Necessity for Scientific Management for supervisor. Handling complexity and achieving optimization.	**02**	**04**
2.	**Planning by Supervisor**		
	2.1 Objectives of planning. Planning activities. Planning by supervisor. Detailing and following of each step. Prescribing standard forms for various activities. Budgeting at supervisory level for materials and man power. Planning a programme and actions for a job.	**04**	**08**
3	**Organizing by supervisor**		
	3.1 Organizing physical resources. Matching human needs with job needs. Allotment of tasks to individuals and establishing relationship among persons working in a group.	**04**	**08**
4.	**Directions by supervisor**		
	4.1 Need for such directions and instructions to subordinates. Need for clarity, completeness and feasibility of instructions. Reviving of effectiveness of communication. Personal counseling. Advance predictions of possible mistakes. Elaborating decisions. On the spot adjustments during execution of job. Laying disciplinary standards in over all working.	**06**	**10**
5	**Motivation to subordinates**		
	5.1 Workers participation in management of a job. Achievement motivation. Recognition for devotion. Delegating responsibilities to subordinates. Activities and intensions towards the growth of an individual. Identification of human needs and providing safety to the workers.	**06**	**10**

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Instructional Strategy:

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Text Books:

Sr. No	Author	Title	Publication
1	Industrial Management	Shrinivasan	Khanna publisher,New Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	Industrial organization and Engineering Economies	Banga and sharma.	Khanna publisher,New Delhi
2.	Industrial Engineering and Management	O.P. Khanna	Dhanpat Raj and Sons, New Delhi
3.	What every Supervisor Should Know	Lestec R. Bittel	McGraw Hill Publishing Company, (GREGG Division) New York

Learning Resources: Books, Articles, C.D.'s, Visits, Video Cassettes No. 15 and 120

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Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction	02	02	-	04
2.	Planning by supervisor	06	01	01	08
3.	Organizing by supervisor	04	02	02	08
4.	Directions by supervisor	05	03	02	10
5.	Motivation to subordinates	05	03	02	10
6.	Coordination & implementation	10	02	02	14
7.	Check list by supervisor	06	02	02	10
8.	Moving up in the organization	08	04	04	16
	Total	**46**	**19**	**15**	**80**

(Prof. P.K.Metkar)	**(Prof. S. B. Kulkarni)**	**(Prof. D.A.Katare)**
Prepared By	**Secretary, PBOS**	**Chairman, PBOS**

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Programme : Diploma in CE/EE / ET/ ME/MT/ CM / IT
Programme Code : 01/02/03/04/05/06/07/15/16/17/18/19
Name of Course : Total Quality Management
Course Code : MA666

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination: Theory	Practical	Oral	Termwork
Duration	**Two class tests, each of 60 minutes**	**3Hrs.**	**--**		**--**
Marks	**20**	**80**	**--**	**--**	**--**

Course Rationale:

In today's international market the quality is another name for universal acceptance for product and services .Hence the mechanical engineers must have consciousness about various quality aspects required for manufacturing /service sector.

To fulfill this need this subject about various factors and philosophies in quality development is introduced. So that student will have most of basic inputs before they enter their profession .

Course Objectives:

After studying this course, the student will be able to

To understand the importance of Quality Standards and consumer need for quality items for price paid by him.

To understand Quality Management Foundation and introduction to total quality management

To know about Quality circle, Kaizen and various Quality improvement tools.

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- To know about Quality Assurance Systems and Quality Management through ISO 9000 series.
  To know about Toyota way and Six Sigma concepts.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
1.	**Introduction**		
	1.4 Basic concepts related with quality, Various definition of quality. Quality of design and quality of conformance, Service quality Vs product quality.		
	1.5 Quality policy: definition and objectives. Quality audit.	06	12
	1.6 Quality assurance: - definition, meaning, it's various forms and advantages .Quality audit, quality mindedness, inspection and quality control.		
2.	**Quality Management Foundation and introduction to total quality management**		
	2.8 Strategic quality management (Hoshin Kanri) Strategic quality planning, quality goals. The vision – future state of organization, good understanding by everyone, inspiration, achievable, QCDF (Quality, Cost Delivery, Flexibility), Customer focus, sharing by all values of the leadership, organization and employees.		
	2.9 Total Quality:- definition ,objectives, eight dimensional model of total quality.	08	12
	2.10 Total Quality management:- definition ,need, mission, initiative and concept. Barriers, implementation and advantages.		
	2.11 TQM Models :- Juran trilogy , Deming programme , Mckinsey model, Crosby program..		
3.	**Quality Management Processes**		
	3.5 **Quality planning** Quality culture (Kaizen and Quality circle) Quality Circle: - concept, objective, structure, steps in formation of quality Circle. Roles of people involved in quality Circle, advantages of quality Circle.	12	16

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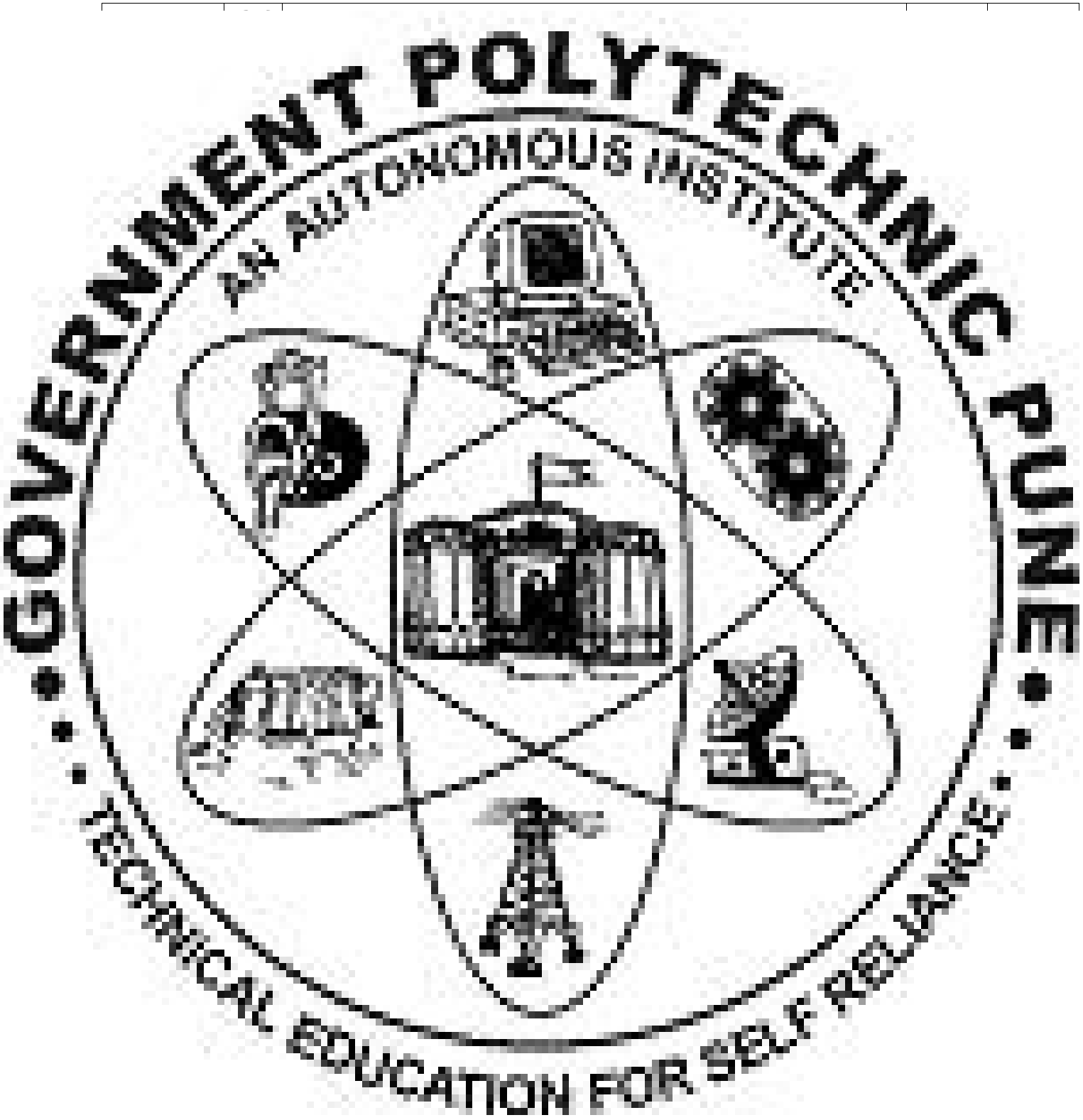
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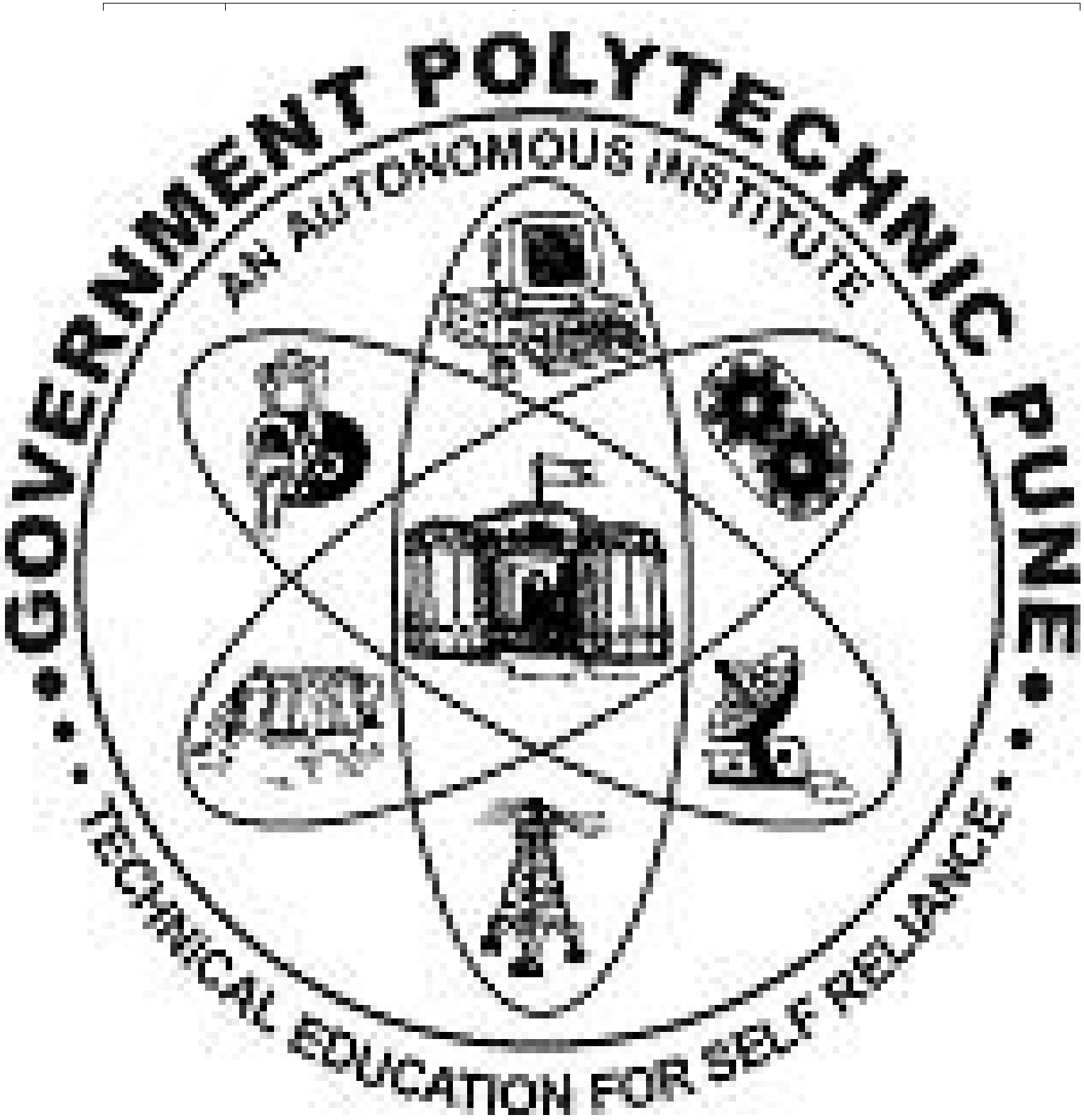
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Instructional Strategy:

Sr. No	Topic	Instructional Strategy
1.	Introduction	Lecture method
2.	Quality Management Foundation and introduction to total quality management	Lecture method
3.	Quality Management Processes	Lecture method, Transparencies, Internet surfing.
4.	Quality Management Infrastructure	Lecture method, Transparencies, Internet surfing.
5.	Principles of the Toyota way	Lecture, Ppt & Discussion
6.	Six Sigma	Lecture method, Ppt & Discussion

Text Books:

Sr. No	Author	Title	Publication
11.	Dr. K.C.Arora	Total Quality Management	S.K.Kataria and sons
12.	B.Janakiraman and R.K. Gopal	Total Quality Management Text and cases	Prentice Hall of India pvt. Ltd. New Delhi.
13.	Subburaj	Total Quality Management	Tata Mc - Graw Hill Co., New Delhi.
14.	Gupta, Srinivas N & B Valarmathi	Total Quality Management	Tata Mc - Graw Hill Co., New Delhi.

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Reference Books:

Sr. No	Author	Title	Publication
9.	Peter S.Pande Robert P.Neuman Roland R.Cavanagh	Six Sigma way	Tata Mc - Graw Hill Co., New Delhi.
10.	Jeffrey K. Liker	The Toyota Way	Tata Mc - Graw Hill Co., New Delhi.
11.	Saganthiland Samuel	Total Quality Management	Prentice Hall of India pvt. Ltd. New Delhi.

Learning Resources: Books, journals, Internetsearches.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Introduction	12	--	--	12
2.	Quality Management Foundation and introduction to total quality management	08	04	--	12
3.	Quality Management Processes	08	08	--	16
4.	Quality Management Infrastructure	08	08	--	16
5.	Principles of the Toyota way	08	04	--	12
6.	Six Sigma	08	04	--	12
	Total	**52**	**28**	--	**80**

Prepared By		
(Prof. P.U.Garge)	**(Prof. S. B. Kulkarni)**	**(Prof. D.A.Katare)**
	Secretary, PBOS	**Chairman, PBOS**

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Programme	**:**	**Diploma in CE/ EE/ ET/ME/MT/CM/IT**
Programme Code	**:**	**01/02/03/04/05/06/07/15/16/17/18/19**
Name of Course	**:**	**Software Project Management**
Course Code	**:**	**MA667**

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination Theory	Practical	Oral	Termwork
Duration	**Two class tests of 1 Hour Minutes**	**03 Hrs.**	**---**		**---**
Marks	**20**	**80**	**---**	**---**	**---**

Course Rationale:

This subject forms the foundation of Software Project Management. It is essential to know these fundamentals to understand the concept of Project Management.

Course Objectives:

After studying this course, the student will be able to

- Understand the core concept of Software Project Management.
- Understand how to create the software projects.

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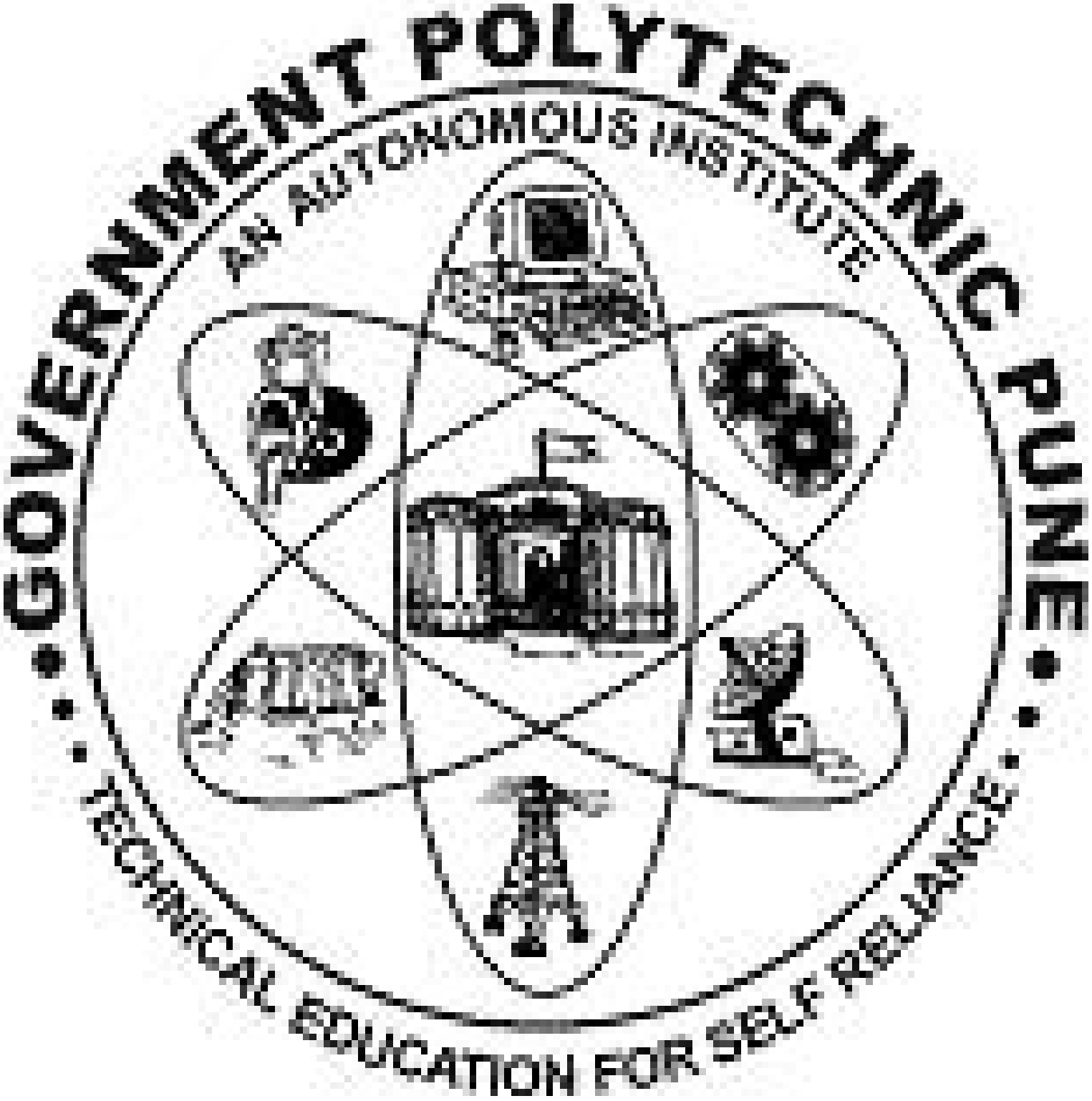

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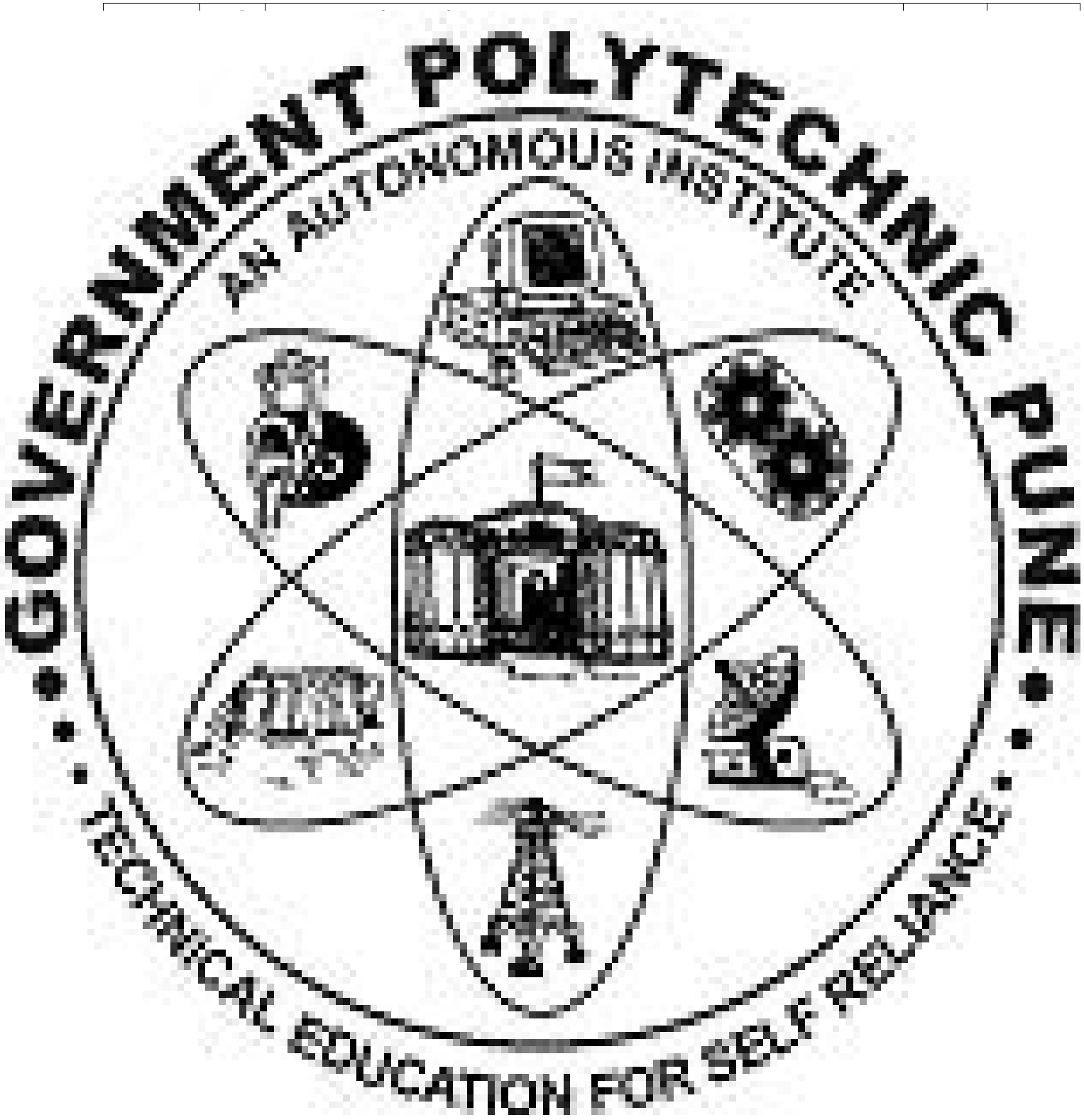
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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Introduction	Class room teaching
2.	Organizing for project management	Class room teaching
3.	Project planning	Class room teaching
4.	Fundamental scheduling procedures	Class room teaching
5.	Cost – time analysis in network planning	Class room teaching
6.	Use of computers in project Management	Class room teaching
7.	Introduction to important laws	Class room teaching
8.	Safety in execution of works	Class room teaching

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Text Books:

Sr. No	Author	Title	Publication
1.	Teresa Luckey	Software Project Management For Dummies	John Wiley and Sons

Reference Books:

Sr. No	Author	Title	Publication
1.	Software Project Management	Bob Hughes, Mike Cotterell	

Learning Resources:

OHP, LCD Projector, and Transference, White board

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Starting Your Software Project	03	04	02	14
2.	Planning Your Software Project	11	07	06	24
3.	Executing Your Software Project Plan	07	05	02	14
4.	Controlling Your Software Project	06	06	02	14
5.	Closing Your Software Project	07	05	02	14
	Total	**39**	**27**	**14**	**80**

(Prof.Smt.T. A. Kumbhare)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

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Programme	**:**	**Diploma in CE/ EE/ET/ ME/MT/ CM /IT**
Programme Code	**:**	**01/02/03/04/05/06/07/15/16/17/18/19**
Name of Course	**:**	**Management Information System**
Course Code	**:**	**MA668**

Teaching Scheme:

Evaluation Scheme:

	Progressive Assessment	Semester End Examination: Theory	Practical	Oral	Termwork
Duration	Two class tests, each of 60 Min. duration	**03 Hrs.**	---	---	---
Marks	**20**	**80**	---	---	---

Course Rationale:

MIS is a concept continuous to evolve, emerging trend consistent with the evolution of the MIS concept endures computing. It is the power of computers, which makes MIS feasible. From this point of view, the course is introduced.

Course Objectives:

After studying this course, the student will be able to

- Understand the role of MIS in various functional areas of management.
- Understand the determination of requirement and analysis it to design information system necessary.
- Understand the supporting role of MIS in decision making.

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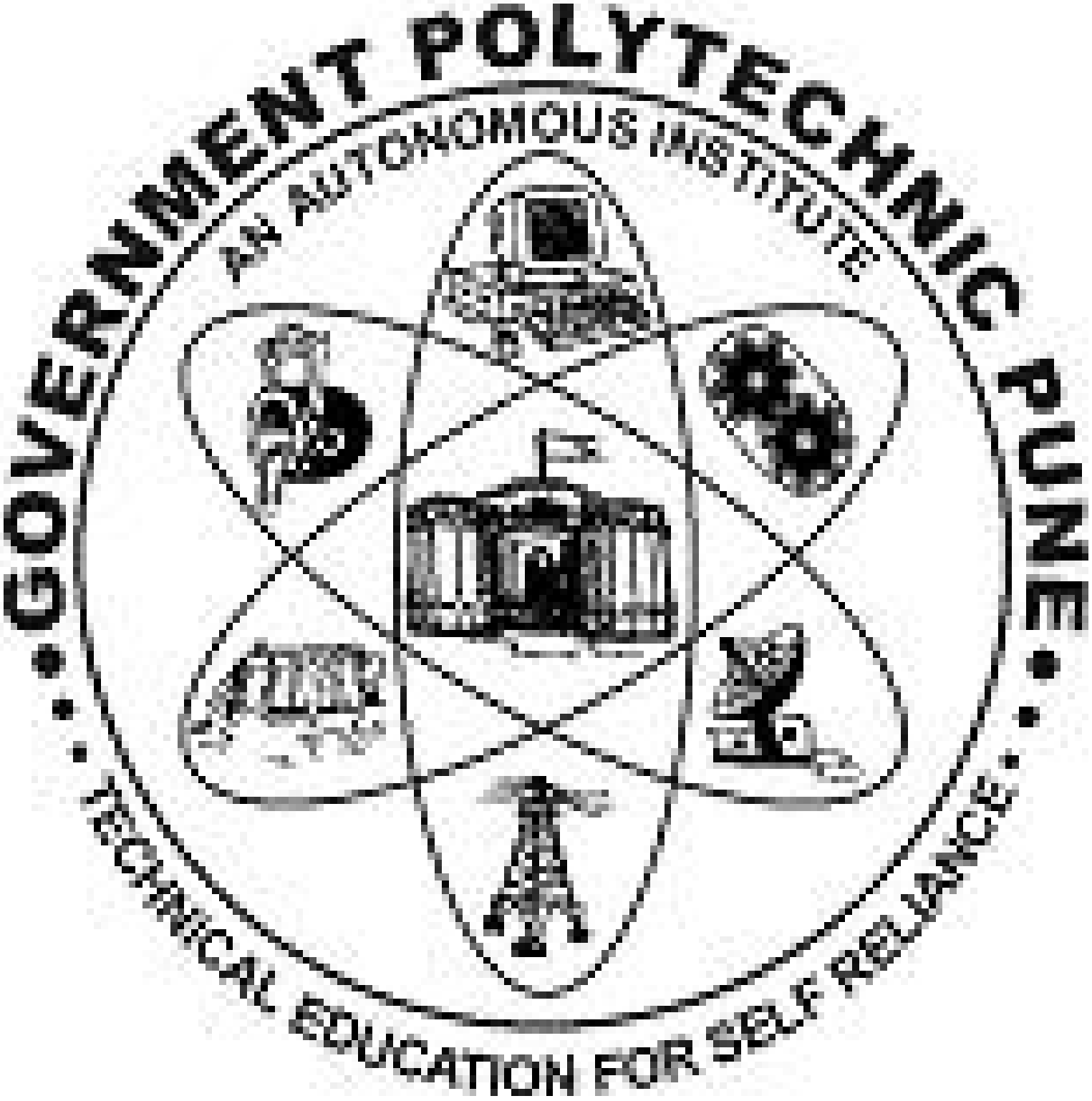

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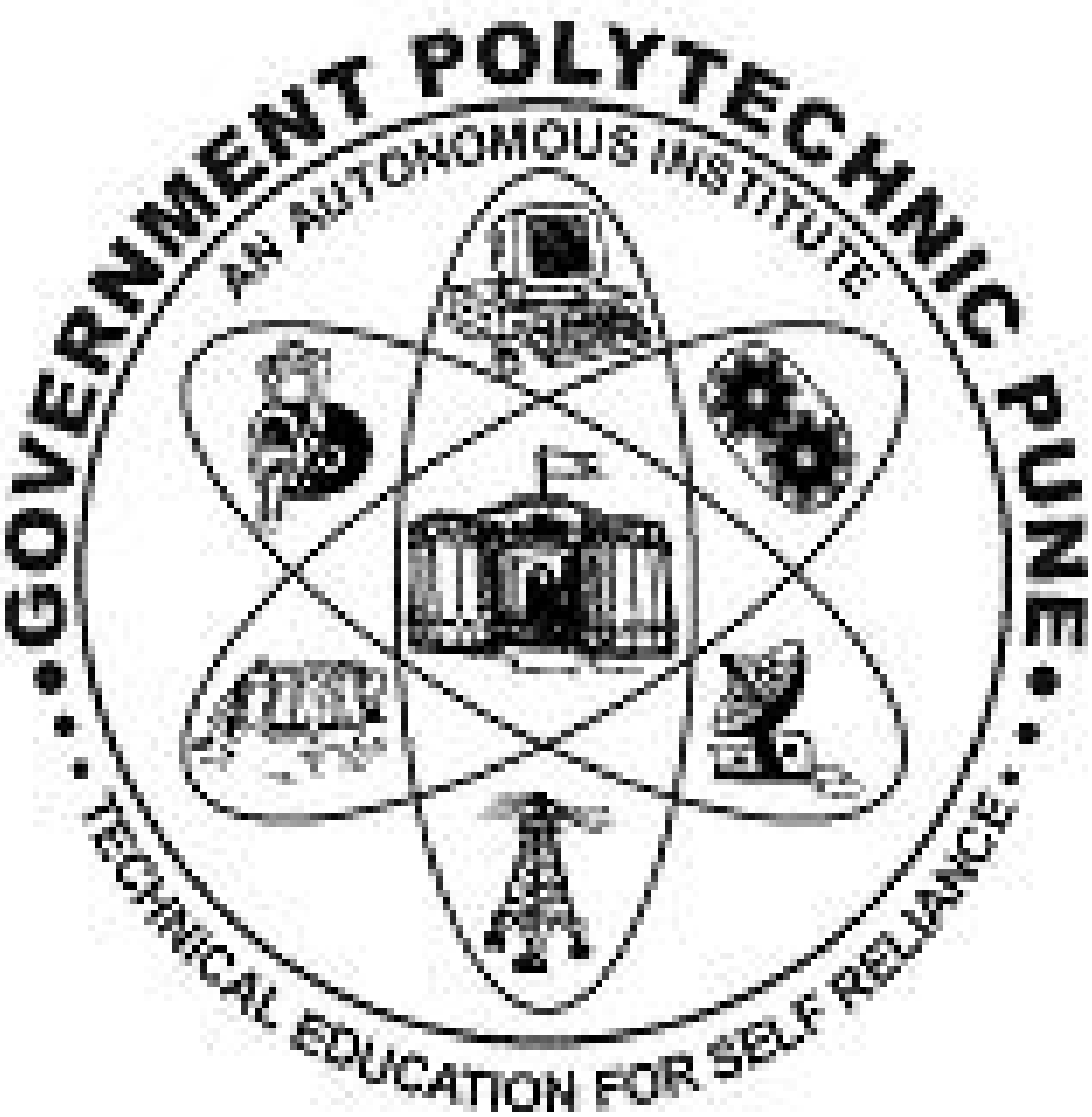
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Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Information and Management	Class room teaching for all
2.	Information Gathering	
3.	Feasibility Analysis	
4.	Decision Table	
5.	Database Management Systems (DBMS)	
6.	Control Audit and security of information systems	

Text Books:

Sr. No	Author	Title	Publication
1.	V Rajaraman	Analysis & design of Information system	PHI

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Reference Books:

Sr. No	Author	Title	Publication
1.	Gordon B. Davis and Margrethe H. Olson	MIS	
2.	Kroenke Davis	Management Information System	2nd edition
3.	Sein	MIS	
4.	Jawadekar W.S.	MIS	
5.	Millind Oka	MIS	
6.	Jayashankar	Decision Support Systems	
7.	Lucas	Information System Concepts for Management	4th edition

Learning Resources:

OHP, LCD Projector and Transparency.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Information and Management	04	04	02	10
2.	Information Gathering	04	02	04	10
3.	Feasibility Analysis	02	08	05	15
4.	Decision Table	02	08	05	15
5.	Database Management Systems (DBMS)	06	08	05	15
6.	Control Audit and security of information systems	04	05	06	15
	Total	**22**	**31**	**27**	**80**

(Prof.Smt.T. A. Kumbhare)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A.Katare)
Chairman, PBOS

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GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Energy Conservation and Audit
Course Code : EE761

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**04**	**64**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	**Two class tests each of 60 minutes.**	**03 Hrs.**	--		--
Marks	**20**	**80**	--	**50**	--

Course Rationale:

Energy is the basis of human life. The energy being a major requirement of society, hence the study of today's energy need, present energy's scenario and strategy for future are essential. The energy development and management carries a lot of significance in today's education. At the same time growing demands and shrinking of recourses is giving rise to situation of energy crisis. To overcome the present situation, knowledge of energy conservation is essential. For monitoring effects and needs of energy conservation methods and proper use of electrical energy in different areas, energy audit is must. Every electrical engineer must also be aware of social concern related to energy utilization.

Course Objectives:

- Co-relate present energy need and present energy situation and thus will understand the need of energy conservation.
- To know about world fossil fuel reserve, rates of consumption, the global green house effect and the possible effect on world climate.
- Understand the technologies of energy utilization.
- To make use of laws, rules and checklist while examining energy and material flow systems.
-

- Suggest the methods of energy conservation for different areas /different load conditions.
- Select the appropriate tariff system and methods for reducing energy consumption and thus the energy bill.
- To develop energy management case studies.
- Apply tools for energy audit and recommend measures for energy conservation.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION – I			
1	**Energy Scenario**			
	1.1	Classification of energy viz primary and secondary energy, commercial & non commercial energy.	**04**	**06**
	1.2	Renewable & non renewable energy, Energy needs of growing economy.		
	1.3	Concept of energy intensity, energy security, energy efficiency.		
	1.4	India's energy data & energy strategy for future.		
	1.5	Energy conservation, its importance, Energy conservation Act 2001 & 2005 & its features.		
2.	**Energy Conservation in Electrical System**			
	2.1	Motive Power: - Energy efficiency of electric motors Review of losses in three phase Induction motor, their causes & percentage Effect of load on motor efficiency, Motor efficiency & energy consumption, motor size and energy consumption Necessity of energy management in motors.	**20**	**24**
	2.2	Opportunity of energy saving in motors viz- stopping idle or redundant running of motor, oversized motors Rewinding effect of energy,Drive transmission efficiency, reducing under loading etc.		

	2.3	Energy Efficient Motor (EEM) :- Definition, features of EEM, high efficiency motor design, application of EEM , Determination of cost effectiveness, implementation of motor management programme ,Efficient use of energy efficient motors with the help of voltage reducers. 2.4 Energy saving starters for three phase I.M. types of loads on three phase I.M. motor speed control system, multispeed motors. Adjustable & variable frequency drives.		
	2.4	Lighting system: Use of light sources of lamp for different applications, energy efficient replacement options, Energy saving potential in sheet lighting.		
	2.5	Installation of high frequency electric ballast,General guidelines while designing energy efficiency in lighting.		
	2.6	Generation transmission & distribution Energy losses in D.G. set operation (captive power generation) Modification in the design of transmission /distribution line & layout for energy saving , Losses in T & D system, reasons for the same & their minimization ,		
	2.7	Amorphous core transformers, energy efficient transformers. Reactive power compensation – shunt & series compensation.		
	2.8	Review of Advantages of improving p.f. for utility & consumers. Selection of capacitors. (Numericals) energy efficient transformers		
3	**Energy Conservation in Electrical & Thermal Utility**			
	3.1	Furnaces : Types & classification, characteristics of efficient furnace, furnace energy supply , furnace losses, general fuel economy measures in furnace , utilizing waste heat as a heat source of other processes, minimization wall losses.	**08**	**10**
	3.2	Oven: - Various energy saving opportunities in oven Energy conservation Opportunities in pumping systems.		
	3.3	Difference between fans/blower/compressors, Energy saving opportunities for the same.		

SECTION – II				
4.	**Economics of Energy Conservation**			
	4.1	Simple payback period analysis, advantages & limitations of payback period ,Time, value of money ,net present value method, rate of return method profitability index for benefit cost ratio	**06**	**08**
	4.2	Study & selection of proper tariff for particular application, fixed & variable components of tariff, Impact of tariff on energy management ROI with depreciation, straight line depreciation, sinking fund depreciation, reducing balance depreciation (numericals)		
5.	**Energy Audit**			
	5.1	Introduction, prerequisite of energy conservation need of Energy Audit principles of Energy Audit, preliminary audit & detailed audit, Procedure of carrying out energy audit, specific energy consumption, energy flow diagram or sankey diagram. Measurement in energy audit, calculation of payback period for energy conservation.	**16**	**16**
	5.2	Study of energy conservation in Devices such as:- 1. Maximum demand controller 2. Energy Monitor 3. Dusk to dawn monitor. 4. Occupancy sensor 5. Welding equipment monitor 6. Intelligent p.f. controller (IPFC)		
	5.3	Energy & the environment		
	5.4	Energy auditor: - roles and responsibilities.		
	5.5	Energy Manager: - Role & importance.		
6.	**Energy Management**			
	6.1	Concept of supply side management & demand side management, Voltage profile management from receiving end	**04**	**06**
	6.2	Method of implementation of DSM, advantages of DSM to consumers, Utility & society		

7.	**Energy and the Environment**			
	7.1	Environment and social concerns related to energy utilization, The Greenhouse Effect.	**06**	**10**
	7.2	Global warming – effect of global warming, Pollution, Acid Rains. Global energy and environment Management		
	7.3	Future Alternative: World energy in 21st century, The all-electrical economy, The hydrogen economy		
			Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	**Name of Practical/Experiment/Assignment**	**Hrs**
1.	**PP**: Search on the website of power ministry & prepare for electricity act 2003 and its amendment & prepare a report	**02**
2.	Energy saving from Induction motor by using latest p.f. improvement device	**02**
3.	Study of energy saving starters for three phases I.M. such as soft starter, automatic star delta,	**02**
4.	Analysis of mechanical load on three phase induction motor and decide whether it should connected in star or delta so that motor should operate at maximum efficiency.	**02**
5.	Energy saving by using VFD	**02**
6.	Energy saving by using electric ballast & regulator as compared to electromagnetic choke & resistive regulator.	**02**
7.	Various energy saving opportunities in furnace, search on the website & prepare a report on energy conservation methods in domestic applications.	**04**
8.	Search on the website & prepare a report on energy conservation methods in domestic applications	**04**
9.	Energy Audit project for a small industry / workshop / section in industry	**06**
10.	**PP:** Case studies of energy audit of electric motors. Lighting, system including cost benefit analysis.	**06**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Energy Scenario.	Lecture, discussion and Internet.
2.	Energy conservation in Electrical system.	Lecture, discussion and Internet.
3.	Energy conservation in Electrical & thermal utility	Lecture, discussion and Internet.
4.	Economics of energy conservation	Lecture, discussion and Internet.
5.	Energy Audit.:-	Project work.
6.	Energy Management:-	Lecture, discussion and Internet.
7.	Energy and the Environment & Future Alternative:	Lecture, discussion and Internet.

Text Books:

Sr. No	Author	Title	Publication
1.	Paul O' Callaghan	Energy Management	McGraw hill, Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	A.S. Pabla	Electrical Power Distribution	Tata McGraw hill, Delhi
2.	S.P. Sukhatme	Solar Energy	Tata McGraw hill, Delhi

Learning Resources:

visit to http://www.bee-india.nic.in, Reference books. Report of case studies, Magazines related to energy management & audit

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION – I				
1.	Energy Scenario.	02	04	--	06
2.	Energy conservation in Electrical system	04	10	10	24
3.	Energy conservation in Electrical & thermal utility	02	04	04	10
	SECTION – II				
4	Economics of energy conservation	04	02	04	08
5.	Energy Audit	02	04	10	16
6.	Energy Management	02	04	-	06
7.	Energy [illegible] the Environment & Future Alternative:	06	04	-	10
		Total: 20	**32**	**28**	**80**

(Prof. Mrs. A.N. Duraphe)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D. A. Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Industrial Automation
Course Code : EE762

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	64
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of one hour.	03 Hrs.	--	--	--
Marks	20	80	50	--	--

Course Rationale:

The aim of this course is to develop the technician to carry out the responsibilities in the industries related to industrial control and automation. Diploma holder employed in industry needs to operate, test and maintain the industrial drives, its power control & PLC system. It is very essential for him to know the electrical logic, Input devices, control supply, control devices and designing control circuits.

This course covers basics of PLC programming; design of PLC based control logics, hydraulic and pneumatic control systems using PLC, HMI programming and introduction to SCADA and drives. This knowledge will help the diploma holder to work as an automation engineer in the industry.

Course Objectives:

- Know general PLC issues.
- Understand the operation of a PLC.
- Understand the different types of sensor outputs.
- Be aware of various actuators available.
- To be able to write simple ladder logic programs.

- Understand latches, timers, counters and MCRs.
  To be able to select simple internal memory bits.
- Be able to understand and design basic input and output wiring.
  Be able to read industrial wiring diagrams of PLC based control.
- To understand data types.
  To understand basic functions that allows calculations and comparisons.
- Be able to program a PLC
  Be aware of PLC installation guidelines, maintenance & troubleshooting of PLC system.
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- Be able to understand requirement of HMI and design basic requirements of HMI.
- Have a general awareness SCADA & its elements
- Understand the terminology of SCADA & recognize the applications of SCADA.
- Able to understand the communications used in SCADA.

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION - I			
1.	**Fundamentals of Programmable Logic Controllers**			
	1.1	Automation, advantages of automation.		
	1.2	Disadvantages of relay & solid state switching devices control panel.		
	1.3	Programmable Logic Controller & Evaluation of PLC and IEC 61131		
	1.4	Types of PLC & Programming Languages of PLC as per IEC61131-3, PLC Manufacturers		
	1.5	Block diagram And Architecture of a PLC		
	1.6	Input devices such as limit switches, pressure switch, float switches, thermostat(No constructional details required only applications in control circuits in view of NO/NC), Review of proximity switches & connection to PLC system.	**18**	**22**

	1.7	Review of analog input devices to PLC system such LVDT, POT, RTD, thermocouples, etc.		
	1.8	Angle position sensors such as slotted disk, encoder.		

	1.9	Review of output devices of PLC such as contactors, relay, Solenoid valve (technical specifications & connections to PLC), Analog output devices of PLC.		
	1.10	Input & Output modules: Types, sink/source concept, Connection of I/O devices, technical specifications and selections of I /Os modules.		
	1.11	Architecture of CPU & Memory of PLC. Input image file (table) & output image file (table). Scan cycle &Watchdog timer.		
	1.12	Function of Power supply in PLC system, Technical specifications of power supply. Use & specifications of SMPS and control transformer in PLC based control panel.		
	1.13	Programming devices of PLC		
	1.14	Features, limitations, cables & applications of communications protocols such Rs232, Rs422, Rs485, Ethernet		
	1.15	Development of Ladder diagram, general guidelines for ladder diagram, Development of ladder diagram of logic gates, simple programming on input / output and interlocking applications. (On PLC simulations softwares)		
	1.16	FBD programming concept & simple programming on it		
	1.17	PLC Vs PC & Advantages of PLC		
2.	**Basic PLC Programming**			
	2.1	Features PLC Software (As per IEC 61131-3).		
	2.2	Structure of project, Program, Function Block & Function.		
	2.3	Creating New Project in Ladder Diagram editor language.	**14**	**18**
	2.4	Rules for Variables, standard data types, PLC or I/O Configurations & Addressing system of PLC.		
	2.5	Memory mapping & memory addressing.		

	2.6	PLC functions blocks and programming**:** • Timer, Types of timer & programming on timer applications. • Counter & types of counters & programming on counter/ timer applications. • Review of Fundamentals & Salient Features of Pneumatics and Hydraulics system. Components of Pneumatics and Hydraulics system.		
	2.7	Design of Pneumatics and Hydraulics control circuits.		
	2.8	Controlling the actuations of pneumatic cylinders by using PLC.		
	2.9	Controlling the actuations of hydraulic cylinders by using PLC.		
	2.10	Programming on pneumatic and Hydraulic systems such as A+ B+ C+ A-B-C, etc.		
		SECTION – II		
3.		**Advanced PLC Programming**		
	3.1	Arithmetic functions.	**12**	**14**
	3.2	Comparison functions & logical functions.		
	3.3	Data transfer functions.		
	3.4	String handling functions.		
	3.5	Data type conversion functions.		
	3.7	Subroutine programming (calling user define program& function), Return, Jump & Label.		
	3.8	Export & import of project.		
	3.9	Analog programming & Scaling to engineering units. Analog input /output modules.		
	3.10	PLC programming on all above topics.		
4.		**PLC Installations, Troubleshooting and Maintenance**		
	4.1	Environmental factors to be considered while PLC Installation.	**04**	**06**
	4.2	Electrical factors and protection of electrical circuit.		
	4.3	Troubleshooting of PLC.		
	4.4	PLC maintenance.		
	4.5	Factors to be considered while PLC system selections.		

5.	**HMI (MMI) Programming**			
	5.1	Introduction of HMI, Specifications, Installation and Connection to PLCs.	**04**	**02**
	5.2	Creating screen, multiple screens, navigating screen, buttons, Tags.		
	5.3	Text input & output, Numeric inputs & outputs, characters input & output, bitmaps.		
	5.4	PLC variables managements and Communication with PLC.		
	5.5	Creating soft keys & function user keys, Turn ON bit / Toggle bits		
	5.6	Create objects such as analog meter, bar graph. Trends & alarm management.		
6.	**SCADA: Introduction of SCADA, Area of Applications**			
	6.1	History of SCADA.	**06**	**10**
	6.2	Components of SCADA.		
	6.3	Master Terminal Unit (MTU) &Remote Terminal Unit (RTU), functions of MTU, RTU in SCADA.		
	6.4	Real time system & use of SCADA in real time system.		
	6.5	Communications, Hardware SCADA& protocols used in SCADA.		
	6.6	Communication system components with SCADA.		
	6.7	Limitations & Advantages of SCADA.		
	6.8	Comparison between HMI & SCADA.		
7.	**Drives**			
	7.1	Review characteristics (a.c., d.c & servo) of motors and name plate.		
	7.2	Review of fundamentals of D.C. Drives, A.C. Drives (VFD), and Servo drives.		
	7.3	Interfacing of drives to PLC.		
		Selection of drives & motors based on load.		
		Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	**PP:** Browse different PLC manufacture's web site (minimum 5) and determine Technical specifications of • DI/DO modules. • Proximity sensors. • AI/AO modules. • Power supply.	**02**
2.	Development of ladder diagram for all logic gates and simulate on PLC simulation software.	**02**
3.	Development of ladder diagram for a) DOL starter. b) Forward / Reverse the direction motor	**01**
4.	Development of ladder diagram for water level control using float switch as sensors	**01**
5.	**PP:** Teacher should give control requirement to group 5-6 students comprising DI /DO/AI/AO & some special modules, then student should determine PLC system (hard ware) requirement of any PLC manufacture	**02**
6.	Development of ladder diagram for a) Automatic compressor using pressure sensing switches as sensors. b) Star- delta starter c) Motor controls, (Interlocking) d) Traffic control e) Conveyer belt for packaging applications f) pneumatic circuits such as i) A+,B+,C+,A-,B-,C- ii) A+, A-, B+, B-, C+, C-. etc. (Minimum 5 programs)	**08**
7.	Programming using arithmetic & comparison functions	**02**
8.	Programming using subroutine concept	**02**
9.	Analog programming & use of scaling function	**02**
10.	Create HMI menu driven application that comprises a) Static / dynamic text	**08**

	b) Numeric input & output. c) Use function keys/ soft keys for screen navigations / PLC variables control. d) Alarm management. e) Bar graph.	
11.	**PP:** determine SCADA configuration for given applications.	**02**
12.	Create a simple application on SCADA software comprising text, graphics & real time data.	**02**
13.	Speed control of A.C. motor by VFD a) By manual setting. b) Control through PLC.	**02**
14.	**PP:** Case study on selection of drives & motors as per load & control requirements.	**02**
	Total	**38**

Note: Any 12 practicals are to be conducted & at least 1 from each chapter.
Note: Every student must evaluate on HMI programming in practical examination.
PP: It stands for professional Practices. It is compulsory to all students & they must complete in a group of 3-5 students for different control requirement.

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Fundamentals of Programmable Logic Control kts.	PPT presentation, B/B, Demonstration of H/W
2.	**Basic PLC Programming.**	B/B, Demonstration of though software.
3.	**Advanced PLC Programming.**	B/B, Demonstration of though software
4.	**PLC Installations, Troubleshooting and Maintenance**	PPT presentation, B/B, Demonstration of artificial fault create & finding through software.
5.	HMI (MMI) Programming.	Demonstration of though software.
6.	SCADA	B/B, Demonstration of though software.
7.	DRIVES.	B/B, Demonstration of though software.

Text Books:

Sr. No	Author	Title	Publication
1.	Gary dunning	Programmable Logic Controller	Thomson Delmar Learning.
2.	Maduchandan Mitra	Programmable Logic Controller	

Reference Books:

Sr. No	Author	Title	Publication
1.	Jon Hackworth	Programmable Logic Controller	
2.	Jon Web	Programmable Logic Controller	
3.	S.K. Bhattacharya	Control of machines	New Age International Pub.
4.		User manuals from Manufactures such as Mec Siemens, AB, ABB, Mitsubishi.	
5.	Stuart A. Boyer	SCADA	I.S.A. Pub.
6.		User manuals of SCADA software	
7.		Animated Learning Materials from web.	

Learning Resources: Industrial Automation monthly magazine, PLC manufacture's website, Free down loaded simulation software & license software, Laboratory PLC & HMI set up, Reference books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Fundamentals of Programmable Logic Controllers.	08	08	04	22
2.	Basic PLC Programming	04	04	10	18
3.	Advanced PLC Programming	02	04	06	12
4.	PLC Installations, Troubleshooting and Maintenance	02	04	00	06
5.	HMI (MMI) Programming.	00	00	00	02
6.	SCADA	04	04	02	10
7.	DRIVES	04	04	02	08
	Total	**26**	**28**	**24**	**80**

(Prof. K.M. Kakade)
Prepared By

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Secretary, PBOS

(Prof. D. A. Katare)
Chairman, PBOS

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Illumination Engineering
Course Code : EE763

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	64
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--		--
Marks	20	80		50	--

Course Rationale:

Electrical energy is mainly utilized for lighting in industries, commercial buildings, hotels, hospitals, residential building, etc. Nowadays advanced lighting accessories are used to increase efficiency and to improve light quality. Therefore there is a growing need of engineers / technicians in this field.

This subject covers illumination basics, different types of lamps, lighting and control components. Lighting for internal, external and special applications is also included. After completing this subject the student can design illumination schemes efficiently and effectively. He can work as service engineer or get self employed.

Course Objectives:

- Select different types light sources, its components & relevant fixtures used for illumination scheme.
- Design lighting schemes for internal and external lighting scheme.
  Understand the illumination control system.
- Understand the latest of illumination methods, their terminology & illumination
-

software.

- Design flood lighting schemes.
- Explain the lighting for special applications.

Course Content:

Chapter No.	Name of Topic/Sub-topic		Hrs	Weightage
	SECTION – I			
1.	**Review of fundamentals of illuminations**			
	1.1	Basic illumination terminology.	04	06
	1.2	Laws of illumination, polar curves, photometry.		
	1.3	Measurement of illumination. (Review of lamps and their comparisons as covered in Electrical installation and maintenance).		
2.	**Lamps**			
	2.1	Types of lamps: a) Arc lamps: HID lamps, Metal halide lamps, compact source metal halide lamp. Xenon arc lamp, Arc lamp classification.	10	12
	2.2	Special purpose lamps: Induction lamp, Flat lamps, Neon lamps and sign lamps, Lasers, ultra violet, infra-red lamps, Mercury vapour, electroluminescent lamp.		
3.	**Lighting Components**			
	3.1	Transformer for lighting, Ballast for fluorescent lamp, Ballast for HID and arc lamps, Igniters and starters,	10	12
	3.2	Lighting control by transformer and ballast's power factor correction of lamps, electronic ballast for Fluorescent lamps, Programmable electronic ballast.		
	3.3	Different types of luminaries.		
4.	**Lighting Control and Control System**			
	4.1	Dimmer, types of dimmer- mechanical, resistance, reactance, transformer, and electronic dimmer.	08	10
	4.2	Why lighting control? (Practical role, the esthetic role, energy management role- Human detection, Use of equipments such as dusk to dawn monitor, peak – off peak hours operation).		
	4.3	Concept of day lighting and techniques used.		
	4.4	Factors affecting selection of lighting controls.		

SECTION – II				
5.	**Lighting for Interior Applications**			
	5.1	**Lighting design using** **I. Traditional method** II. Point to point method III. Zonal cavity method IV. Computer softwares and related terminology.	**12**	**15**
	5.2	Standards for home lighting, office lighting, Meeting rooms, Conference room, auditorium, Places of worship, Importance of lighting at work place, Museums, art galleries, libraries, Visitor centers, exhibitions, shops and offices, Hotels, hospitals and institutions, Restaurants, bars, pubs, Illumination signs		
6.	**Flood Lighting for External Applications**			
	6.1	Introduction, Factory lighting, security lighting, road lighting, Road tunnel lighting, Flood lighting, Public lighting, railway platform lighting.	**12**	**15**
	6.2	Lighting for Display Boards/Hoarding, stage lighting, sports lighting.		
7.	**Lighting for Special Applications**			
	7.1	Lighting for agriculture, horticulture, lighting for health care center.	**08**	**10**
	7.2	Automobile lighting (two wheelers and four wheelers).		
	7.3	Lighting for decorative purpose.		
		Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	**PP:** Collect and study Techno-commercial information of different lamps available in market. (i.e. Lamp manufactures, technical specification, cost etc.)	**02**
2.	**PP:** Visit to Lamps Manufacturing industry for testing lamps &its control circuit.	**06**

3.	**PP:** Collect and study techno-commercial information of different luminaries (i.e. fixtures) available in market (i.e. Manufactures, technical specification, orientation, cost etc.)	**02**
4.	Design standard lighting scheme for conference hall /work shop / hotels / hospitals / restaurant / park (Any three) By using any of the methods a, b, c and /or by using Illumination design software.	**08**
5.	**PP:** Visit to any three lighting schemes listed in chapter: 5	**06**
6.	Design standard lighting scheme for factory/security/road/road tunnel/flood lighting/platform/advertising boards/ stage /sports (any three). By using any of the methods a, b, c and /or by using Illumination design software.	**06**
7.	Study of lighting scheme of two wheeler OR four wheeler.	**02**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION – I	
1.	Review of fundamentals of illuminations	Lecture, discussion, chalk – board
2.	Lamps	Lecture, discussion, chalk-board, transparencies
3.	Lighting Components	Lecture, transparencies, Q/A technique
4.	Lighting Control and Control System	Lecture, discussion, chalk-board, transparencies
	SECTION – II	
5.	Lighting for Interior Applications	Lecture, transparencies, case study
6.	Flood Lighting for External Applications	Lecture, transparencies, models
7.	Lighting for special application	Lecture, transparencies, visits

Text Books:

Sr. No	Author	Title	Publication
1.	May Cayless, A M Marsden	Lamps and Lighting	Oxford and IBH Publishing Co. Ltd.

Reference Books:

Sr. No	Author	Title	Publication
1.	Butterworths, Stanley, Lyons	Handbook of Industrial Lighting	Butterworth's
2.	Robert S Simpson	Lighting Control Technology and Applications	Focal Press
3.	Kao Chen	Energy Management in Illuminating Systems	CRC Press

Learning Resources: Transparencies, Lighting components & fixtures from manufacturer's catalog or website, Free down loaded illumination software, Reference books

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION – I				
1.	Review of fundamentals of illuminations	04	02	--	06
2.	Lamps	04	04	04	12
3.	Lighting Components	04	04	04	12
4.	Lighting Control and Control System	02	04	04	10
	SECTION – II				
5.	Lighting for Interior	03	04	08	15
6.	Applications Flood Lighting for External Applications	03	04	08	15
7.	Lighting for special application	04	06	--	10
	Total	**24**	**28**	**28**	**80**

(Prof. Mrs. A.S.Marulkar)
Prepared By

(Prof. S. B. Kulkarni)
Secretary, PBOS

(Prof. D.A. Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Microcontrollers and Applications
Course Code : EE764

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	64
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	20	80	--	50	--

Course Rationale:

This is an elective subject for the diploma in Electrical Engineering. Now a days microcontrollers are extensively used in control applications. Therefore there is a growing need of engineers / technicians in this field. Hence it is necessary to study microcontroller basics, hardware and its programming.
This subject covers microcontroller 8051 architecture, its instruction set, programming and applications. After completing this subject the student can write and execute programs for microcontroller based applications.

Course Objectives:

- Describe architecture and operation of microcontroller 8051
- Develop assembly language programs using instruction set of 8051
- Design and develop microcontroller based systems
- Explain various applications of microcontrollers

Course Content:

Chapter No.	Name of Topic/Sub topic		Hrs	Weightage
	SECTION – I			
1.	**Introduction**			
	1.1	Review of microprocessor and difference between Microprocessor and Micro-controller.	**03**	**04**
	1.2	Microcontrollers – Introduction and applications, Four bit microcontroller, Eight bit microcontrollers, Sixteen bit microcontrollers, Thirty two- bit microcontrollers.		
2.	**8051 Architecture**			
	2.1	The 8051 oscillator and clock, Program counter and data pointer, A , B and CPU registers, Flags and Program status word, Internal RAM and ROM, Stack and Stack Pointer,	**12**	**18**
	2.2	Input/ Output pins, ports, and Circuits, Interfacing External Memory, Counter and Timers.		
	2.3	Serial Data Input/output – Serial Data Transmission, Data Reception, Serial Data transmission Modes, Interrupts.		
3.	**Basic Assembly Language Programming Concepts**			
	3.1	Assembly language	**07**	**06**
	3.2	Assembly language programming process		
	3.3	Programming of 8051, 8051 instruction syntax.		
4.	**Instruction Set of 8051**			
	4.1	Introduction, Addressing modes, external data movements, Push and Pop, Opcodes, Data exchanges, Example Programs	**10**	**12**
	4.2	Logical operations – Bit and Byte level logical operations, Rotate and Swap operations, Example programs		
	SECTION – II			
5.	**Arithmetic Operations**			
	5.1	Flags, Incrementing and decrementing, Unsigned and signed addition, Unsigned and signed subtraction, Multiplication and division, Example programs	**08**	**10**

	5.2	Jump and Call instructions – Bit jumps, Byte jumps, Unconditional jumps, Calls and Subroutines, Example Program		
6.	**Peripheral interfacing with 8051 Microcontroller**			
	6.1.	Introduction to Micro-controller, specification of Atmel 8051 micro-controller	**12**	**14**
	6.2.	Interfacing of basic component like LED's, Pushbuttons relay and Latches.		
	6.3.	Keyboard Interfacing: Interfacing 7-segment and LCD display, LCD module, LCD instruction, ADC and DAC interfacing, Interfacing stepper motor, interfacing DC motor		
7.	**Industrial Application of Micro-controller**			
	7.1.	**Measurement application :** Angular, speed measurement , Temperature measurement, current , voltage ,power & Energy	**12**	**16**
	7.2.	**Automation and control applications :** Basic PID Controller, DC Motor control, Steeper Motor control, Temperature control		
			Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Practical/Experiment/Assignment	Hrs
1.	Study of 8051 Microcontroller.	**02**
2.	Programming examples – Data transfer instructions	**04**
3.	Programming example s – Logical Operations.	**04**
4.	Programming examples – Arithmetic Operations.	**04**
5.	Programming examples – Jump and Call instructions	**04**
6.	Demonstration and Testing of following applications 1. Keyboard Interface 2. LCD display Interface 3. D/A or A/D converter Interface 4. Relay Interface 5. Measurement of speed or temperature.	**10**
7.	Demonstration and testing of Stepper motor control by 89C51 Microcontroller.	**04**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION – I	
1.	Introduction	Lecture, discussion, chalk – board
2.	8051 Architecture	Lecture, discussion, chalk-board, transparencies
3.	Basic Assembly Language Programming Concepts.	Lecture, transparencies, Q/A technique
4.	Instruction set of 8051	Lecture, discussion, chalk-board, transparencies
	SECTION – II	
5.	Arithmetic Operations	Lecture, transparencies, case study
6.	Peripheral interfacing with 8051 Microcontroller.	Lecture, transparencies, LCD, models
7.	Industrial Application of Micro controller.	Lecture, transparencies, visits, LCD

Text Books:

Sr. No	Author	Title	Publication
1.	Ajay V. Deshmukh	Microcontrollers theory and applications	TMH, New Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	Kenneth J Ayala	8051 Microcontrollers architecture, Programming and Applications	International Thomson publishing, India

Learning Resources:

Transparencies, Lighting components & fixtures from manufacturer's catalog or website, Free down loaded illumination software, Reference books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION – II				
1.	Review of fundamentals of illuminations	04	02	--	06
2.	Lamps	04	04	04	12
3.	Lighting Components	04	04	04	12
4.	Lighting Control and Control System	04	04	04	10
	SECTION – II				
5.	Lighting for Interior	03	04	08	15
6.	Applications (Flood Lighting for External Applications)	03	04	08	15
7.	Lighting for special application	04	06	-	10
	Total	**24**	**28**	**28**	**80**

(Prof. J.G.Momin)
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(Prof. D.A. Katare)
Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Heating Ventilation and Air Conditioning
Course Code : EE765

Teaching Scheme:

	Hours /Week	Total Hours
Theory	04	64
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	20	80	--	50	--

Course Rationale:

This is a technology subject which is an elective subject for diploma in Electrical Engineering. Presently the need of HVAC is increasing with the growth in IT sector, commercial establishments, hospitals, hotels etc. Therefore, there is a growing need of engineers / technicians in this field. Hence, technicians / supervisors from electrical engineering branch are also expected to have some basic knowledge of HVAC systems.
This subject covers installation, testing and maintenance of Heating Ventilation and Air-conditioning systems. After completing this subject the student can carry out testing and maintenance of HVAC equipment efficiently and effectively. He can work as service engineer or get self employed.

Course Objectives:

- Carryout routine and preventive maintenance of HVAC system.
- Calculate heat load and approximate capacity of the equipment using thumb rule.
- Select appropriate equipment.
- To carry out energy conservation opportunities in HVAC systems

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
	SECTION – I		
1.	**Refrigeration**		
	1.1 Definitions- Refrigeration, Ton of refrigeration, Coefficient Of Performance, Energy Efficiency Ratio	**10**	**12**
	1.2 Vapour Compression System- its operation, functions of components in VCC, Effect of super heating and sub cooling of refrigerant, Representation of VCC on P-H chart.		
	1.3 Vapour Absorption System- its operation, its merits and demerits compared to vapour compression system.		
	1.4 Air refrigeration system- its operation and applications.		
	1.5 Refrigerants-Desirable properties of refrigerants (Physical, Chemical, Thermodynamic), Comparison between primary and secondary refrigerants, Effect of CFC's on global warming and ozone depletion ,Types of refrigerants, Those in use, Applications of important refrigerants.		
2.	**Air Conditioning**		
	2.1 Psychometry:- Definition, Dalton's law of partial pressures, psychometric properties of air, Sling psychrometer, Skeleton of psychometric chart, Representation on it of simple air conditioning processes on psychometric chart, Evaporative cooling, Dessert cooler, Cooling tower	**10**	**12**
	2.2 Definition of air conditioning, Thermodynamics of human body with environment, Factors affecting human comfort, Effective Temperature.		
	2.3 Classification of Air conditioning systems.		
	2.4 Functions of components used in air conditioners.		
	2.5 Heating systems (Introductory treatment)		

	2.6	Natural ventilation, Mechanical ventilation- Air extraction system, Air supply system, Combined supply and extraction system.		
3.	**Applications of Refrigeration and Air conditioning**			
	3.1	Domestic Refrigerator- Electrical parts and components of refrigerator, Rating and selection of electrical components, Electrical wiring, Electrical testing and trouble shooting, Electrical circuit of double door refrigerator, Electrical circuit of no frost refrigerator.	**12**	**16**
	3.2	Water cooler and it's wiring diagram.		
	3.3	Window air conditioner- schematic layout, working, electrical parts, electrical circuit.		
	3.4	Split AC- working, electrical circuit.		
	3.5	Other applications of air conditioning such as package, central, automobile, railway and aircraft air conditioning.		
		SECTION – II		
4.	**Refrigeration & Air conditioning Controls**			
	4.1	High pressure & low pressure controls with electric circuit.	**12**	**16**
	4.2	Different types of thermostats- Electrical resistance type, thermocouple type, electronic type.		
	4.3	Temperature range and temperature differential control.		
	4.4	Thermostatic expansion valve for fluid flow control.		
	4.5	Over current protection control.		
	4.6	Humidity sensing elements, Electronically operated humidistat,		
	4.7	Actuators,		
	4.8	Block diagram of automatic control system		
5.	**Cooling Load**			
	5.1	Concept of SHF, RSHF	**10**	**12**
	5.2	Sensible and latent heat gains.		
	5.3	Sources of heat loads.		

	5.4	Aspects considered for cooling load calculation for office, commercial shops, Banks, Hospitals, and Hotels.		
	5.5	Procedure for cooling and load estimation (Simple numericals)		
6.	**Maintenance and Energy Conservation**			
	6.1	Maintenance and safety of A/C and refrigerator system.	**10**	**12**
	6.2	Different aspects & strategies used for energy conservation in HVAC systems w.r.t.initial design and planning stage, equipment selection, service and maintenance and concept of PLV and IPLV		
	6.3	Thermal Insulating materials: Desirable properties, different types, applications of some other insulating materials		
			Total	**64**	**80**

List of Practical/Experiments/Assignments:

Sr. No.	**Name of Experiment/Assignment**	**Hrs**
1.	To carryout trail on vapour compression test rig for finding its performance.	**02**
2.	Demonstration and study of various tools used in refrigeration.	**04**
3.	To carryout trouble shooting of domestic refrigerator and finding remedies for the same	**04**
4.	**PP**: Collect catalog of A.C. and To compare window air conditioners of different manufacturers w.r.t. technical specifications, features offered, price range	**04**
5.	**PP**: Visit to ice plant / air conditioning plants / cold storage	**06**
6.	Study of control systems used in refrigeration and air conditioning systems	**04**
7.	Cooling load calculation a case study	**04**
8.	To prepare maintenance schedule of central air conditioning plant – weekly, quarterly, half yearly, yearly	**04**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION – I	
1.	Refrigeration	Lecture, Discussion, Chalkboard, Models
2.	Air Conditioning	Lecture, Discussion, Chalkboard, Models
3.	Applications Of Refrigeration & Air Conditioning	Lecture, Q/A, Models, visit.
	SECTION – II	
4.	Refrigeration & Air Conditioning controls.	Lecture, Discussion, Chalkboard, Models
5.	Cooling load	Lecture, Frequencies, case study.
6.	Maintenance & Energy Conservation	Lecture, Trend, Frequencies, Q/A.

Text Books:

Sr. No	Author	Title	Publication
1.	P.N. Ananthnara-Yanan	Basic Refrigeration & Air Conditioning	TMH New Delhi

Reference Books:

Sr. No	Author	Title	Publication
1.	M. Adithan , S.C. Laroiya	Practical Refrigeration & Air Conditioning	New age International (p) Ltd.

Learning Resources: Charts, Cutouts, Visits, Handouts, data books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION – I				
1.	Refrigeration	04	04	04	12
2.	Air Conditioning	06	06	-	12
3.	Applications of Refrigeration and Air conditioning	04	06	06	16
	SECTION – II				
4.	Refrigeration & Air conditioning Control	06	04	04	16
5.	Cooling Load			06	12
6.	Maintenance & Energy Conservation	04	04	04	12
			32	**32**	**80**

(Prof. Mrs. M.H. Bilgi) (Prof. S. B. Kulkarni) (Prof. D.A. Katare)
Prepared By Secretary, PBOS Chairman, PBOS

Programme : Diploma in Electrical Engineering
Programme Code : 02/16
Name of Course : Advanced Electric Traction
Course Code : EE766

Teaching Scheme:

	Hours / Week	Total Hours
Theory	04	04
Practical	02	32

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two Class tests each of 60 minutes.	03 Hrs	--	--	--
Marks	20	100	--	50	--

Course Rationale:

Electric traction means a locomotion in which the driving force is obtained from electric motors. One of the practical applications of electricity, which enters into the everyday life of many of us & its use in service of mass transport – the electric propulsions of vehicles – electric trains, trolley buses, tram cars and in the latest developments such as metro and sky bus. In view of the growing importance and technological developments, which have come about in this area in the recent past; for Electrical Engineering students, it is desirable to study the course dealing with electric traction. This subject belongs to technology area.

Course Objectives:

- List and explain different equipments used in the power circuit and auxiliary circuit of electric locomotives.
- Explain importance of maintenance of electric locomotive.

- State and explain functioning of the protection systems used in electric locomotives.
- Describe the recent trends in electric traction; such as, LEM propelled Traction.

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
	SECTION – I		
1.	**Electric Locomotives**		
	1.1 Nomenclature used For Electric Locomotives	**14**	**16**
	1.2 Types of Electric Locomotives By Nomenclature.		
	1.3 AC Locomotive: a) Equipments of AC Electric Locomotive: Power Circuit Equipments and Auxiliary Circuit Equipments. b) Equipments in Power Circuit and their Functions: Power Circuit Diagram of AC Locomotive: Pantograph, Circuit breaker, Tap Changer. c) Traction Transformer, Rectifier, Smoothing Choke, Traction Motor. d) Equipments in Auxiliary Circuit & their Functions: Head Light, Mast Light, Horn, Marker Light, Battery, Air Compressor, Blowers, Exhausters, Compressors, Selsyn transformer. e) List and Purpose of Different Type of Relays: f) List and Purpose of Different Type of Contactors:		
	1.4 Three Phase Locomotive. a) Power Circuit of Three Phase Locomotive. b) Power Supply Arrangement for Auxiliary Machines in Three Phase Locomotive.		
2.	**Maintenance of Locomotives**		
	2.1 Locomotive Maintenance.	**08**	**12**
	2.2 Need of Maintenance and Policy of Obselence.		
	2.3 Defects.		

	2.4	Ideal Maintenance: Means to Improve the Reliability of Locomotive, Means to Improve Availability of Locomotive, Means to Reduce Maintenance Cost, Maintenance Record, Training Facility, Characteristics of Efficient Maintenance.		
	2.5	Electrical Faults and Their Causes.		
	2.6	Fault Localization.		
	2.7	Necessity of Testing- Testing Procedure, Individual Equipment Tests.		
3.	**Protection of Electric Locomotive**			
	3.1	Introduction.	**10**	**12**
	3.2	Broad Strategy For Protection.		
	3.3	Surge Protection - Direct Lightning Strokes, Switching Surges: External and Internal.		
	3.4	Overload Protection of Main Power Circuit.		
	3.5	Earth Fault Protection of Power and Auxiliary Circuit.		
	3.6	Protection from Over Voltage and Under Voltage.		
	3.7	Differential Protection of Traction Circuits.		
	3.8	Protection Against High and Low Air Pressure in the Compressed Air Circuit.		
	3.9	Temperature Monitoring.		
	3.10	Protection of Transformer By Buchholz Relay.		
	3.11	Monitoring of Ventilation System of Electric Locomotive Equipments.		
	3.12	Protection Against Accidental Contact with HT Equipment.		
	3.13	Protection Against Fire- Fire Prevention Strategy.		
SECTION – II				
4.	**Linear Electric Motor Propelled Traction**			
	4.1	Introduction.	**10**	**12**
	4.2	Linear Electric Motor (LEM)		
	4.3	Linear Induction Based Traction System: - Moving Primary Fixed Secondary Single Sided LIM, Moving Secondary Fixed Primary Single Sided LIM, Moving Primary Fixed Secondary Double Sided LIM.		

	4.4	Strengths/Weaknesses of LIM Propelled Railway Traction:		
	4.5	Practical Possibilities of LIM Propelled Transportation		
	4.6	Inputs/Modifications for Adoption of LIM- Propulsion in the Existing System: Track Modification, Vehicle Modification. Voltage and Speed Control, LIM Propelled		
	4.7	Underground Metro Rail System- Factors Influencing Adoption of LIM for Metro Rail – International Scenario		
	4.8	Wheel Less Traction: Levitation Schemes, Present Scenario.		
5.	**Train Lighting and Air Conditioning**			
	5.1	Systems of Train Lighting.	**05**	**08**
	5.2	Special requirements of Train Lighting.		
	5.3	Methods for obtaining unidirectional pulsating and constant output.		
	5.4	Single and double [illegible] system.		
	5.5	End on Generation.		
	5.6	Railway coach air conditioning- Requirements, Types of installations, Air conditioned rolling stock, Air conditioning equipments on coaches.		
6.	**Signaling and Supervisory Control**			
	6.1	Requirements of signaling system	**08**	**12**
	6.2	Types of signals.		
	6.3	Three and Four aspects of colour light signals,		
	6.4	DC and AC track circuit		
	6.5	Supervisory control: Remote control system, Remote control system equipment and network, Mimic diagram, Control desk for TPC, Remote control switching equipment, The F.M.V.F.T. ,Power supply, Controlled station equipment, Supervisory and alarm facilities, Frequency allocation.		
7.	**Control and Braking**			

	7.1	Traction motor control: D.C series motor control, series/parallel control, speed control by field weakening, (Simple numericals),Use VFD & VVFD for control of traction motors.	**09**	**12**
	7.2	Static power correction, Introduction to static power correction equipments.		
	7.3	Requirements of braking system		
	7.4	Electric braking- Eddy current brakes, Reverse current braking, Rheostatic braking. Electrical regenerative braking (No derivation and no numericals), Conditions necessary to achieve electric regenerative braking.		
	7.5	Suitability of dc shunt, series and induction motor for electric regenerative braking.		
			Total	**64**	**80**

List of Practicals/Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs
1.	**PP:** Visit to A.C. locomotive and draw (on half imperial sheet) for power circuit and study main components in power circuit of A.C. locomotive.	06
2.	**PP:** Visit to locoshed and a. Develop maintenance chart for locomotive and to list out electrical faults, which are occurring in locomotive. b. Study the protection and control systems used in locomotive.	06
3.	**PP:** Visit to kalyan locoshed and b) Study the testing of traction motors. c) Study the testing of air circuit breakers for traction system.	06
4.	**PP:** visit to traction sub-station and a. Study the layout of traction sub-station. b. Study the protection system to traction sub-station.	04
5.	**PP:**Visit the train lighting a.c. sections and a. Study the general and A/C coach lighting diagram. b. Develop maintenance charts for train lighting and A/C system in coach.	06

6.	**PP:** Visit to signal and telecommunication section of Indian railway and study signaling system in railway.	04
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
1.	Electric Locomotives:	Class-room teaching & industrial visits.
2.	Maintenance of Locomotives:	Class-room teaching & industrial visits.
3.	Protection of Electric Locomotive:	Class-room teaching & industrial visits.
4.	LEM for Electric Traction.	Class-room teaching .
5.	Train Lighting and Air conditioning.	Class-room teaching & industrial visits.
6.	Signaling and Supervisory Control.	Class-room teaching & industrial visits.
7.	Control and Braking.	Class-room teaching & industrial visits.

Text Books:

Sr. No	Author	Title	Publication
1.	H. Partab	Modern Electric Traction	Dhanpat Rai & Sons.

Reference Books:

Sr. No	Author	Title	Publication
1.	Upadhyay, S. N. Mahendra	Electric Traction	Allied Publishers Ltd.
2.	----------	International railway journal.	

Learning Resources:

Industrial visits, class room teaching, Handouts, Manuals, etc. Visit to railindia.com, Indian railway fan's club.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
1.	Electric Locomotives:	04	06	06	16
2.	Maintenance of Locomotives:	04	04	04	12
3.	Protection of Electric Locomotive	04	04	04	12
4.	LEM Propelled Traction	04	04	02	12
5.	Train Lighting and Air conditioning:	04	02	02	08
6.	Signaling and Supervisory Control	04	04	04	12
7.	Control and Braking	02	04	04	08
	Total	**28**	**26**	**26**	**80**

Prepared By

(Prof. Mrs. M.H. Bilgi And Mr. A.M. Tayde, SSE(TRS) Indian Railway

(Prof. S. B. Kulkarni) Secretary, PBOS

(Prof. D. A. Katare) Chairman, PBOS

GOVERNMENT POLYTECHNIC, PUNE
(An Autonomous Institute of Govt. of Maharashtra)

Programme	**:**	**Diploma in Electrical Engineering**
Programme Code	**:**	**02/16**
Name of Course	**:**	**Special Purpose Electric Machine**
Course Code	**:**	**EE767**

Teaching Scheme:

	Hours /Week	Total Hours
Theory	**04**	**64**
Practical	**02**	**32**

Evaluation Scheme:

	Progressive Assessment	Semester End Examination			
		Theory	Practical	Oral	Term work
Duration	Two class tests each of 60 minutes.	03 Hrs.	--	--	--
Marks	20	80	--		---

Course Rationale:

After completing diploma the supervisors employed in manufacturing industries, state electricity boards, generating stations, process industries etc. They are required to work in the field of quality control and process control, for which they require to repair, test and maintain, operate and control various types of advanced electrical machines. Hence, it is necessary for them to know the principle of operation, performance characteristics, and practical applications of some advanced electrical machines and drives used in industries.

Course Objectives:

- Explain the construction, operation and control of advanced electrical machines and drives
- Understand the performance of machines on various load conditions.
- Select the suitable drive for specific application

Course Content:

Chapter No.	Name of Topic/Sub topic	Hrs	Weightage
	SECTION – I		
1.	**A.C. Series motor**		
	1.1 Plain series Motor: General Construction Modification & improvements in the design of A.C. series motor , commutation ,Torque equation, equation of induced e.m.f. phasor diagram.	**08**	**10**
	1.2 Series motor characteristics: a) Speed –current Characteristics b) Torque –speed Characteristics c) Power factor characteristics		
	1.3 Compensated series motor –compensating winding, circle diagram, braking & performance and application.		
2.	**Universal Motor**		
	2.1 Construction & working, torque speed characteristics, reversal of direction of rotation.	**10**	**12**
	2.2 Distributed field and compensated motor, speed control, applications.		
3.	**Repulsion Motor**		
	3.1 General construction , compensating winding ,operation of repulsion start, induction run motor, reversing of repulsion start induction motor, Brush riding characteristics & application of the same brush riding repulsion start induction run motor its construction , starter winding & connections .	**06**	**08**
4.	**Induction Generator**		
	4.1 Motor & generating action of three phase I.M. Working of I.G. , Performance of I.G. at constant voltage & constant frequency.	**08**	**10**
	4.2 Difference between I.G. & Synchronous gen. Equivalent circuit phasor diagram circle diagram of I.G. advantages, disadvantages & application.		

	4.3	**Special purpose Induction machines -** Principle construction, operation & application of 1) Synchronous 2) Solid rotor I.M. 3) Non –magnetic 4) Induction control Motor		
		SECTION – II		
5.		**Special purpose synchronous machines**		
	5.1	Principle, construction & application Reluctance synchronous motor.		
	5.2	Principle, construction & application of Stepper motor.		
	5.3	Operating principle, constructional details, working & application , advantages & disadvantages of: 1) Permanent magnet stepper motor. 2) Variable reluctance stepper motor. 3) Hybrid stepper motor. 4) Enhanced PMH stepper motor. 5) Disc magnet stepper motor. 6) Electro hydraulic stepper motor.	**08**	**10**
6.		**Linear Induction Motors**		
	6.1	Principle, Type, Construction, Torque –speed characteristics, advantages, disadvantages & application of L.I.M.	**06**	**08**
7.		**Motors for control applications**		
	7.1	Features and application of Single phase stepper motor (Unipolar drive)		
	7.2	Single phase stepper motor (bipolar type)		
	7.3	Two phase (Unipolar type)		
	7.4	Four phase stepper motor (Unipolar drive)		
	7.5	Open frame synchronous & stepper motor 3 wire	**12**	**14**
	7.6	Stepper motor (open frame) and Numericals on step angle.		
	7.7	Servo motors: types viz A.C. & D.C. –general construction working & schematic diagram of the same.		

	7.8	Advantages of A.C. servo motors over D.C. series motors, applications of both the types.		
	7.9	Reversible step servo motor – construction working & application of high torque reversible stepper A.C. motor.		
	7.10	A.C/D.C. tachometer construction, working & use Synchronous & control Transformer – sychro system with transmitter.		
8	**Other Machines**			
	8.1	Brushless D.C. Motor – construction & types working & applications, characteristics		
	8.2	Braking Motor – construction operation & application of the same. Features and application of Single phase stepper motor (Unipolar drive)	**06**	**08**
			Total	**64**	**80**

List of Practical Experiments/Assignments:

Sr. No.	Name of Experiment/Assignment	Hrs.
1.	Load test on A.C. series motor.	**04**
2.	Study of any two Special motors from curriculum through market survey or internet search.	**04**
3.	Load test on Induction Generator	**04**
4.	Reluctance motor through market survey or internet search.	**04**
5.	Study of Linear Motor	**04**
6.	Visit to motor manufacturing industry and report preparation.	**06**
7.	Study of Stepper.	**02**
8.	Study of servo motors (AC & DC)	**04**
	Total	**32**

Instructional Strategy:

Sr. No.	Topic	Instructional Strategy
	SECTION – I	
1.	Series motor	Lecture, discussion, chalk – board, models
2.	Repulsion motor	Lecture, discussion, chalk-board, transparencies
3.	Induction Generator	Lecture, transparencies, Q/A technique
4.	Special purpose Induction machines	Lecture, discussion, chalk-board, transparencies
	SECTION – II	
5.	Special purpose synchronous machines	Lecture, transparencies, case study
6.	Linear Induction Motors	Lecture, transparencies, models
7.	Motors for control applications	Lecture, transparencies, visits
8.	Other Machines	Lecture, transparencies, visits

Text Books:

Sr. No	Author	Title	Publication
1.	Electrical Machines	Nagrath Kothari	TMH
2.	Electrical Machines	J. B. Gupta	

Reference Books:

Sr. No	Author	Title	Publication
1.	Advanced Electrical Machines	Openshaw Taylor	

Learning Resources: Class room teaching, Laboratory work, animated clips/ images for motor operation from web site, Reference books.

Specification Table:

Sr. No.	Topic	Cognitive Levels			Total
		Knowledge	Comprehension	Application	
	SECTION – I				
1.	Series motor	02	04	04	10
2.	Repulsion motor	04	04	04	12
3.	Induction Generator		04	04	08
4.	Special purpose Induction machines		04	04	10
	SECTION – II				
5.	Special purpose synchronous machines		04	04	08
6.	Linear Induction Motors	--	04	04	08
7.	Motors for control applications	04	06	06	16
8.	Other Machines		04	04	08
		Total: 12	**34**	**34**	**80**

(Prof. Mrs. A.N.Duraphe)
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