PROGRESSIVE EDUCATION SOCIETY'S

MODERN COLLEGE OF ENGINEERING

1186A, SHIVAJINAGAR, OFF J.M, PUNE-411005

(AFFILIATED TO SAVITRIBAI PHULE PUNE UNIVERSIT, PUNE)

DEPARTMENT OF ELECTRICAL ENGINEERING

E-CURRICULUM BOOKLET

(2019 Course)

FOR THE PROGRAMME

TE – ELECTRICAL ENGINEERING

(SEMISTER-I)

QUALITY POLICY OF THE INSTITUTE

We, PES Modern College of Engineering are committed to develop and foster cultured and promising professionals by imparting quality education in the field of Engineering and Management.

VISION OF THE INSTITUTION

To create a collaborative academic environment to foster professional excellence and ethical values

MISSION OF THE INSTITUTE

1. **To develop ethical standards capable of creating and managing global enterprises.**
2. **To foster innovation and research by providing a stimulating learning environment.**
3. **To ensure equitable development of students of all ability levels and backgrounds.**
4. **To be responsive to changes in technology, socio-economic levels and environmental conditions.**
5. **To foster and maintain mutually beneficial partnerships with alumni and industry.**

QUALITY POLICY OF THE DEPARTMENT

Electrical Engineering department is committed to develop promising engineers with ethical and social responsibility through excellence in academics, research, skill development and consultancy.

VISION OF THE DEPARTMENT

To build technically competent Electrical Engineers with ethical and social responsibility.

MISSION OF THE DEPARTMENT

- **To develop abilities in students for acquiring knowledge and skills to flourish in dynamic technical environment.**
- **To nurture cultured professionals by providing facilities for their overall development.**
- **To motivate the students for research work and activities beneficial to society.**
- **To enhance strong bonding with various organization and alumni.**

Program Educational Objectives (PEOs)

Graduates will be able to:

PEO 1: Solve and analyze problems in Electrical Engineering using fundamental knowledge.

PEO 2: Adopt lifelong learning ability by acquiring various skills.

PEO 3: Practice ethically in their profession.

PEO 4: Achieve global competency through interactions with various industries, research and professional organizations.

PROGRAM OUTCOMES (POs)

PO1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyses complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. Conduct investigations of complex problems: The problems that cannot be solved by straight forward application of knowledge, theories and technique applicable to the engineering discipline that may not have a unique solution. For example, a design problem can be solved in many ways and lead to multiple possible solutions that require consideration of appropriate constraints/requirements not explicitly given in the problem statement. (Like: cost, power requirement, durability, product life, etc.). Which need to be defined (modeled) within appropriate mathematical framework that often requires use of modern computational concepts and tools.

PO5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. Communication: Communicate: effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES:

PSO1: Students will be able to apply logical and technical concepts of automation, control syste and electric mobility.

PSO2: Students will be able to develop adequate competency in electrical energy manageme through conventional and non-conventional energy sources.

CORE VALUES

- Excellence in the field of Electrical Engineering.
- Social responsibility with integrity.
- Lifelong Learning.
- Unity in Diversity.

SHORT TERM GOALS

- To enhance alumni interaction.
- To develop innovation lab to enhance research and entrepreneurship by providing various facilities.

LONG TERM GOALS

- To promote consultancy activity for revenue generation by developing high-tech standard laboratory.
- To encourage the faculty for research work and up gradation of qualifications.
- To enhance teaching-learning process through ICT.
- To establish competitive entrance exam cell in department.

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Course Structure

Savitribai Phule Pune University

Savitribai Phule Pune University, Pune
Syllabus: Third Year (TE) Electrical Engineering (2019 course)
(w.e.f 2021-22)

SEMESTER-I

Course code	Course Name	Teaching Scheme				Examination Scheme						Credit				
		Th	Pr	Tu	SEM /PW /IN	ISE	ESE	TW	PR	OR	Total	Th	Pr	Tu	SEM /PW /IN	Total
303141	Industrial and Technology Management	3	0	0	0	30	70	0	0	0	100	3	0	0	0	3
303142	Power Electronics	3	4#	0	0	30	70	0	50	0	150	3	2	0	0	5
303143	Electrical Machines-II	3	2	0	0	30	70	25	25	0	150	3	1	0	0	4
303144	Electrical Installation Design and Condition Based Maintenance	3	4//	0	0	30	70	25	0	25	150	3	2	0	0	5
303145	Elective-I	3	0	0	0	30	70	0	0	0	100	3	0	0	0	3
303146	Seminar	0	0	0	1	0	0	50	0	0	50	0	0	0	1	1
303147	Audit course-V	2*	0	0	0	0	0	0	0	0	0	GRADE: PP/NP				0
Total		**15**	**10**	**0**	**1**	**150**	**350**	**100**	**75**	**25**	**700**	**15**	**5**	**0**	**1**	**21**

303145: Elective-I	**303147 : Audit Course-V**
303145A : Advanced Microcontroller and Embedded System	303147A : Energy storage systems
303145B : Digital Signal Processing	303147B : Start-up & Disruptive innovation
303145C : Open Elective	

SEMESTER-II

Course code	Course Name	Teaching Scheme				Examination Scheme						Credit				
		Th	Pr	Tu	SEM /PW /IN	ISE	ESE	TW	PR	OR	Total	Th	Pr	Tu	SEM /PW /IN	Total
303148	Power System-II	3	2	1	0	30	70	25	50	0	175	3	1	1	0	5
303149	Computer Aided Design of Electrical Machines	3	4#	0	0	30	70	50	0	25	175	3	2	0	0	5
303150	Control System Engineering	3	2$	1$	0	30	70	25	0	25	150	3	1	0	0	4
303151	Elective-II	3	0	0	0	30	70	0	0	0	100	3	0	0	0	3
303152	Internship	0	0	0	4	0	0	100	0	0	100	0	0	0	4	4
303153	Audit Course VI	2*	0	0	0	0	0	0	0	0	0	GRADE: PP/NP				0
Total		12	8	2	4	120	280	200	50	50	700	12	4	1	4	21

303151: Elective-II	**303153 : Audit Course-VI**
303151A . IoT and its Applications in Electrical Engineering 303151B . Electrical Mobility 303 151C: Cybernetic Engineering	303153A. Ethical Practices for Engineers 303153B .Project Management
303151D: Energy Management	

#Practical consists of Part A & part B. PART A; Regular experiments & part B; to bridge the gap between theory & actual industrial practices. For subject 303144; there will be auto cad drawing on Electrical installation, Electrical wiring, cabling etc. For 303149, Part A, Regular drawing by hand & part B same drawing by AutoCAD.
$ tutorial credit merged with Practical.
* Conduct over and above these lectures.

Industrial and Technology Management (303141)

Subject –Industrial and Technology Management

Weekly Work Load(in Hrs)	Lecture	Tutorial	Practical
	03	-	-

Online/ In-sem	Theory	Practical	Oral	Term-work	Total Marks	Credit
30	70	-	-	-	100	03

Syllabus

Unit 01: Introduction to Management and Economics : (07 Hrs.)

A) Management: Meaning, scope, function, and importance of management. Difference between Administration and management.

B)Industrial Economics: Definition of economics, Demand and Supply concept, Demand Analysis.Types of Demand, Determinants of Demand, Law of demand and supply, Elasticity of demand and Supply, Law of Diminishing Marginal utility, Demand forecasting: Meaning and methods.

C) Business Organizations: Line organization, Staff organization and Functional Organization, (Project, Matrix, Committee Organization.)

D) Business Ownership and its Types: Types of business ownership, Sole proprietorship, Partnership (Act 1934), LLP (Limited Liability Partnership) (Act 2008). One person company, Joint Stock Company: Public Limited and Private Limited, Public Sector Undertaking (PSU).

Unit 02: Technology Management: (05 Hrs.)

A) Technology Management: Definition of technology Management and its relation with society, Development, application and its scope.

B) Classification of Technology Management: Classification of technology management at various Levels- its importance on National Economy, Ethics in technology management, Critical

factors in Technology management.

Unit 03: Intellectual Property Rights (IPR) & Human Resource Management (HRM):

A) Introduction to Intellectual Property Rights (IPR): Meaning of IPR, Different forms of IPR, Patents, Criteria for securing Patents. Patent format and structure, Copy rights and trademark (Descriptive treatment only).

(**B) Human Resource Management:** Introduction, importance, scope, HR planning, Recruitment, selection, training and development, Performance management.

Unit 04: Quality Management (06Hrs.)

A) Quality Management: Definition of quality, continuous improvement, Types of quality, Quality of Design, Seven QC Tools, Poka Yoke (Mistake Proofing), Quality circles, Kaizen. TQM, 5S (Case Study of Toyota, descriptive treatment). Six-Sigma. Basic software used for inventory management and quality management like Zoho inventory, Oracal, Netsuite, Vyapar, Quick book commerce.

B) Quality Management Standards (Introductory aspects only):- The ISO9001:2000 Quality Management System Standard-The ISO14001:2004, ISO26000, ISO 10004:2012, ISO 9001:2012 ISO 9001:2016, Environmental Management System Standard.

Unit 05: Marketing and Financial Management (06 Hrs.)

A) Marketing Management: Meaning of Market, Marketing strategy, motives, market characteristics and its types, Perfect Competition, Monopoly, Monopolistic completion and Oligopoly. New product development, Product life cycle, Marketing and selling, methods of selling, marketing planning. Market survey and market research, Online Marketing (Digital Marketing).

B) Financial Management: Definition of financial management, cost Concept, Types of costs (Fixed, Variable, average, marginal, and total cost) and methods of costing price, capital. Debit, credit, Profit and loss statement, Balance sheet, Depreciation Analysis, causes and significance, methods of calculation of depreciation, Taxation system, and type of taxe

Unit 06: Motivational Theory and Entrepreneurship: (06Hrs.)

A) Motivation: Introduction to Motivation, theories of work motivation, Content Theories: Maslow's Hierarchy of Needs, Herzberg's Two factor theory, McClelland's Three Needs Theory, McGregor'sTheory X and Theory Y. Process Theories: Adam's Equity Theory, Vroom's Expectancy Theory, Taylor's Motivation Theory.

B) Leadership: Importance of Leadership, Types of Leadership: Autocratic, Democratic and Laissez-faire Leadership, qualities of good Leader. Group dynamics: Types and interactions of groups, Stages of group dynamics: Norming, Storming, Forming, Performing and Adjourning.

C) Entrepreneurship: Importance and limitations of rational decision making, Decision making under Certainty, uncertainty and risk. Incentives for small business development, Government policies and Incentives, Case study on Small scale industries in India.

Text Books:

[T1] O. P. Khanna, industrial engineering and management, Dhanpat Rai and sons, New Delhi.

[T2] E. H. McGraw, S. J. Basic managerial skill for all **.**

[T3] Tarek Khalil, Management of Technology Tata McGraw Hill Publication Pvt. Ltd.

[T4] Prabuddha Ganguli Intellectual Property rights Tata McGraw Hill Publication Company **.**

[T5] Management Accounting and financial management by M. Y.Khan and P.K. Jain, Tata Mcgraw Hill-Tata-ISBN **.**

Reference Books:

[R1]C. B. Mamoria and V. S. P. Rao- Personnel Management, Himalaya Publishing House, 30th Edition 2014.

[R2] Harold Koonlz and OD'onnel–Management. Tata McGraw Hill Publication1980.

[R3] Philip Kotler-Marketing Management. Pearson Edition 2008.

[R4] Robert Heller, Managing Teams, Dorling Kindersley, London.

[R5] Kelly John M, Total Quality Management, InfoTech Standard, Delhi.

[R6] Joseph M. Juran, Juran's Quality Handbook TATA McGraw-Hill.

[R7] Dale H. Bester field and Carol Bester field Total Quality Management Prentice Hall of India Pvt. Ltd

[R8] Shiv Sahai Singh [Editor] The Law of Intellectual Property rights'

[R9] N. R. Subbaram, What Everyone Should Know About Patents, Pharma Book Syndicate, Hyderabad.

[R10] Principles and Practices of Management -Dr. P.C. Shejwalkar, Dr. Anjali Ghanekar, Deepak Bhivpatki

[R11] Financial Management by I. M. Pandey, Vikas Publishing House Pvt. Ltd., Delhi Philip Kotler- Marketing Management.

Unit	Text Books	Reference Books
Unit 1	T1	R2,R10
Unit 2	T1, T2,T3	R5
Unit 3	-	R3,R5,R6
Unit 4	T5	R3, R11
Unit 5	T1	R1,R2
Unit 6	T4	R8

Course Objective:

The course aims:-

1. Differentiate between different types of business organizations and discuss the Fundamentals of economics and management.
2. Explain the importance of technology management and quality management.
3. Understand the importance of Quality and its significance.
4. Understand the importance of Quality and its significance.
5. Describe the characteristics of marketing & its types and overview of financial Management.
6. Discuss the qualities of a good leader and road map to Entrepreneurship.

Course Outcome:

Course Outcomes: At the end of the course, a graduate will be able to –

C301.1	Illustrate the fundamentals of managerial economics and management and differentiate various types of business organization.	(Apply BTL:3)
C301.2	Summarize the concept of technology management and Industrial management.	(Understanding:BTL:2)
C301.3	Explain the importance of IPR and role of Human Resource Management in an organization	(Understanding:BTL:2)
C301.4	Understand the importance of Quality and its significance.	(Understanding:BTL:2)
C314.5	Describe the characteristics of marketing & its types and overview of financial Management.	(Understanding:BTL:2)
C301.6	Discuss the qualities of a good leader and road map to Entrepreneurship.	Understanding:BTL:2)

Academic Activity Planner

Units	Unit Test1 (10marks)	Unit Test2 (10marks)	Assignment No:1 (10marks)	Assignment No:2 (10marks)	OBT : (10marks)	MCQ (10marks)
1	✓					
2		✓				
3			✓			
4				✓		
5					✓	
6						✓

Teaching Plan

Teaching plan as per University Syllabus

Sr.No.	Unit	Broad Topics to be Covered	Total Lecture Planned
1	I	Introduction to Management and Economics	08
2	II	Technology Management	05
3	III	Intellectual Property Rights (IPR) & Human Resource Management (HRM)	06
4	IV	Quality Management	06
5	V	Marketing and Financial Management	06
6	VI	Motivational Theory and Entrepreneurship	06

Unit Wise Lecture Plan

Unit No.-I: Introduction to Management and Economics

Objectives:-

- Differentiate between different types of business organizations and discuss the Fundamentals of economics and management

Outcomes:-

- Illustrate the fundamentals of managerial economics and management and differentiate various types of business organization.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Management: Meaning, scope, function	T1,R2,R10	Chalk and Talk
2	Importance of management. Difference between administration and management.	T1,R2,R10	Chalk and Talk
3	Industrial Economics: Definition of economics, Demand and Supply concept, Demand Analysis. Types of Demand, Determinants of Demand, Law of demand and supply	T1,R2,R10	Chalk and Talk
4	Elasticity of demand and supply, Law of Diminishing Marginal utility, Demand forecasting: Meaning and methods.	T1,R2,R10	Chalk and Talk
5	Business Organizations: Line organization, Staff organization	T1,R2,R10	Chalk and Talk

6	Functional Organization (Project, Matrix, Committee Organization.)	T1,R2,R10	Chalk and Talk
7	Types of business ownership, Sole proprietorship, Partnership (Act 1934), LLP (Limited Liability Partnership) (Act 2008).	T1,R2,R10	Chalk and Talk
8	One person company, Joint Stock Company: Public Limited and Private Limited, Public Sector Undertaking (PSU).	T1,R2,R10	Chalk and Talk

Question Bank Unit No.-I

Q.1 Define management and what are the functions of management?

Q.2 Explain the concept of industrial Management .What is need and scope of industrial management?

Q.3.Differtiate between administration and Management.

Q.4 Explain economical demand.

Q.5 State law of demand. Explain methods of demand Forecasting in detail.

Q.6 What are the methods of demand forecasting?

Q.7 Describe Elasticity of Demand. Describe the different degree of elasticity with examples.

Q.8 What are the types of Business Organization? Explain line, line and staff organization in detail.

Q.9 What is line and staff organization? State its advantages and disadvantages.

Q.10 Explain the types of Business Ownership - Partnership Firm.

Q.11 Differentiate between Partnership (Act 1934) & LLP (Limited Liability Partnership), (Act 2008).

Q.12 How Write shot note on requirements of Public limited and private limited company.

Unit No.-II: Technology Management

Objectives: -

- Explain the importance of technology management and quality management.

Outcomes: -

- Summarize the concept of technology management and Industrial management.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Technology Management: Definition of technology Management and its relation with society	T1,T2,T3,R5	Chalk and Talk, PPT
2	Technology Management development, application and its scope.	T1,T2,T3,R5	Chalk and Talk, PPT
3	Classification of technology management at various Level.	T1,T2,T3,R5	Chalk and Talk, PPT
4	Importance on National Economy, Ethics in technology management.	T1,T2,T3,R5	Chalk and Talk, PPT
5	Critical factors in technology management.	T1,T2,T3,R5	Chalk and Talk, PPT

Question Bank Unit No.-II

Q.1 Give classification of technology and explain each in detail.

Q.2 Explain the basic concept of technology management. Explain the technology management at various level

Q.3 Explain the scope of industrial Management in detail.

Q.4 Explain the management and its role in society.

Q.5 What are the critical, factor in technology Management?

Q.6 Classify the technology management at various level

Q.7 Describe importance of Technology Management on economy

Q.8 Describe the areas of application of Technology Management.

Q.9 What are the functions of technology management?

Q.10 Describe the Technology Management framework.

Unit No.-III: Intellectual Property Rights (IPR)

& Human Resource Management (HRM)

Objectives:-

- Understand the importance of Quality and its significance.

Outcomes:

- Understand Explain the importance of IPR and role of Human Resource Managementin an organization

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Meaning of IPR, Different forms of IPR	R3,R5,R6	Chalk and Talk
2	Patents, Criteria for securing Patents. Patent format and structure	R3,R5,R6	Chalk and Talk
3	Copy rights and trademark (Descriptive treatment only)	R3,R5,R6	Chalk and Talk
4	Human Resource Management: Introduction, importance, scope.	R3,R5,R6	Chalk and Talk
5	HR planning, Recruitment, selection	R3,R5,R6	Chalk and Talk
6	Training and development, Performance management.	R3,R5,R6	Chalk and Talk

Question Bank Unit: III

Q.1 what is the intellectual property rights Explain all its types.

Q.2.Write short notes on Trademark.

Q.3. Explain the following

i) Patent ii) Industrial Design iii) copyrights.

Q.4. State the laws, Trade mark and copyrights laws

Q.5. State the criteria for securing patent .What are the guidelines of the common IPR policy on patents?

Q.5 Write patent format and structure in details.

Q.6 Write short notes on HR planning and recruitment.

Q.7 Differentiate between Recruitment and selection.

Q.8 Write short notes on selection.

Q.9 Write short notes on training and development.

Q.10 .Explain the types of training and development method.

Q.11.State objectives and types of performance appraisal.

Unit No.-IV: Quality Management

Objectives:-

- Understand the importance of Quality and its significance.

Outcomes: -

- Understand the importance of Quality and its significance.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Quality Management: Definition of quality, continuous improvement, Types of quality	T5,R5,R11	Chalk and Talk
2	Quality of design, Seven QC Tools, Poka Yoke (Mistake Proofing), Quality circles, Kaizen. TQM, 5S (Case study of Toyota, descriptive treatment). Six-Sigma	T5,R5,R11	Chalk and Talk
3	Basic software used for inventory management and quality management like Zoho inventory, Oracal, Netsuite, Vyapar, Quick book commerce.	T5,R5,R11	Chalk and Talk
4	Quality Management Standards (Introductory aspects only):- The ISO9001:2000 Quality Management System Standard-The ISO14001:2004.	T5,R5,R11	Chalk and Talk
5	Management System Standard ISO26000, ISO 10004:2012, ISO 9001:2012	T5,R5,R11	Chalk and Talk

	ISO 9001:2016		
6	Environmental Management System Standard.	T5,R5,R11	Chalk and Talk

Question Bank Unit IV:

Q.1 What is quality management? State the goalpost view of quality.

Q.2 Write short notes on total quality management.

Q.3 Write short notes on Ishikawa Diagram with example.

Q.4 What is Patero analysis ?

Q.5 Explain the quality circles.

Q.6 Write short notes on Kaizen.

Q.7 What is TQM? Explain in details.

Q.8 Explain in details Six Sigma.

Q.9 Write short notes on ISO standard system 14001;2004.

Q.10 Explain environmental system standard in details.

Unit No. - V: Marketing and financial Management

Objectives:-

- Describe the characteristics of marketing & its types and overview of financial Management.

Outcomes: -

- Describe the characteristics of marketing & its types and overview of financial Management.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Marketing Management: Meaning of Market, Marketing strategy, motives, market characteristics and its types	T1, R1, R2	Chalk and Talk
2	Perfect Competition, Monopoly, Monopolistic completion and Oligopoly. New product development, Product life cycle	T1, R1, R2	Chalk and Talk
3	Marketing and selling, methods of selling, marketing planning. Market survey and market research, Online Marketing (Digital Marketing)	T1, R1, R2	Chalk and Talk
4	Financial Management: Definition of financial management, cost Concept, Types of costs (Fixed, Variable, average, marginal, and total cost)	T1, R1, R2	Chalk and Talk
5	Methods of costing price, capital. Debit, credit, Profit and loss statement, Balance sheet	T1, R1, R2	Chalk and Talk

6	Depreciation Analysis, causes and significance, methods of Calculation of depreciation, Taxation system, and type of taxes.	T1, R1, R2	Chalk and Talk

Question Bank Unit No.-V

Q.1 What are the types of marketing management?

Q.2 What are the characteristics of marketing management?

Q.3 Explain the concept of perfect competition,

Q.4 Explain the concept of monopolistic competition.

Q.5 Explain the oligopoly in details.

Q.6 Explain in detail the marketing and selling.

Q.7 What is difference between market survey and market research?

Q.8 Write short notes on online marketing. Enlist its four benefits.

Q.9 What is cost? Explain the three methods of costing in details.

Q.10 Explain the term price.

Q.11 Explain the term capital.

Q.12 Explain the term debit and credit.

Q.13 Explain the term books of account.

Unit No.-VI: Motivational Theory and Entrepreneurship

Objectives:-

- Discuss the qualities of a good leader and road map to Entrepreneurship.

Outcomes:-

- Discuss the qualities of a good leader and road map to Entrepreneurship.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Motivation: Introduction to Motivation,. theories of work motivation, Content Theories: Maslow's Hierarchy of Needs, Herzberg's Two factor theory, McClelland Three Needs Theory, McGregor's Theory X and Theory Y.	T4,R8	Chalk and Talk
2	Process Theories: Adam's Equity Theory, Vroom's Expectancy Theory, Taylor's Motivation Theory	T4,R8	Chalk and Talk
3	Leadership: Importance of Leadership, Types of Leadership: Autocratic	T4,R8	Chalk and Talk
4	Group dynamics: Types and interactions of groups, Stages of group dynamics: Norming, Storming, Forming, Performing and Adjourning.	T4,R8	Chalk and Talk
5	Entrepreneurship: Importance and limitations of rational decision making, Decision making underCertainty, uncertainty and risk.	T4,R8	Chalk and Talk

6	Incentives for small business development, Government policies and incentives, Case study on Small scale industries in India.	T4,R8	Chalk and Talk

Question Bank Unit No.-VI

Q.1 Define motivation with the neat diagram showing various needs, explain Maslow's Hierarchy of needs theory in details.

Q.2 Explain Herzberg's two factor theory in details.

Q.3 What happened if the initiatives for small business development is not given?

Q.4 What are the qualities of good leadership? Explain in details.

Q.5 Explain the group dynamics in details.

Q.6 What are the types of group dynamics?

Q.7 Write short notes on

i) Norming
ii) Storming
iii) Forming
iv) Performing
v) Adjourning.

Q.8 Define entrepreneurship. Explain the concept and trials of entrepreneurship.

Q.9 What are the limitations of rational decision making?

Q.10 What are the importance of rational decision making?

Q.11 Explain the decision making under certainty and uncertainty and risk.

Q.12 State the policies and incentives of SSI.

POWER ELECTRONICS

(303142)

Subject – Power Electronics

Weekly Work Load(in Hrs)	Lecture	Tutorial	Practical
	03	-	04

Online/ In-sem	Theory	Practical	Oral	Term-work	Total Marks	Credit
30	70	50	-	-	150	05

Syllabus:

Prerequisite:

- Knowledge of semiconductor material, basic electronics, diode, BJT, UJT, FET and its characteristics.
- Working of Diode based rectifier, concept of RMS and average value
- Use square notebooks for notes and plotting of waveforms.

Objectives: To enable students to gain knowledge and understanding in the following aspects:

- Fundamentals of power electronic devices and characteristics.
- The concepts and operating principles of power electronics circuits.
- Design procedures and techniques of power electronics systems.

Unit 01 Power Semi-Conductor Devices **06 hrs**

Construction, Static and dynamic Characteristics, specifications/rating of SCR , Triggering Circuits (R, R-C, UJT), Commutation Circuits (class C & D), Protection (over voltage, over current, and Thermal), Gate Turn Off (GTO) Thyristor (Construction, Working and Application), TRIAC- four mode operation, triggering of TRIAC using DIAC, Application-light dimmer.

Unit 02 Transistor based Devices and DC-DC converter **06 hrs**

Transistor based Devices: MOSFET & IGBT- Construction, working, Static and Dynamic Characteristics DC-DC converter: Principle of operation of chopper, classification on the basis of operating quadrants (A, B, C, D, E), Control techniques: CLC, TRC, PWM and FM Techniques. Analysis of Step-up Chopper and Numerical with RLE load. Buck Boost Chopper (Descriptive Treatment), Applications- Chargers for Battery operated vehicles.

Unit 03: Single Phase AC-DC Converter 06 hrs

Single phase Converter: Fully controlled converter, Half controlled converter (Semi- converter)- Operation of all converters with R & RL load, derivation of Average and RMS output voltage, power factor, THD, TUF. Numerical based on output voltage and current calculations, Single phase dual converter (Descriptive treatment only), Application-Speed control of DC motor.

Unit 04 Three Phase Converter and AC Voltage Regulator 06 hrs

Three phase converters: Fully controlled converter, Half controlled converter (Semi converter) Operation of all converters with R, RL load, derivation of Average and RMS output voltage. Numerical based on output voltage and current calculations, AC voltage regulator: Single phase AC Voltage regulator; operation with R and RL Load, derivation of Average and RMS output voltage. Concept of two stage AC voltage regulator (Descriptive treatment only).

Unit 05 Single phase DC-AC Converter (Transistor based) 06 hrs

Full bridge VSI, derivation of output voltage and current, Numerical, current source inverter with ideal switches and load commutated CSI, Voltage control techniques, Application- UPS.

Unit 06 Three phase DC-AC Converter (Transistor based) 06 hrs

Three phase VSI for 1200 and 1800 modes of operation and their comparison, PWM based VSI, voltage control and harmonic elimination techniques (Single Pulse Modulation, Multilevel Control), Multilevel Converter concept its classification (Neutral Point Clamped Converter, Flying Capacitor Converter, cascaded multilevel converter) and their comparison, Application- Speed control of 3 phase Induction motor.

Text Books:

1. M.H.Rashid - Power Electronics 2nd Edition, Pearson publication
2. Ned Mohan, T.M. Undeland, W.P. Robbins - Power Electronics, 3rd Edition, John Wiley and Sons
3. B.W. Williams: Power Electronics 2nd edition, John Wiley and sons
4. Ashfaq Ahmed- Power Electronics for Technology, LPE Pearson Edition.
5. Dr. P.S. Bimbhra, Power Electronics, Third Edition, Khanna Publication.
6. K. Hari Babu, Power Electronics , Scitech Publication.

References:

1. Vedam Subramanyam - Power Electronics , New Age International , New Delhi
2. Dubey, Donalda, Joshi,Sinha, Thyristorised Power controllers, Wiely Eastern New Delhi.
3. M. D. Singh and K. B. Khandchandani, Power Electronics, Tata McGraw Hill
4. Jai P. Agrawal, Power Electronics systems theory and design LPE, Pearson Education, Asia.
5. L. Umanand, Power Electronics – Essentials and Applications Wiley Publication.
6. J. Michael Jacob – Power Electronics Principal and Applications.
7. M.H.Rashid - Power Electronics Handbook, Butterworth-Heinemann publication, 3 edition
8. M.S. Jamil Asghar, Power Electronics, PHI.
9. V.R. Moorthi, Power Electronics Devices, circuits, and Industrial applications, Oxford University Press

Online Resources:

[O1] NPTEL Web course and video course on Power Electronics by Dr. B. G. Fernandis, IIT, Mumbai.

Course Objectives:

To enable students to gain knowledge and understanding in the following aspects:

- Fundamentals of power electronic devices and characteristics.
- The concepts and operating principles of power electronics circuits.
- Design procedures and techniques of power electronics systems.

Course Outcomes:

CO1 Students will be able to explain the working principle and characteristics of SCR with different switching circuits & the working of GTO,TRIAC and GTO

CO2 Students will be able to determine the characteristics of MOSFET, IGBT ,Operating quadrants of chopper with its control techniques and its applications

CO3 Students will be able to explain the types of AC-DC power converters according to R, RL Load & the working of Single phase dual converter with its application

CO4 Students will be able to explain the three phase AC-DC power converters and AC Voltage Regulator with respect to R, RL Load.

CO5 Students will be able to explain the DC-AC converters with its control technique

CO6 Students will be able to explain three phase DC-AC power Converter by using computer-aided techniques & Multilevel Converter concept.

Academic Activity Planner

Units	Unit Test1 (10marks)	Unit Test2 (10marks)	Assignment No:1 (10marks)	Assignment No:2 (10marks)	OBT : (10marks)	MCQ (10marks)
1	✓					
2		✓				
3			✓			
4				✓		
5					✓	
6						✓

Teaching Plan

Teaching plan as per University Syllabus

Sr.No.	Unit	Broad Topics to be Covered	Total Lecture Planned
1	I	Power Semi-Conductor Devices	06
2	II	Transistor based Devices and DC-DC converter	06
3	III	Single Phase AC-DC Converter	06
4	IV	Three Phase Converter and AC Voltage Regulator	06
5	V	Single phase DC-AC Converter (Transistor based)	06
6	VI	Three phase DC-AC Converter (Transistor based)	06

Unit wise Lecture Plan

Unit No.-I: Power Semi-Conductor Devices

Pre-requisites:-

- Knowledge of semiconductor material, basic electronics, diode, BJT, UJT

Objective :-

- To understand fundamentals of power electronic devices and characteristic.

Outcome :

- Students will be able to explain the working principle and characteristics of SCR with different switching circuits & the working of GTO,TRIAC and GTO

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Construction, Static and dynamic Characteristics of SCR	T5, T6, R3, R8, O1	PPT
2	specifications/rating of SCR , Triggering Circuits (R, R-C, UJT),	T5, T6, R3, R8, O1	PPT
3	Commutation Circuits (class C & D),	T5, T6, R3, R8, O1	PPT
4	Protection (over voltage, over current, and Thermal), Gate Turn Off (GTO) Thyristor (Construction, Working and Application),	T5, T6, R3, R8, O1	PPT
5	TRIAC- four mode operation	T5, T6, R3, R8, O1	Chalk & talk
6	triggering of TRIAC using DIAC, Application-light dimmer.	T5, T6, R3, R8, O1	Chalk & talk

Question Bank: Theory

Unit :I

Q. 1 Explain construction, working and static VI characteristics of SCR.Discuss holding and latching current of SCR.

Q.2 Explain dynamic characteristics of SCR in terms of turn on and turn off time.

Q.3 Why is reverse breakdown voltage greater than the forward breakdown voltage in SCR?

Q.4 Explain Class C and Class D commutation in SCR.

Q.5 Explain construction, working and static and dynamic VI characteristics of GTO. Compare GTO with SCR

Q.6 What are the applications of SCR. Explain one of them in detail

Q.7 What are different types of protection circuits of SCR.

Q.8 Explain the following specifications of thyristor:

1) dv/dt rating
2) di/dt rating
3) I^2t rating

Q.9 Explain design procedure of snubber circuit.

Q.10 Explain various triggering methods of SCR.Which is most preferred? Explain UJT triggering with neat circuit diagram.

Unit No.-II: Transistor based Devices and DC-DC converter

Pre-requisites:-

- Knowledge of semiconductor material, basic electronics, FET and its characteristics.

Objectives:-

- Fundamentals of power electronic devices and characteristics.

Outcomes:-

- Students will be able to determine the characteristics of MOSFET, IGBT ,Operating quadrants of chopper with its control techniques and its applications

Lecture No.	Details of the Topic to be covered	References	Mode of delivery
1	Transistor based Devices: MOSFET Construction, working, Static and Dynamic Characteristics	T4, T5, T6, R3, R5, R6, R9, O1	PPT
2	IGBT- Construction, working, Static and Dynamic Characteristics	T4, T5, T6, R3, R5, R6, R9, O1	PPT
3	DC-DC converter: Principle of operation of chopper,	T4, T5, T6, R3, R5, R6, R9, O1	PPT
4	Classification on the basis of operating quadrants (A, B, C, D, E), Control techniques: CLC, TRC, PWM and FM Techniques	T4, T5, T6, R3, R5, R6, R9, O1	Chalk & talk
5	Analysis of Step-up Chopper and Numerical with RLE load.	T4, T5, T6, R3, R5, R6, R9, O1	Chalk & talk
6	Buck Boost Chopper (Descriptive Treatment), Applications- Chargers for Battery operated vehicles.	T4, T5, T6, R3, R5, R6, R9, O1	Chalk & talk

Unit No.-II

Question Bank: Theory

1. What are the differences between MOSFET & IGBT?
2. With a neat diagram explain switching action of power MOSFET.
3. Explain transfer and output characteristics of MOSFET?
4. Explain transfer and output characteristics of IGBT?
5. Explain switching characteristics of IGBT and compare MOSFET and IGBT.
6. Explain the principle of operation of step down chopper?
7. Explain how choppers are classified? Draw neat circuit diagram and explain the working of class C chopper feeding a motor load.
8. Explain working of class E chopper feeding a motor load with the help of a circuit diagram.
9. Explain the Control techniques: CLC & TRC?
10. In a step up chopper applied voltage is 200 Vand output voltage is 600 V. If conducting time of a thyristor is 200 μsec ,compute:
    a) Chopper frequency
    b) Find output voltage for when pulse width is half for constant frequency operation.
11. A step up chopper has a supply voltage of 250 V while the output voltage is 400 V.If the total time period of chopper is 100 μsec , determine,
    a) Pulse width of the output voltage
    b) If the pulse width is reduced to 1/3 for constant frequency operation find the output voltage

Unit No.-III: Single Phase AC-DC Converter

Pre-requisites :-

- Working of Diode based rectifier, concept of RMS and average value

Objectives :-

- The concepts and operating principles of power electronics circuits.

Outcomes:-

- Students will be able to explain the types of AC-DC power converters according to R, RL Load & the working of Single phase dual converter with its application

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Single phase Converter: Fully controlled converter Operation with R & RL load	T1, T5, R3, O1	**PPT**
2	Single phase Converter: Half controlled converter (Semi-converter)- Operation with R & RL load	T1, T5, R3, O1	**PPT**
3	Derivation of Average and RMS output voltage, power factor, THD, TUF.	T1, T5, R3, O1	**PPT**
4	Numerical based on output voltage and current calculations	T1, T5, R3, O1	**PPT**
5	Single phase dual converter (Descriptive treatment only),	T1, T5, R3, O1	**PPT**
6	Application-Speed control of DC motor.	T1, T5, R3, O1	**PPT**

Question Bank: Theory

Unit III

Q. 1 Write the classification of AC-DC power conversion using SCR

Q.2 Explain working of single phase half wave converter with R and R-L load. Derive expressions for V_L

Q.3 Explain working of single phase mid point converter with R and R-L load. Derive expressions for V_L

Q.4 Explain working of single phase half controlled (semi converter) with R and R-L load

Q.5 Explain working of single phase full controlled converter with R, R-L load

Q.6 Explain the effect of source inductance on operation on converter. Derive an expression of calculation of an overlap angle and voltage drop

Q.7 Explain working of Single phase dual converter for

1. With circulating current mode
2. With non-circulating current mode

Q.8 Explain the concept of current source converter, operation with and without overlap angle

Q.9 A single phase half controlled bridge convertor feeds a load comprising a resistance of 10 Ω and a large inductance to provide a constant and ripple free current. Calculate the average value of output voltage and current. Firing angle is 45° and input ac voltage is 120 V,50 Hz.

Unit No.-IV: Three Phase Converter and AC Voltage Regulator

Pre-requisites:-

- The concepts and operating principles of power electronics circuits.

Objectives:-

- Working of Diode based rectifier, concept of RMS and average value

Outcomes:-

- Students will be able to explain the three phase AC-DC power converters and AC Voltage Regulator with respect to R, RL Load.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Three phase converters: Fully controlled converter Operation with R, RL load,	T5, T6, R1, R7, O1	**PPT**
2	Three phase converters: Half controlled converter (Semi converter)- Operation with R, RL load	T5, T6, R1, R7, O1	**PPT**
3	derivation of Average and RMS output voltage, Numerical based on output voltage and current calculations	T5, T6, R1, R7, O1	**PPT**
4	AC voltage regulator: Single phase AC Voltage regulator; operation with R and RL Load	T5, T6, R1, R7, O1	**PPT**
5	Derivation of Average and RMS output voltage.	T5, T6, R1, R7, O1	**PPT**
6	Concept of two stage AC voltage regulator	T5, T6, R1, R7, O1	**PPT**

Question Bank: Theory

Unit 4

Q. 1 Explain advantages of Three phase converter over single phase converter**,** Discuss working of Three phase half and full wave converter with firing angle of 30 °with R and R-L load. Derive an expressions for V_L(rms) and I_L(rms).

Q.2 Explain three phase half controlled converter (Semicoverter) with R, RL and RLE load and derive Average and RMS output voltage, power factor, THD, TUF.

Q.3 Explain three phase Fully controlled converter, rectification and inversion mode with R, RL and RLE load and derive Average and RMS output voltage, power factor, THD, TUF.

Q.4 State and explain effect of source inductance on performance of convertor.

Q.5 A three phase half wave controlled convertor is fed from 3 phase 440 V 50Hz source and is connected to resistive load of 10 Ω per phase. Calculate the average value of load voltage and current for a firing angle of 30° and 60°

Q.6 What is AC voltage regulator. Explain construction, working ,characteristic and applications of DIAC

Q.7 Explain construction, four mode operations ,characteristic and applications of TRIAC

Q.8 Discuss Single phase AC Voltage regulator principle with R and RL Load, Derive Average and RMS output voltage and draw its waveforms

Unit No.-V: Single phase DC-AC Converter (Transistor based)

Pre-requisites:-

- Basic Principle of operation of DC-AC converters

Objectives:-

- To learn the switching techniques for inverters and the type of inverters.
- To study the operation of inverters.

Outcomes:-

- Students will be able to explain the DC-AC converters with its control technique

Lecture No.	Details of the Topic to be covered	References	Mode of delivery
1	Full bridge VSI	T1, T2, T3, R3, O1	PPT
2	derivation of output voltage and current,	T1, T2, T3, R3, O1	PPT
3	Numerical,	T1, T2, T3, R3, O1	PPT
4	current source inverter with ideal switches and load commutated CSI	T1, T2, T3, R3, O1	PPT
5	Voltage control techniques	T1, T2, T3, R3, O1	PPT
6	Application- UPS.	T1, T2, T3, R3, O1	PPT

Question Bank: Theory

Unit No.-V

1. Explain the principle of operation of an inverter?
2. What are the differences between half bridge & full bridge inverters?
3. Derive the output voltage equation for half bridge inverter?
4. Derive the output voltage equation for full bridge inverter with R-L load.
5. Explain with circuit diagram and waveforms operation of single phase current source inverter.
6. Explain single pulse, multiple pulse and sinusoidal pulse width modulation techniques?
7. Compare between VSI and CSI.

Unit No.-VI: Three phase DC-AC Converter (Transistor based)

Pre-requisites:-

- Basic working principle of machines and its rotating theory

Objectives: -

- To study various speed control methods of a.c. motors.
- To impart various applications of a.c. motors.

Outcomes:-

- After successfully completing this unit, students will be able to: analyze construction, working, operation and applications under different operating conditions of single phase Induction motor, plot

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Three phase VSI for 1200 and 1800 modes of operation and their comparison,	T1, T2, T3, R3, O1	PPT
2	PWM based VSI, voltage control and harmonic elimination techniques (Single Pulse Modulation, Multilevel Control),	T1, T2, T3, R3, O1	PPT
3	Multilevel Converter concept its classification (Neutral Point Clamped Converter,)	T1, T2, T3, R3, O1	PPT
4	Multilevel Converter concept its classification (Flying Capacitor Converter)	T1, T2, T3, R3, O1	PPT
5	Multilevel Converter concept its classification (cascaded multilevel converter) and their comparison	T1, T2, T3, R3, O1	PPT

6	Application- Speed control of 3 phase Induction motor.	T1, T2, T3, R3, O1	PPT

Question Bank: Theory

Unit : VI

1. Give the classification of single phase motors .Explain any two types of single phase induction motors.
2. Explain the double field revolving theory for operation of single phase induction motor.
3. Explain the operation of shaded pole induction motor with diagram.
4. Develop equivalent circuit of a single phase induction motor ignoring core losses.
5. Explain the working principle of single phase induction motor .Mention its four applications.
6. Explain CSCR motor with circuit dig
7. Compare single phase and three phase IM
8. Explain the methods of self starting of single phase

Practical Assessment

List of Experiments

Sr.No.	Name of the Practical
	PART : A
1	Static VI characteristic of SCR / GTO
2	Static VI characteristic of TRIAC.
3	Single phase Half controlled converter with R and RL load.
4	Single phase fully controlled converter with R load.
5	Single Phase fully controlled converter with and without Free Wheeling diode with RL load
6	Three phase AC-DC fully controlled bridge converter R and RL load.
7	Single phase A.C. voltage regulator with R and RL load.
8	Output and Transfer Characteristic of MOSFET and IGBT (Both)
	PART : B
1	Fabrication of AC voltage regulator. (compulsory)
2	Study of 1-ø bridge inverter SPWM
3	Study of Forced commutation circuits of SCR (Class C and Class D).
4	Study and design of SMPS.
5	Study of PWM controls of a single-phase inverter.
6	Performance analysis of three phase diode clamped Multilevel inverter
7	Study of three phase Active power filter.
8	Industrial Visit to Power Electronics manufacturing unit/Renewable energy power plant.

ELECTRICAL MACHINES – II

(303143)

Subject –Electrical Machines II

Weekly Work Load(in Hrs)	Lecture	Tutorial	Practical
	03	-	02

Online/ In-sem	Theory	Practical	Oral	Term-work	Total Marks	Credit
30	70	25	-	25	150	04

Syllabus:

Unit I: Three phase Synchronous machines: (06 hrs)

Three phase Synchronous machines:

Construction, rotating-field type and rotating-armature type, salient-pole and non-salient-pole type and their comparison. Excitation Methods.

Three phase Synchronous generator (cylindrical rotor type): Principle of operation. EMF equation and winding factors (No derivation), rating of generator. Generator on no-load and on balanced load. Armature reaction and its effect under different load power factors. Voltage drop due to armature resistance, leakage flux and synchronous reactance. Per phase equivalent circuit and Phasor diagram. Power - power angle relation.

Three phase Synchronous generator (salient pole type):

Armature reaction as per Blondel's two reaction theory for salient-pole machines, Direct-axis and quadrature-axis synchronous reactance's and their determination by slip test. Phasor diagram of salient-pole generator and calculation of voltage regulation.

Unit II:

Voltage regulation of Three phase Synchronous generator 06Hrs

Performance of open circuit and short circuit test on synchronous generator, determination of voltage regulation by emf, mmf, and Potier triangle methods. Determination of voltage regulation by direct loading. Short circuit ratio.

Parallel operation of 3-phase alternators:

Necessity, conditions, Load sharing between two alternators in parallel (Descriptive treatment only). Process of synchronizing alternator with infinite bus-bar by lamp method (one dark & two equally bright lamp method) and by the use of synchroscope, Synchronizing current, power and torque (no numerical).

Unit III: Three phase synchronous motor 6Hrs

Principle of operation. Methods of starting. Equivalent circuit, significance of torque angle, Losses, efficiency and Power flow chart. Operation of 3-phase Synchronous motor with constant load and variable excitation ('V' curves and 'inverted V' curves). Phenomenon of hunting and its remedies. Applications of 3-phase synchronous motors. Comparison of 3 phase synchronous motor with 3-phase induction motor.

Unit IV: 3-ph induction motor, Induction generator and special purpose motors 6Hrs

Speed control of three phase induction motor by various methods (Stator side and rotor side controls). Action of 3-phase induction motor as induction generator, applications of induction generator. Introduction to Energy Efficient three phase Induction Motor and Super Conducting Generator.

Special Purpose Motors : Construction, principle of working, characteristics, ratings and applications of Brush less D.C. motors, Stepper motors (permanent magnet and variable reluctance type only), Permanent Magnet motor (A.C. & D.C.).

Unit V : A.C. series motor 06Hrs

Operation of D.C. series motor on a.c. supply, nature of torque developed, problems associated with AC. operation and remedies.

Compensated series motor: Compensating winding, conductively and inductively compensated motor. Approximate phasor diagram. Use of compoles for improving commutation. Ratings and applications of Compensated Series motors.

Universal motors: Ratings, performance and applications, comparison of their performance on A.C. and D.C. supply.

Unit VI: Single phase induction motor **06Hrs**

Construction of single phase induction motor, double field revolving theory. Equivalent circuit and torque-slip characteristics on the basis of double revolving field theory. Tests to determine the parameters of equivalent circuit and calculation of performance characteristics of motor. Methods of self-starting. Types of single phase induction motors: Split-phase motors (Resistor split-phase motor, Capacitor-start motor, Capacitor start and capacitor run motor and permanent capacitor motor). Comparison of 1-phase induction motor with 3-phase induction motor.

Text Books

1. Nagrath and Kothari, Electrical Machines, 2nd Ed., Tata McGraw Hill.
2. S. K. Bhattacharya, Electrical Machines, Tata McGraw Hill
3. A.S. Langsdorf, Theory of Alternating Current Machinery, Tata McGraw Hill
4. P. S. Bimbhra, Electric Machinery, Khanna Publications.
5. B.R. Gupta and Vandana Singhal -Fundamentals of Electric Machines, New Age International (P) Ltd.
6. B. L Theraja –Electrical Technology, Vol II , S. Chand publication
7. V. K. Mehta and Rohit Mehta, Principles of Electrical Machines, S Chand Publication
8. Krishna Reddy –Electrical Machines Vol.II and III, SCITECH publications
9. Ashfaq Husain, Electrical Machines, Dhanpat Rai and Co.
10. M V Deshpande, Electrical Machines, Prentice Hall of India

Reference Books

1. M.G. Say, Performance and Design of A.C. Machines (3rd Ed.), ELBS
2. J B Gupta - Theory and performance of Electrical Machines, S K Kataria Publications
3. Samarjit Ghosh, Electrical Machines, Pearson Publication
4. Bhag S Guru and Huseyin R Hiziroglu, Electrical Machinery and Transformer, 3rd Edition, Oxford University Press
5. E G Janardanan, Special Electrical Machines, Prentice Hall of India.
6. Suvarnsingh Kalsi Application of high Temperature super conductors to electric power

equipment (Rotating Machines) Wiley publication

Reference Web Links/ Research Paper/ Referred Book other than Mention in Syllabus:

1. www.nptel.in/electricalmachine/

Course Objectives: The course aims to learn

- Learn construction & working principle of three phase synchronous machines and 1-ph induction motors.
- Calculate voltage regulation of Alternator by different methods.
- Study the applications of different machines in industrial, commercial & social sectors.
- Determine the performance indices of AC series & single phase motors by experimentation.

Course Outcomes

For Theory

CO1: Students will be able to explain the construction and working of alternators.

CO2: Students will be able to analyze alternators under different operating conditions.

CO3: Students will be able to determine performance parameters and applications of synchronous motor.

CO4: Students will be able to determine performance parameters and applications of synchronous motor.

CO5: Students will able to illustrate working and performance parameters of a. c. series motor.

CO6: Students will be able to analyze working, applications and performance parameters of single phase Induction motor.

For Practical

CO1 -Students will be able to calculate voltage regulation of Alternator by different methods.

CO2- Students will be able to determine performance parameter of Synchronous Motor

CO3- Student will be able to analyze performance of Single phase Induction Motor and speed control of three phase induction motor

CO4- Student will be able to illustrate performance parameter of ac series motor through different loading Conditions.

Academic Activity Planner

Units	Unit Test1 (10marks)	Unit Test2 (10marks)	Assignment No:1 (10marks)	Assignment No:2 (10marks)	OBT : (10marks)	MCQ (10marks)
1	✓					
2		✓				
3			✓			
4				✓		
5					✓	
6						✓

Teaching plan as per University Syllabus

Sr.No.	Unit	Broad Topics to be Covered	Total Lecture Planned
1	I	Three phase Synchronous machines, Three phase Synchronous generator	06
2	II	Voltage regulation of Three phase Synchronous generator, Parallel operation of 3-phase alternators	06
3	III	Three phase synchronous motor	06
4	IV	Three phase induction motor, generator and special motors	06
5	V	A.C. series motor	06
6	VI	Single phase induction motor	06

Unit No.-I: Three phase Synchronous machines

Pre-requisites:-

- Basic working principle of machines and its rotating theory

Objective :-

- To understand construction and working of synchronous machines.

Outcome :

- Students will describe construction and working of alternators.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Three phase Synchronous machines: Construction, rotating-field type and rotating-armature type, salient-pole type and non-salient-pole type and their comparison. Damper winding	T2,T5,T7,R2	Chalk and Board ,PPT
2	Three phase Synchronous generator (cylindrical rotor type): Principle of operation. Emf equation, winding factors, rating of generator	T2,T5,T7,R2	Chalk and Board ,PPT
3	Generator on no-load and on balanced load	T2,T5,T7,R2	Chalk and Board ,PPT
4	Armature reaction and its effect under different load power factors, Voltage drop due to armature resistance, leakage flux and synchronous reactance. Per phase equivalent circuit and phasor diagram	T2,T5,T7,R2	Chalk and Board ,PPT
5	Load characteristics. Losses and efficiency, power–flow chart.	T2,T5,T7,R2	Chalk and Board ,PPT
6	Direct-axis and quadrature-axis synchronous	T2,T5,T7,R2	

	reactances and their determination by slip test. Phasor diagram of Salient-pole generator and emf equation.		Chalk and Board ,PPT

Unit_I

Question Bank: Theory

1. Explain the construction of alternator
2. Why a 3-phase synchronous motor will always run at synchronous speed?
3. What are the two classification synchronous machines?
4. What are the advantages of salient pole type of construction used for synchronous machines?
5. Why do cylindrical rotor alternators operate with steam turbines?
6. Which type of synchronous generators are used in Hydroelectric plants and why
7. What is the relation between electrical degree and mechanical degree?
8. Why short-pitch winding is preferred over full pitch winding?
9. What do you mean by synchronous reactance?

Unit No.-II: Voltage regulation and Parallel operation of Three phase Synchronous generator

Pre-requisites:-

- Basic working principle of machines and its rotating theory

Objectives:-

- To understand various methods to determine regulation and efficiency of a.c. machines

Outcomes:-

- After successfully completing this unit students will be able to analyze working, controlling and applications of three phase alternators under different operating conditions.

Lecture No.	Details of the Topic to be covered	References	Mode of delivery
1	Performance of open circuit and short circuit test on synchronous generator	T9,T5,T7,R2,R3	Chalk and Board ,PPT
2	determination of voltage regulation by emf, mmf methods	T9,T5,T7,R2,R3	Chalk and Board ,PPT
3	Potier triangle method	T9,T5,T7,R2,R3	Chalk and Board ,PPT
4	Determination of voltage regulation by direct loading. Short circuit ratio	T9,T5,T7,R2,R3	Chalk and Board ,PPT
5	Parallel operation of 3-phase alternators: Necessity, conditions, Load sharing between two alternators in parallel	T9,T5,T7,R2,R3	Chalk and Board ,PPT
6	Parallel-Generator theorem. Process of synchronizing alternator with infinite bus-bar by lamp methods and by use of synchroscope, power and current.	T9,T5,T7,R2,R3	Chalk and Board ,PPT

Unit_II

Question Bank: Theory

1. Explain any one method of predetermining the regulation of an alternator.
2. Explain why the Potier reactance is slightly higher than leakages reactance.
3. Explain dark lamp method of synchronizing an alternator with the bus bar.
4. Explain Blondel's two-reaction theory,
5. Explain how will you determine the d and q axes reactance of a synchronous machine in your laboratory.
6. Derive an expression for synchronizing power
7. Explain synchronous impedance method
8. Explain AT method
9. Explain synchronization of 3 phase alternator
10. Explain Potier triangle method

Unit No.-III: Three phase synchronous motor

Pre-requisites :-

- Basic working principle of machines and its rotating theory

Objectives :-

- To understand construction and working of synchronous machines
- To study various speed control methods of a.c. motors.
- To impart various applications of a.c. motors.

Outcomes:-

After successfully completing this unit students will be able to:

- Students will evaluate performance parameters, working and applications of synchronous motor.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Principle of operation. Methods of starting	T9,T2,T7,T4,R2	Chalk and Board ,PPT
2	Pull-in and pull-out torques. Equivalent circuit, significance of torque angle and torque equation. Losses, efficiency and Power flow chart	T9,T2,T7,T4,R2	Chalk and Board ,PPT
3	Operation of 3-phase Synchronous motor with constant excitation and variable load. Operationwith constant load and variable excitation (‘V’ Curves and ‘inverted V’ curves)	T9,T2,T7,T4,R2	Chalk and Board ,PPT
4	Phenomenon of hunting and its remedies	T9,T2,T7,T4,R2	Chalk and Board ,PPT
5	Applications of 3-ph synchronous motors. Introduction to synchronous – induction motor.	T9,T2,T7,T4,R2	Chalk and Board ,PPT

6	Comparison of 3 ph synchronous motor with 3-phase induction motor & Numericals	T9,T2,T7,T4,R2	Chalk and Board ,PPT

Unit No.-III

Question Bank: Theory

1. Explain why a synchronous motor does not have starting torque.
2. Explain one method of starting a synchronous motor.
3. Why does the power factor of industrial installation tend to be low? How can it be improved?
4. Does the change in excitation affect the p.f of the synchronous motor?
5. An over excited synchronous motor is called a synchronous condenser. Explain.
6. Mention some specific applications of synchronous motor.
7. Explain what happens when the load on a synchronous motor is changed.
8. What is meant by constant power circle for synchronous motor?
9. What is meant by hunting in a synchronous motor? Why is it undesirable? What is done to minimize it?
10. Explain V-curves and inverted V-curves.
11. Draw the power angle diagram of a synchronous machine.
12. Explain briefly the principle of operation of three-phase synchronous motor.
13. Describe the effect of varying the excitation on the armature current and power factor of a synchronous motor when input power to the motor is maintained constant

Unit No.-IV: Three phase induction motor, generator and special motors

Pre-requisites:-

- Basic working principle of machines and its rotating theory

Objectives:-

- To study various speed control methods of a.c. motors.
- To impart various applications of a.c. motors/Special motors.

Outcomes:-

After successfully completing this unit students will be able to:

- recognize, construction, working and applications of Induction generators, Induction regulators and special purpose machines.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Speed control of three phase induction motor by various methods (Stator side and rotor side controls).	T2,T4,T7,T5,R3	Chalk and Board ,PPT
2	Action of 3-phase induction motor as induction generator,	T2,T4,T7,T5,R3	Chalk and Board ,PPT
3	Applications as induction generator	T2,T4,T7,T5,R3	Chalk and Board ,PPT
4	Single phase and three phase Induction voltage regulator: construction, principle of working and applications.	T2,T4,T7,T5,R3	Chalk and Board ,PPT
5	Stepper motors (only permanent and variable reluctance type),	T2,T4,T7,T5,R3	Chalk and Board ,PPT
6	Permanent Magnet motor	T2,T4,T7,T5,R3	Chalk and Board ,PPT

Unit No.-IV

1. Develop the equivalent circuit for 3-phase induction motor?
2. Explain the different speed control methods of squirrel cage induction motor.
3. Describe the principle of operation of synchronous induction motor.
4. Explain any one method of speed control of three- phase induction motor
5. Draw the slip-torque characteritics for a three-phase induction motor and explain.
6. Explain how a rotating magnetic field is produced in a three-phase induction motor.
7. Draw and explain the equivalent circuit of a three-phase induction motor.
8. Describe with a neat diagram, the principle of operation of induction generator
9. Draw and explain the torque/slip curves of a three-phase induction motor for different values of rotor resistance.
10. Starting from the first principles, develop the equivalent circuit of a 3- phase induction motor.
11. Explain the construction and working of stepper motor.
12. Explain the principle of operation and applications of reluctance motor.
13. Explain the principle of operation and applications of repulsion motor and hysteresis motor

Unit No.-V: A.C. series motor

Pre-requisites:-

- Construction working of DC series motor

Objectives:-

- To study various speed control methods of a.c. motors.
- To impart various applications of a.c. motors.

Outcomes:-

After successfully completing this unit students will be able to:

- analyze construction, working and operation and applications under different operating conditions of a.c. series motor, plot and evaluate its performance parameters.

Lecture No.	Details of the Topic to be covered	References	Mode of delivery
1	Operation of d.c. series motor on a.c. supply, nature of torque developed, problems associated with a.c. operation and remedies.	T1,T2,T4,T7,R2	Chalk and Board ,PPT
2	Plain Series motor: direct and quadrature axis fluxes. Transformer and rotational emfs in the field winding and the armature winding.	T1,T2,T4,T7,R2	Chalk and Board ,PPT
3	Approximate phasor diagram (Ignoring leakage fluxes, magnetising current and currents in the short-circuited armature coils)	T1,T2,T4,T7,R2	Chalk and Board ,PPT
4	Circle diagram, performance characteristics from circle diagram. Drawbacks of plain series motor	T1,T2,T4,T7,R2	Chalk and Board ,PPT
5	Compensated series motor:	T1,T2,T4,T7,R2	Chalk and Board

	Compensating winding, conductively and inductively compensated motor. Use of compoles for improving commutation		,PPT
6	Ratings and applications of Compensated Series motors. Universal motors: ratings, performance and applications, comparison of their performance on a.c.and d.c. supply	T1,T2,T4,T7,R2	Chalk and Board ,PPT

Unit No.-V

Question Bank: Theory

1. How is the speed control affected in a 3-phase AC series commutator motor?
2. 3-phase ac series commutator motor does not need any protection against excessive speed. Why?
3. How is the speed control affected in a 3-phase AC shunt commutator motor?
4. What is a universal motor?
5. Why should a motor be named as universal motor?
6. What is the principle of operation of universal motor?
7. What is the necessity of having laminated yoke in an ac series motor?
8. Why compensating winding is provided in a universal motor for ac operation?

Unit No.-VI: Single phase induction motor

Pre-requisites:-

- Basic working principle of machines and its rotating theory

Objectives: -

- To study various speed control methods of a.c. motors.
- To impart various applications of a.c. motors.

Outcomes:-

After successfully completing this unit, students will be able to:

- analyze construction, working, operation and applications under different operating conditions of single phase Induction motor, plot

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Construction of single phase induction motor, mmf produced by single phase stator winding carrying an alternating current	T1,T2,T9,T7,R2	Chalk and Board ,PPT
2	Its representation by two revolving fields. Equivalent circuit and torque-slip characteristics on the basis of double revolving field theory	T1,T2,T9,T7,R2	Chalk and Board ,PPT
3	Tests to determine the parameters of equivalent circuit and calculation of performance characteristics of motor	T1,T2,T9,T7,R2	Chalk and Board ,PPT
4	Methods of self-starting. Types of single phase induction motors: Split-phase motors (Resistor split-phase motor	T1,T2,T9,T7,R2	Chalk and Board ,PPT

5	Capacitor-start motor, Capacitor start and run motor and permanent capacitor). Shaded pole induction motor – their construction	T1,T2,T9,T7,R2	Chalk and Board ,PPT
6	operation, torque-slip characteristics and applications. Comparison of 1-phase induction motor with 3-phase induction motor	T1,T2,T9,T7,R2	Chalk and Board ,PPT

Unit No.-VI

Question Bank: Theory

1. Give the classification of single phase motors .Explain any two types of single phase induction motors.
2. Explain the double field revolving theory for operation of single phase induction motor.
3. Explain the operation of shaded pole induction motor with diagram.
4. Develop equivalent circuit of a single phase induction motor ignoring core losses.
5. Explain the working principle of single phase induction motor .Mention its four applications.
6. Explain CSCR motor with circuit dig
7. Compare single phase and three phase IM.
8. Explain the methods of self starting of single phase IM.

Practical Assessment

List of Experiments

Sr.No.	Name of the Practical
1	Regulation of cylindrical rotor alternator by EMF and MMF method.
2	Regulation of cylindrical rotor alternator by direct loading method.
3	Regulation of cylindrical rotor alternator by potier triangle method.
4	Regulation of salient pole alternator by slip test.
5	V and inverted V curve of synchronous motor.
6	V/F method of speed control of 3 phases Induction Motor.
7	Load test on a.c. series motor
8	Speed control of three phase induction motor by rotor resistance control method.

Electrical Installation, Maintenance and Testing (303144)

Name of the Subject –Electrical Installation, Maintenance and Testing.

Weekly Work Load(in Hrs)	Lecture	Tutorial	Practical
	03	-	02

Online/ In-sem	Theory	Practical	Oral	Term-work	Total Marks	Credit
30	70	-	25	25	150	05

Syllabus

Unit 01: Economics of Distribution Systems: (06 Hrs.)

Classification of supply systems (State Only) 2021-22 Page 22 (i)DC, 2-wire system, (ii) Single phase two wire ac system, (iii) Three phase three wire ac supply system, iv) Three phase four wire ac supply system. Comparison between overhead and underground systems (For above mentioned systems) on the basis of volume requirement for conductor. AC Distribution System: Types of primary and secondary distribution systems, calculation of voltage drops in ac distributors (Uniform and Non Uniform Loading) (Numerical) Economics of power transmission: Economic choice of conductor (Kelvin's law) (Derivation and Numerical) Distribution Feeders: Design considerations of distribution feeders; radial and ring types of primary feeder's voltage levels, energy losses in feeders.

Unit 02: Substation and Earthing: (06 Hrs.

Substation: Classification of substations, Various equipments used in substation with their specifications, Bus bar arrangements in the substation: Simple arrangements like single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams. Earthing: Necessity of Earthing, Types of earthing system (Equipment and Neutral), and Maintenance Free Earthing system. Methods of testing earth resistance, Different electrode configurations (Plate and Pipe electrode), Tolerable step and touch voltages, Steps involved in design of substation earthing grid as per IEEE standard 80 – 2000.

Unit 03: Maintenance and Condition Monitoring: (08hrs)

Importance and necessity of maintenance, different maintenance strategies like breakdown maintenance, planned/preventive maintenance and condition based maintenance. Planned and preventive maintenance of transformer, Induction motor and Alternators. Insulation stressing factors, Insulation deterioration, polarization index, dielectric absorption ratio. Concept of condition monitoring of electrical equipments. Advance tools and techniques of condition monitoring, Thermography. Failure modes of transformer, Condition monitoring of oil as per the IS/IEC standards, Filtration/reconditioning of insulating oil, Condition monitoring of transformer bushings, On load tap changer, dissolved gas analysis, degree of polymerization. Induction motor fault diagnostic methods – Vibration Signature Analysis, Motor Current Signature Analysis. Hot Line Maintenance - Meaning and advantages, special types of non-conducting Materials used for tools for hot line maintenance.

Unit 05: Installation and estimation of distribution system (06 Hrs.)

Introduction cable sizing, Estimation and conductor size calculations of internal wiring for Residential and Commercial (Numerical) installations and estimate for underground LT service lines.

Unit 06:Testing and Electrical Safety: (06 Hrs.)

Understanding CAT Ratings & Using CAT rated Instrument, Electrical Installation Testing ProceduresInsulation resistance test between installation and earth, Insulation resistance test between conductors (use of GUARD Terminal in IR test & Application) (methods used for IR Testing) Testing of polarity, Testing of earth continuity paths (Applications of PAT Tester “Portable Appliance Tester” in commercial like hotels hospital & Industry also) and Earth resistance test (methods for earth testing 2-pole,3-pole new methods clamp on type where we can performs test in Live) Contents of first aid box, treatment for cuts, burns and electrical shock. Procedures for first aid (e.g. removing casualty from contact with live wire and administering artificial respiration). Various statutory regulations (Electricity supply regulations, factory acts and Indian electricity rules of Central Electricity Authority (CEA), Classification of hazardous area. (Introduction to OSHA)

Industrial Visit:

Visit to repair workshop (Any One).

i) Three phase induction motor ii) Transformer iii)

Power Cable. List of Experiments :

Compulsory experiments:

(Drawing sheets for 1 and 2 using AutoCAD or other CAD software)

1. Single Line diagram of 132 or 220 or 400 kV substation (based on actual field visit) Symbols, Plate or Pipe earthing.
2. Estimation for 11 kV feeders and substation.
3. Assignment on design of earthing grid for 132/220 kV substation.

List of Experiments

Part-A: (Any Eight of the following)

1) Measurement of Dielectric Absorption Ratio and Polarization Index of insulation.2) Study of thermograph images and analysis based on these images.

3) Practice of earthing and Measurement of Earth resistance of Campus premises by using 4 Pole, 3 Pole, new technology practicing in industry clamp on method.

4) Single Line diagram of 132 or 220 or 400 kV substation (based on actual field visit) Symbols, Plate or Pipe earthing. (Drawing sheets 1 using AutoCAD or other CAD software)

5) Assignment on design of earthing grid for 132/220 kV substation.

6) Design and estimation of light and power circuit of labs/industry.

7)Measurement of insulation resistance of motors and cables

8) PRECAUTIONS FROM ELECTRIC SHOCK AND METHOD OF SHOCK TREATMENT.

9) Using of Installation Multifunction Testers for RCD testing, Phase Sequence Indication, Insulation resistance measurement, Continuity testing

10)Use REVIT / any BOQ (Bill of Quantity)estimation software for estimation and costing

11) Design and estimation of light and power circuit of residential wiring.

Part-B:(Any 4 out of these)

1) Estimation and costing for 11 kV feeders and substation.(voltage drop calculation,SLD, substation layout)

2. Study of troubleshooting of electrical equipment based on actual visit to repair workshop (Any

One). i) Three phase induction motor ii) Transformer iii) Power Cable

3. Trouble shooting of household equipment – Construction, working and troubleshooting of any two household Electrical equipment's (Fan, Mixer, Electric Iron, Washing Machines, Electric Oven, Microwave - Limited to electrical faults) (Here we perform Practical by using PAT Testers)

4) Design, Estimation and costing of earthing pit and earthing connection for computer lab, Electrical Machines Lab.

5)WIRING INSTALLATION AND MAINTENANCE OF PUMP MOTOR

6)Activity: Interview of Electrical maintenance personnel/Technician/Electrician

7)Activity: Safety awareness for housing societies/schools/Junior colleges

8)Activity: Preparation of Tender notice and studying the Tender notices published in newspapers

9)Any innovative activity related to EIMT syllabus Industrial Visit (if any): Visit to substation/ installation sites.

Text Books:

[T1] B. R. Gupta- Power System Analysis and Design, 3rd edition, Wheelers publication.

[T2] S. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment, Khanna publishers.

[T3] S. L. Uppal - Electrical Power - Khanna Publishers Delhi.

[T4] Hand book of condition monitoring by B. K. N. Rao, Elsevier Advance Tech., Oxford (UK). **[T5]** S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House.

[T6] B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication.

[T7] Hand book on Electrical Safety.

Reference Books:

[R1]P.S. Pabla –Electric Power Distribution, 5th edition, Tata McGraw Hill.

[R2]S. L. Uppal, Electrical Wiring and Costing Estimation, Khanna Publishers, New Delhi.

[R3]Surjit Singh, Electrical wiring, Estimation and Costing, Dhanpat Rai and company, New Delhi.

[R4]Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill,New Delhi

[R5]B.D. Arora-Electrical Wiring, Estimation and Costing,- New Heights, New Delhi.

[R6]M.V. Deshpande, Elements of Power Station design and practice, Wheelers Publication.

[R7]S. Sivanagaraju and S. Satyanarayana, Electric Power Transmission and Distribution, Pearson Publication .

IS/IEEE Standards:

1. IS : 1180 – Distribution Transformer.
2. IS : 2026 – Power Transformer.
3. IS: 4029 – Testing of 3 Phase Induction Motor.
4. IS : 694:1986 – PVC insulated cables for working voltages up to and including 1100 V.
5. IS : 900:1992 – Code of practice for installation and maintenance of Induction Motors.
6. IEEE 80:2000 – IEEE Guide for Safety in AC Substation Grounding.
7. IEEE 142 Guide for Earthing.
8. Indian Electricity Rules

Unit	Text Books	Reference Books
Unit 1	T1,T3	R7
Unit 2	T1,T3	R2, R3
Unit 3	T2, T4, T5, T6	R8
Unit 4	T3	R2, R3, R4, R5
Unit 5		R2, R3, R4, R5
Unit 6	T2,T7	

Reference Web Links/ Research Paper/ Referred Book other than Mention in Syllabus:

Text Books :

[T1] B. R. Gupta- Power System Analysis and Design, 3rd edition, Wheelers publication.

[T2] S. Rao, Testing Commissioning Operation and Maintenance of Electrical Equipment, Khanna publishers.

[T3] S. L. Uppal - Electrical Power - Khanna Publishers Delhi.

[T4] Hand book of condition monitoring by B. K. N. Rao, Elsevier Advance Tech., Oxford (UK).

[T5] S. K. Shastri – Preventive Maintenance of Electrical Apparatus – Katson Publication House.

[T6] B. V. S. Rao – Operation and Maintenance of Electrical Equipment – Asia Publication.
[T7] Hand book on Electrical Safety.

Reference Books :

[R1] P.S. Pabla –Electric Power Distribution, 5th edition, Tata McGraw Hill.
[R2] S. L. Uppal, Electrical Wiring and Costing Estimation, Khanna Publishers, New Delhi.
[R3] Surjit Singh, Electrical wiring, Estimation and Costing, Dhanpat Rai and company, New Delhi.
[R4] Raina K.B. and Bhattacharya S.K., Electrical Design, Estimating and Costing, Tata McGraw Hill, New Delhi .
[R5] B.D. Arora-Electrical Wiring, Estimation and Costing,- New Heights, New Delhi.
[R6] M.V. Deshpande, Elements of Power Station design and practice, Wheelers Publication.
[R7] S. Sivanagaraju and S. Satyanarayana, Electric Power Transmission and Distribution, Pearson Publication .
[R8] Power Equipment Maintenance and Testing (Power Engineering Book 32) by Paul Gill.

Course Objective:

The course aims :-

1. To understand the basic concepts, design and estimation of distribution systems & substation
2. To enable candidate to design earthing system for residential and industrial premises
3. To understand practical aspects of condition monitoring and maintenance of various electrical equipment
4. To learn testing methods of various electrical equipment.

Course Outcome:

At the end of the course, a graduate will be able to –

C304.1A	Students will be able to Determine distribution system with economics of distribution system	(Understand:BTLl:2)

C304.2A	Students will be able to demonstrate substation and earthing systems	(Apply:BTL:3)
C304.3A	Student will be able to Identify the importance and necessity of Maintenance	(Apply: BTL:3)
C304.4A	Students will be able to analyze different condition monitoring methods	(Analyse:BTL:4)
C304.5A	Student will be able to carry out estimation and costing of residential and commercial installations	(Evaluate:BTL:5)
C304.6A	Students will be able to apply Electrical Safety procedures.	(Apply:BTL:3)
	Practical	
C304.1B	Students will be able to design 132/220/400kv substation and earthing grid.	(Design:BTL:6)
C304.2B	Students will be able to analyze thermograph images	(Analyse:BTL:4)
C304.3B	Students will be able to explain construction, working and troubleshooting of household and industrial electrical equipments.	Understand:BTLl:2)
C304.4B	Students will be able to design earthing pit and earthing connection along with measurement of earth resistance for computer lab, Electrical Machines Lab, HT Substation.	(Evaluate:BTL:5)

Academic Activity Planner

Units	Unit Test1 (10marks)	Unit Test2 (10marks)	Assignment No:1 (10marks)	Assignment No:2 (10marks)	OBT : (10marks)	MCQ (10marks)
1	✓					
2		✓				
3			✓			
4				✓		
5					✓	
6						✓

Teaching Plan

Teaching plan as per University Syllabus

Sr.No.	Unit	Broad Topics to be Covered	Total Lecture Planned
1	I	Economics of Distribution Systems	06
2	II	Substation and Earthing	06
3	III	Maintenance and Condition Monitoring	08
4	IV	Estimation and Costing	04
5	V	Installation and estimation of distribution system	06
6	VI	Testing and Electrical Safety	06

Unit wise Lecture Plan
Unit No.-I: Economics of Distribution Systems

Pre-requisites:-
Introduction of Electrical supply system, typical A.C power supply scheme, Classification of Supply systems.

Objectives:-

- To understand the basic concepts, design and estimation of distribution systems, substation.

Outcomes:-

After successfully completing this unit students will be able to:

- Define and compare the Distribution systems, and substations

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Classification of Supply systems. (State only) i) DC 2-wire system ii)1 Phase 2 wire AC Distribution system	T1,T2,R1	Chalk and Talk
2	Classification of Supply systems: 3 Phase 3 wire systems ,3 Phase 4 wire systems, Comparison between overhead and underground systems (for above mentioned systems) on the basis of volume requirement for conductor.	T1,T2,R1	Chalk and Talk
3	Types of secondary distribution systems, Voltage drops in ac distributors (uniform and non-uniform loading)	T1,T2,R1	Chalk and Talk
4	Types of primary distribution systems, , (Numerical), Economics of power transmission- Economic choice of conductor size (kelvins law), (numerical)	T1,T2,R1	Chalk and Talk

5	Economic choice of AC transmission voltage Distribution, Feeders: Design Considerations of Distribution Feeders	T1,T2,R1	Chalk and Talk
6	Radial and Ring types of primary feeders, AC Distribution system :Design voltage levels, energy losses in feeders.	T1,T2,R1	Chalk and Talk

Question Bank Unit No.-I

1. Differentiate between:

i. Feeder and Distributor.

ii. Overhead line and Underground line.

2. Explain the general design consideration of distribution feeder.

3. A single phase distributor has a resistance of 0.2 Ω and reactance of 0.3Ω. At far end the voltage 'Vb' is 240 V. and current is 100 Amp at 0.8 p. f. lagging. At midpoint 'a' the current is 100 Amp at 0.6 p. f. lagging with respect to voltage 'Va' at 'a'. Find supply voltage and phase angle between 'Vs' and 'Vb'.

4. Compare overhead and underground supply system stating their advantages and disadvantages.

5. The cost /KM for each conductor of a section 'a' m2 for transmission line is (2800 + 1300a) the load factor of load current is 80% and the load factor for the loss is 65%. The rate of interest and depreciation is 10% and the cost of energy is 5 paisa/kwh. Find the most economical current density for transmission line by use of Kelvin's law.

6. State and explain Kelvin's law. State limitations of Kelvin's law.

7. A 3 phase 4 wire distributor supplies a balanced voltage of 400/230V to a load consisting of 80A atp.f. 0.8 lagging, 70A at p.f. 0.9 lagging and 50A at unity p.f. for R, Y and B phase respectively. Calculate the voltage drop in neutral conductor and hence calculate voltage at supply end of 'R' phase considering load voltage as reference. The resistance of each phase and neutral is 0.2 ohms.

8. How the D.C. Distribution is classified?

9. Compare 3-phase, 4-wire A. C. underground system with 3-phase 3-wire system on the basis of volume required for the conductor material.

10. How to Approach the Problems on A. C distribution when P.F. is referred to the respective load voltages?

Unit No.-II: Substation and Earthing

Pre-requisites:-

- Basic knowledge of electrical equipment and earthing used in substation .

Objectives: -

- To enable candidate to evaluate substation equipment and earthing system for different area.

Outcomes:

- After successfully completing this unit, students will be able to: Calculate requirement of substation equipment and required earthing system.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Classification and types of substation, Indoor and Outdoor substations, Various equipment's used in substation with their specifications	T1,T3,R1	Chalk and Talk, PPT
2	Bus bar arrangements in the Sub-Stations	T1,T3,R1	Chalk and Talk, PPT
3	Single bus bar, sectionalized single bus bar, main and transfer bus bar system with relevant diagrams.	T1,T3,R1	Chalk and Talk, PPT
4	Substation earthing system i) Types of earthing (Equipment and Neutral)	T1,T3,R1	Chalk and Talk, PPT
5	Maintenance free earthing system. ii) Different electrode configuration (Plate and Pipe Electrode)	T1,T3,R1	Chalk and Talk, PPT
6	Tolerable step and touch voltages, Steps involved in design of substation earthing grid as per IEEE standard 80 – 2000.	T1,T3,R1	Chalk and Talk, PPT

Question Bank Unit No.-II

1. Explain in detail the function of the equipment's used in substation.
2. State and explain the factors which affect the soil resistivity.
3. Draw the single line diagram of 11kV outdoor substation. Explain its earthing system.
4. List the various bus bar systems and with neat sketch explain the single bus bar system with sectionalization.
5. Explain the Following terms with their equivalent circuit
   i. Step Potential.
   ii. Touch Potential.
6. Explain in detail the earthing grid of substation w.r.t. IEEE standard 80-2000.

Unit No.-III: Maintenance and Condition Monitoring.

Pre-requisites:-

- Basic concepts of Maintenance and Importance of Condition Monitoring

Objectives:-

- To understand different maintenance strategies.
- To study the concept of condition monitoring of electrical equipments. Advanced tools and techniques of condition monitoring

Outcomes:

- Demonstrate the knowledge of different maintenance strategies.
- Understand practical aspects of condition monitoring and maintenance of various electrical equipments.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Importance and necessity of maintenance.	T3	Chalk and Talk
2	Different maintenance strategies like Breakdown maintenance, planned maintenance and condition based maintenance	T3,T4	Chalk and Talk
3	Planned and preventive maintenance of transformer, induction motor	T3,T4	Chalk and Talk
4	Planned and preventive maintenance of alternators. Insulation stressing factors and, insulation deterioration.	T3,T4	Chalk and Talk
5	Polarization index, dielectric absorption ratio, Concept of condition monitoring of electrical equipments	T3,T4	Chalk and Talk
6	Advanced tools and techniques of condition monitoring	T3,T4	Chalk and Talk

Question Bank Unit: III

Q.1 State different types of maintenance strategies. Explain Breakdown and preventive maintenance. Q.2.Explain planned and preventive maintenance of transformer.

Q.6. What is breakdown maintenance and condition based maintenance? Give one example of each.

Q.7. State the basic causes of insulation degradation and explain how they affect the quality of insulation.

Q.7 Explain the preventive maintenance activities of induction motor which can be performed without actually dismantling the motor completely.

Q.8 Explain the different strategies of maintenance.

Q.7Define and Explain w. r. t. condition monitoring

i) Polarization Index.

ii) Dielectric Absorption Ratio.

Q.11 Explain preventive maintenance of power transformer in detail.

Q.12 State and explain different factors affecting life of insulation of equipment.

Q.10. Write a short note on insulating stressing factors.

Unit No.-IV: Basics of estimation and costing

Pre-requisites:-

- Price lists

Objectives:-

- To learn about material and it's cost required for any project..

Outcomes:-

- After successfully completing this unit students will be able: Prepare boq for any project

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Introduction cable sizing, Estimation and conductor size calculations of internal wiring for Residential and Commercial	T3,T4	Chalk and Talk
2	(Numerical)	T3,T4	Chalk and Talk
3	(Numerical)	T3,T4	Chalk and Talk
4	installations and estimate for underground LT service lines.	T3,T4	Chalk and Talk

Question Bank Unit IV

1. Discuss in detail various failure modes of transformer.
2. Write a troubleshooting chart of transformer.
3. How transformer oil gets contaminated? With suitable block diagram explain the reconditioning process of transformer oil.
4. Explain the Transformer contamination process. Explain the filtration of t/f oil with block diagram.
5. Explain the process of condition monitoring of transformer bushings.
6. Write short note on degree of polymerization.
7. Explain tan delta measurement for condition monitoring of insulation.
8. Explain in detail condition monitoring of On Load Tap Changer.
9. Explain how dissolved gas analysis is useful for condition monitoring of transformer.
10. How degree of polymerization and partial discharge measurement is used for condition monitoring of transformer?
11. State and explain different faults and their causes occurring in the induction motor.
12. which are the faults occurred in induction motor? What are the causes and remedies?
13. What is signature analysis? How it is used for condition monitoring of induction motor ?
14. Write a detail on thermography and its use in condition monitoring of induction motor.
15. Explain the various abnormal condition and causes of failure of induction motor.
16. What is tan δ? Explain its importance in Condition Monitoring of electrical machines.
17. State the induction motor fault parameters.
18. Write short note on infrared thermography in relation with condition monitoring of induction motor.
19. Explain the various abnormal condition in induction motor.
20. Explain diagnostic methods for induction motor.

Unit No. - V: Installation and estimation of distribution system

Pre-requisites:-

- Basic concepts of HT, LT overhead and Underground Cable.

Objectives:-

- To give overview of aspects of Estimation and Costing of internal wiring for Residential and Commercial Installation

Outcomes:-

After successfully completing this unit students will be able to:

- Understand, Estimation and Costing of internal wiring for Residential and Commercial Installation.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Introduction, HT, LT overhead lines and underground cables	R3, R4, R5	Chalk and Talk
2	cable sizing, price catalogue	R3, R4, R5	Chalk and Talk
3	labour rates, schedule of rates and estimating data (only theory),	R3, R4, R5	Chalk and Talk
4	Estimation and conductor size calculations of internal wiring for Residential and Commercial installations	R3, R4, R5	Chalk and Talk
5	Numerical on Estimation and conductor size calculations of internal wiring for Residential Commercial installations	R3, R4, R5	Chalk and Talk
6	Numerical on Estimation and conductor size calculations of internal wiring for Commercial (Numericals) installations and estimate for underground LT service lines.	R3, R4, R5	Chalk and Talk

Question Bank Unit No.-V

1. Draw the single line diagram of 11kV outdoor substation.
2. How the quantity of material required for internal wiring is determined?
3. What are the essentials of estimating and costing?
4. Differentiate between: Overhead Line & Underground line.
5. Write the general rules for the residential and commercial wiring work.
6. State the general factors that should be considered in estimation of HT or LT lines.
7. Describe how the labor rates and schedule of rates are considered for estimating the data for laying of overhead lines.
8. Explain the procedure of installation of Underground LT service lines.
9. How cable sizing is decided for particular application? Explain how prize catalogue is referred for the same.
10. Explain the estimation of LT underground cable line for substation. Justify your answer by considering cable size, prize, labor rates, rate of escalation.
11. Give the various steps in estimation.
12. Write a short note on:
    i) Schedule of labor rates.
    ii) Points of consideration to determine size of conductor of line.
    iii) Current carrying capacity
    iv) Voltage drop.
13. What do you mean by a service line? What are the types of service line? Drawing a suitable diagram, explain briefly only one.
14. What are the essentials of estimating and costing?

Unit No.-VI: Testing and Electrical Safety

Pre-requisites:-

- Basic knowledge of Electrical Equipment's, Different fault condition.

Objectives:-

- To learn the Electrical Safety (Accident and Precaution) guidelines while handling electricity.

Outcomes:-

- After successfully completing this unit students will be able to: Understand to prevent the accidents and precautions to be taken.

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Causes of Accidents, Prevention of Accidents & precautions to be taken.	T1,T4,R1	Chalk and Talk
2	Dangers arising as a result of faulty equipments and tools, chemicals, water, poor joints and insulation strains and moving machines.	T1,T4,R1	Chalk and Talk
3	Contents of first aid box, treatment for cuts, burns and electrical shock. Procedures for first aid (e.g. removing casualty from contact with live wire and administering artificial respiration).	T1,T4,R1	Chalk and Talk
4	Various statutory regulations (Electricity supply regulations, factory acts and Indian electricity rules of Central Electricity Authority (CEA),	T1,T4,R1	Chalk and Talk
5	Classification of hazardous area.	T1,T4,R1	Chalk and Talk
6	Review of Unit		Chalk and Talk

Question Bank Unit No.-VI

1. Explain the causes of accidents. How they can be prevented?
2. Write down IE Act and Statutory Regulations for Electrical Safety.
3. Write short notes on following:
4. Contents of First Aid Box
5. Treatment for Electrical Shock
6. Danger Arising due to Failure of Insulation.
7. Objectives of Electrical Safety.
8. State any 10 objectives of safety.
9. State the meaning of the following terms:

i. Safety
ii. Hazard
iii. Accident

10. What are the reasons/causes of electrical accidents?
11. How electrical accident can be avoided?
12. What precautions are to be taken to use electrical appliance for house hold purpose?

List of Experiments

Compulsory experiments:

List of Experiments

Part-A: (Any Eight of the following)

1. Measurement of Dielectric Absorption Ratio and Polarization Index of insulation.
2. Study of thermograph images and analysis based on these images.
3. Practice of earthing and Measurement of Earth resistance of Campus premises by using 4 Pole, 3 Pole, new technology practicing in industry clamp on method.
4. Single Line diagram of 132 or 220 or 400 kV substation (based on actual field visit) Symbols, Plate or Pipe earthing. (Drawing sheets 1 using AutoCAD or other CAD software)
5. Assignment on design of earthing grid for 132/220 kV substation.
6. Design and estimation of light and power circuit of labs/industry.
7. Measurement of insulation resistance of motors and cables
8. PRECAUTIONS FROM ELECTRIC SHOCK AND METHOD OF SHOCK TREATMENT.
9. Using of Installation Multifunction Testers for RCD testing, Phase Sequence Indication, Insulation resistance measurement, Continuity testing
10. Use REVIT / any BOQ (Bill of Quantity)estimation software for estimation and costing
11. Design and estimation of light and power circuit of residential wiring.

Part-B:(Any 4 out of these)

1. Estimation and costing for 11 kV feeders and substation.(voltage drop calculation,SLD, substation layout)
2. Study of troubleshooting of electrical equipment based on actual visit to repair workshop (Any One). i) Three phase induction motor ii) Transformer iii) Power Cable
3. Trouble shooting of household equipment – Construction, working and troubleshooting of any two household Electrical equipment's (Fan, Mixer, Electric Iron, Washing Machines, Electric Oven, Microwave - Limited to electrical faults) (Here we perform Practical by using PAT Testers)

4. Design, Estimation and costing of earthing pit and earthing connection for computer lab, Electrical Machines Lab.
5. WIRING INSTALLATION AND MAINTENANCE OF PUMP MOTOR
6. Activity: Interview of Electrical maintenance personnel/Technician/Electrician
7. Activity: Safety awareness for housing societies/schools/Junior colleges
8. Activity: Preparation of Tender notice and studying the Tender notices published in newspapers
9. Any innovative activity related to EIMT syllabus Industrial Visit (if any): Visit to substation/ installation sites.

303145A –Elective I:

Advance Microcontroller and Embedded System

Subject: 303145A –Elective I:

Advance Microcontroller and Embedded System

Unit 01: PIC Architecture and Embedded C (07 hrs)

Comparison of CISC and RISC Architectures, Data and Program memory organization, Program Counters, Stack pointer, Bank Select Register, Status register, Embedded C concepts, Header and source files and pre-processor directives, Data types, data structures, Control loops, functions, bit operations.

Unit 02: Port and Timer 0 Programming (05 hrs)

I/O Ports and related SFRs, I/O port programming in C. PIC 18 Timer 0 Programing in C. Delay programming (with and without Timer0). LED Interfacing and its programming.

Unit 03: CCP Module and its applications (06 hrs)

CCP module in PIC 18 microcontroller, Timers required for CCP Applications, Applications of CCP mode Generation of Square waveform using Compare mode of CCP module. Period measurement of unknown signal using Capture mode in CCP module, Speed control of DC motor using PWM mode of CCP module.

Unit 04: Interrupt structure and its Programming (05 hrs)

Interrupt Programming, Programming of Timer0 interrupts, Programming of External interrupts INT0.

Unit 05: ADC structure and LCD interfacing (08 hrs)

PIC ADC, Programming of ADC using interrupts, Measurement of temperature and Power. Using PIC microcontroller. Interfacing of LCD (16x2) in 4 bit mode

Unit 06: Serial Communication and its protocols (08 hrs.)

Serial Communication structure and its programming (Data transmit and receive), Introduction to Communication protocols as SPI and MODE BUS

Text Books:

[T1] PIC Microcontroller and Embedded Systems Using Assembly and C for PIC18 by Muhammad Ali Mazidi, Rolind D. McKinley, Danny Causey, Pearson Education.

[T2] Fundamentals of Microcontrollers and Applications in Embedded Systems with PIC by Ramesh Gaonkar, Thomson and Delmar learning, First Edition.

[T3] Programming And Customizing the PIC Microcontroller by MykePredko, TATA McGraw Hill.

[T4] PIC microcontroller: An introduction to software and Hardware interfacing by HanWay-Huang Thomson Delmar Learning.

[T5] Microcontroller Theory and Applications with PIC18F, M.Rafiquzzaman, John Wiley and Sons

Reference Web Links/ Research Paper/ Referred Book other than Mention in Syllabus:

[R1] PIC18F458 datasheet

[R2] MPLAB IDE user guides

[R3] MICROCHIP Technical Reference Manual of 18F4520 Embedded Design with PIC 18F452 -- Microcontroller by John B. Peatman, Prentice Hall

www.microchip.com

Embedded Design with PIC 18F452 Microcontroller by John.B.Peatman, Prentice Hal

Unit	Text Books	Reference Books
1	T1,T2,T3,T4	R1
2	T1, T2,T3,T4,T5	R1,R2
3	T1,T4,T5	R1

4	T1,T2,T3,T4	R1
5	T1,T2,T3,T4	R1
6	T1,T2,T3,T4	R1,R3

COURSE OBJECTIVES

From the study of this course students will learn:

1. Help Students understand Architecture of PIC 18F458 microcontroller.

2. Create and enhance ability to write and Interpret Assembly and C language for PIC 18F458.

3. Make students understand procedure to interface peripherals with PIC 18F458 for various Applications.

COURSE OUTCOMES

After successfully completing the course students will be able to:

CO1. Explain architecture of PIC 18F458 microcontroller.

CO2. Use Ports and timers for peripheral interfacing and delay generation.

CO3. Interface and generate events using CCP module

CO4. Effectively use interrupt structure in internal and External interrupt mode

CO5. Effectively use ADC for parameter measurement and also understand LCD interfacing

CO6. Use Serial Communication and various serial communication protocols

Academic Activity Planner

Units	Unit Test1 (10marks)	Unit Test2 (10marks)	Assignment No:1 (10marks)	Assignment No:2 (10marks)	OBT : (10marks)	MCQ (10marks)
1	✓					
2		✓				
3			✓			
4				✓		
5					✓	
6						✓

Teaching plan as per University Syllabus

Sr.No.	Unit	Broad Topics to be Covered	Total Lecture Planned
1	I	PIC Architecture and Embedded C	07
2	II	Port and Timer 0 Programming	05
3	III	CCP Module and its applications	06
4	IV	Interrupt structure and its Programming	05
5	V	ADC structure and LCD interfacing	07
6	VI	Serial Communication and its protocols	06

Unit No.-I: PIC Architecture

Pre-requisites:- Microprocessor and Microcontroller Architecture.

Objectives : PIC 18F458 Microcontroller architecture.

Outcome: PIC 18F458 Microcontroller internal Architecture

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Introduction about PIC microcontroller and comparison of some features with 8051	T1	PPT
2	CISC and RISC architecture, PIC18f458 block diagram	T1,T2,R2	PPT
3	Explanation of pin diagram	T1,T2,R2	PPT
4	RAM & ROM organization, calculation of bank, explanation on access bank and bank select register.	T1,T2,R2	PPT
5	Status register with examples, Program counters, Stack pointer	T1,T2,R2	PPT
6	Embedded C concepts, Header and source files and pre-processor directives,	T1,T2,R2	PPT
7	data structures, Control loops, functions, bit operations.	T1,T2,R2	PPT

Unit : I

1 What is the difference between a microprocessor and a microcontroller?

2 Define the terms: bit, byte, and word.

3 Calculate the number of bits that can be stored in 1 KB memory.

4 If the address range of flash memory in a microcontroller is 00000 H to 1FFFFH, calculate the size of the memory.

5 Calculate the decimal value of the Hex integer 78H if it is an unsigned number.

6 Find the Hex equivalent of the negative decimal number –138H 10H and show its binary representation in an 8-bit processor.

7 Find the ASCII codes for upper-case letters A and Z, and lower-case letters a and z from Appendix

8. Discuss different data types in embedded C

9. Explain about working of status register, bank select register and access bank.

10. Compare CISC and RISC

11 explain data transfer instructions used in PIC microcontroller

12. Define stack memory

13 Define stack pointer and program counter.

14 explain data types used in PIC microcontroller.

15.Define source and header files used in embedded C.

Unit No.-II: Port and Timer 0 Programming

Pre-requisites:-

- Basics of PIC18f458 architecture

Objectives :-

- To study C language programming of ports and timer 0 for PIC 18F458.

Outcomes :

- To use Ports and timers for peripheral interfacing and delay generation

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	I/O Ports and related SFRs,	T1,T2,R2	PPT
2	I/O port programming in C.-I	T1,T2,R2	PPT
3	I/O port programming in C.-II	T1,T2,R2	PPT
4	PIC 18 Timer 0 Programing in C.	T1,T2,R2	PPT
5	LED Interfacing and its programming.	T1,T2,R2	PPT

Unit : II

1. Write C18 program to copy the status of PORTB.0 to PORTD.0 without affecting the others pins of both the ports
2. C18 program to create a square wave of 50% duty cycle on bit 0 on PORT D.
3. Write C18 program to create a square wave of 66% duty cycle on bit 2 of PORT B
4. Write C18 program to complement all bits of PORT B, PORT C & PORT D Continuously
5. Write C18 program to toggle all bits of PORT D continuously
6. Write a c18 program to toggle all bits of PORT C Continuously with some delay. Use Timer 0, 16-bit mode, No per scalar is used.
7. Write C18 program to toggle RB5 Continuously every 50 ms used Timer 0, 16-bit mode, 1:4 Prescaler to create the delay. Crystal Frequency 10 MHz.
8. Write C18 program to create a square wave of Frequency 10 KHz on PORT B.1 use Timer 0 in 8 bit mode to create a delay. Assume Crystal Frequency 10 MHz
9. Write C18 program to generate a square wave 50Hz frequency on PORT B.5. Use Timer 0 in 16-bit mode with maximum prescalar.
10. Write and explain a program to count UP from 00 to FFh and send the count to SFR PORTB put a delay in between each count transfer. Use one CALL instruction for sending the data to Port B and another one for time delay.
11. True or false. The CALL and RCALL instructions take the same amount of time to execute even though one is a 4-byte instruction and the other is a 2-byte instruction.
12. An LED is connected to each pin of Port D. Write a program to turn on each LED from pin DO to pin D7. Call a delay module before turning on the next LED
13. Write the following programs:
14. Create a square wave of 50% duty cycle on bit 0 of Port C.
15. Create a square wave of 66% duty cycle on bit 3 of Port C.
16. Assume that bit RB3 is an input and represents the condition of a door alarm. If it goes LOW, it means that the door is open. Monitor the bit continuously. Whenever it goes LOW, send a HIGH-to-LOW pulse to port RC5 to turn on a buzzer

17. A switch is connected to pin RB2. Write a program to check the status of SW and perform the following:

Unit No.-III: CCP Module and its applications

Pre-requisites:- Basics of PIC18f458 architecture, ports, timer0 programming.

Objectives : To study C language programming of CCP module for PIC 18F458

Outcomes : To interface and generate events of CCP module used inPIC18f458

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	CCP module in PIC 18 microcontroller, Timers required for CCP Applications	T1,T2,R2	PPT
2	Timer 1, 2, 3 working and its use	T1,T2,R2	PPT
3	Capture , compare and PWM mode – detail discussion	T1,T2,R2	PPT
4	Applications of CCP mode Generation of Square waveform using Compare mode of CCP module	T1,T2,R2	PPT
5	Period measurement of unknown signal using Capture mode in CCP module	T1,T2,R2	PPT

6	Speed control of DC motor using PWM mode of CCP module.	T1,T2,R2	PPT

Unit: III

1. Assume a pulse is being fed to the CCP 1 pin. Using Capture mode write C18 program to measure the period of the pulse and puts the results on PORTB and PORTD. Use Timer 3 for Capture mode
2. Write a C18 Program to create a 1.8 KHz PWM frequency with 25% duty cycle on the CCP pin. Assume XTAL = 10 MHz
3. Assume a pulse is being fed to the CCP 1 pin. Using Capture mode write Assembly language program to measure the period of the pulse and puts the results on PORTB and PORTD. Use Timer 1 for Capture mode
4. 4 Write a C18 Program to create a 1 KHz PWM frequency with 50% duty cycle on CCP1 pin assume XTAL= 10MHz, and N= 16
5. Using Compare mode write a C18 and ALP Program to generate a square wave of frequency 10KHz and 50% duty cycle on the CCP1 pin use Timer 1.
6. True or false. We can use any timers we want for the Compare mode.
7. Which register is used to choose the timer for the Compare mode?
8. True or false. In Compare mode, the CCP pin must be configured as an input pin.
9. Give the pin number used for the standard CCP1 in the P1C18F452/458 (or PIC18F4520/4580) chip.
10. True or false. The PIC 18 chip can have multiple CCP modules inside a single chip.
11. True or false. After the timer's register values are transferred to CCPR1H:CCPR1L, the timer's registers are cleared.
12. True or false. The timer's register values are transferred to CCPR1H:CCPR1L every time the CPU is reset.
13. True or false. For CCP1, we must use PR2 to set the PWM period.
14. True or false. For CCP1, we must use CCPR1L to set the PWM duty cycle.

15. Which pin of the PIC 18F45 8/4580 is used for PWM?
16. Find the values of registers PR2, CCP1RL, and DCB1B2:DC1B1 bits for the PWM frequency of 2 kHz with 25% duty cycle. Assume XTAL =10 MHz.

Unit No.-IV: Interrupt structure and its Programming

Pre-requisites:- Basics of PIC18f458 architecture related to interrupts.

Objectives:- To study interrupt structure in internal and External interrupt mode

Outcomes: To use interrupt structure in internal and External interrupt mode Effectively

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Interrupt Vs polling,classification of interrupts, IVT,	T1,T2,R2	PPT
2	steps in executing interrupts, sources of interrupts	T1,T2,R2	PPT
3	Enabling & disabling interrupts, interrupt registers, Priority of interrupts	T1,T2,R2	PPT
4	Programming of Timer0 interrupts,	T1,T2,R2	PPT
5	Programming of External interrupts INT0	T1,T2,R2	PPT

Unit: IV

1. Write PIC18 program and assembly program to generate square wave 2KHz with timer0 on pin PORTB.5 with interrupt. Assume XTAL=10KHz
2. Write PIC18 program and assembly program that displays ‘Y’ at port C and ‘N’ at port D. It also generates a square wave of 5 KHz with timer0 interrupt at port pin RB6. . Assume

XTAL=10KHz

3. Write a PIC18 program and assembly language program to generate a square wave that is half the frequency of the signal applied at INT0 on pin PORTB.5
4. Assume that TimerO is programmed in 8-bit mode, TMROH = FOH, and the TMROIE bit is enabled. Explain how the interrupt for the timer works.
5. Write a program using the TimerO interrupt to create a square wave of 1 Hz on pin RB7 while data from PORTC is being sent to PORTD. Assume XTAL =10 MHz
6. Write a program using the Timerl interrupt to create a square wave of 3 kHz on pin RB7 while data from PORTC is being sent to PORTD. Assume XTAL = 10 MHz.
7. What address in the interrupt vector table is assigned to INTO, INTI and INT2? How about the pin numbers on PORTB?
8. To which register does the INTOIE bit belong? Show how it is enabled.
9. To which register does the INTI IE bit belong? Show how it is enabled.
10. Show how to enable all three external hardware interrupts.
11. Assume that the INTOIE bit for external hardware interrupt INTO is enabled and is negative edge-triggered. Explain how this interrupt works when it is activated.
12. True or false. Upon reset, all the external hardware interrupts are negative edge-triggered.
13. In Question 38, how do we make sure that a single interrupt is not recognized as multiple interrupts?
14. The INTOIF bit belongs to the register.
15. The INTI IF bit belongs to the register.
16. True or false. The last two instructions of the ISR for INTI are:
17. How do we make the hardware interrupt negative edge-triggered?
18. True or false. INT0-INT2 must be configured as an input pin for a hardware interrupt to come in
19. Which register holds the INTEDGx bits?
20. Which register has TMR1IP bit? Show how to assign it low priority.
21. Which register has the INT1IP bit? Show how to assign it low priority.
22. Assume that INTIIP and INT2IP are both Os. Explain what happens if both INTI IF and INT2IF are activated at the same time.

Unit No.-V: ADC structure and LCD interfacing

Pre-requisites:- Basics of PIC18F458 architecture related to ADC

Objectives:-PIC 18F458 Microcontroller architecture.

Outcomes: To use ADC for parameter measurement and also understand LCD interfacing Effectively

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	PIC ADC Programming of ADC using interrupts	T1,T2,R2	PPT
2	Programming of ADC using interrupts … continued	T1,T2,R2	PPT
3	Interrupts in PIC18F458, Interrupt register- I	T1,T2,R2	PPT
4	Interrupts in PIC18F458, Interrupt register -II	T1,T2,R2	PPT
5	Measurement of temperature using PIC microcontroller	T1,T2,R2	PPT
6	Measurement of Power using PIC microcontroller	T1,T2,R2	PPT
7	Interfacing of LCD (16x2) in 4 bit mode.	T1,T2,R2	PPT

Unit: V

1 Explain the functions of a transducer, A/D converter, and D/A converter.

2 Calculate the resolution of a 16-bit A/D converter.

3 Given an analog signal from 0 to +10 V and a 12-bit A/D converter, calculate the values of LSB, MSB, and the full-scale output voltage.

4 If the reference voltages in PIC18 A/D module are VREF- = 0 V and VREF+ = +5 V, calculate the output voltages for the following digital values: 80H, 200 H, and 03FA H.

5 Write initialization instructions to set up PIC18 A/D converter module to read two channels AN0 and AN1 alternatively and meet the following requirements: the minimum sample time = 16µs if F = 20 MHz, 2) VDD and VSS are used as reference voltages, 3) results are right justified, and 4) frequency select ratio is F OSC / 16

6 Write initialization instructions to set up the PIC18452 A/D converter module to read channel AN0 and meet the following requirements: 1) minimum sample time = 16µs if F = 10 MHz, 2) VDD and Vss are used as reference voltages, 3) results are right justified, and 4) frequency select ratio is FOSC/16

7 In the A/D of PIC 18 what happens to the converted analog data? How do we know that the ADC is ready to provide us the data?

8 In the A/D of PIC18 what happens to the old data if we start conversion again before we pick up the last data?

9 Assume Vref- - Gnd. For the A/D of PIC 18, find the step size for each of the following $V_{re}f_{+}$: (a) V_{ref} = 1.024 V (b) V_{ref} = 2.048 V (c) V_{ref} = 2.56 V

10 In the PIC18, what should be the Vref value if we want a step size of 2 mV?

11 Find the value for the ADCONO register if we want Fosc/8, channel 0, and ADON on.

12 Find the value for the ADCON1 register if we want Fosc/64, 3 channels of analog input, and right-justified output.

13 True or false. DAC0808 is the same as DAC1408.

14 Find the number of discrete voltages provided by the «-bit DAC for the following:
(a) w = 8 (b)n= 10 *(c)n*= 12

15. For DAC1408, if $I_{re}f$ = 2 mA, show how to get the I_{0U}| of 1.99 when all inputs are HIGH.

Unit No.-VI: INTERFACING OF PIC MICROCONTROLLER

Pre-requisites:- Basics of PIC 18F458 Microcontroller architecture related to serial communication

Objectives:- To study serial communication and protocols of PIC 18F458 Microcontroller

Outcomes: To use Serial Communication and various serial communication protocols

Lecture No.	Details of the Topic to be covered	References	Mode of Delivery
1	Revision on serial communication, Baud rate calculation, Register used for serial communication	T1,T2,R2	PPT
2	Register used for serial communication -II	T1,T2,R2	PPT
3	PIC18 serial communication structure and its programming- I	T1,T2,R2	PPT
4	PIC18 serial communication structure and its programming- II	T1,T2,R2	PPT
5	Introduction to Communication protocols as SPI	T1,T2,R2	PPT
6	Introduction to Communication protocols as MODE BUS	T1,T2,R2	PPT

Unit: V

1. Explain the difference between serial I/O and parallel I/O.
2. Explain the difference between asynchronous and synchronous data transmission.
3. Calculate the bit time when a fax machine transmits data at 1200 bps.
4. Calculate the byte to be loaded in the SPBRG register to set the baud in the asynchronous mode = 9600 if FOSC = 16 MHz and the BRGH bit is cleared in the TXSTA register.Write a subroutine to initialize the EUSART in asynchronous mode to meet the following specifications:
    1) 9600 baud with FOSC = 32 MHz,
    2) one Start and Stop bits and 9 bits data, and
    3) enable transmit and receive.
5. Identify the signals necessary to implement the SPI protocol.
6. Identify the signals that are required in the I2C mode.
7. Write short note on MODBUS communication protocol.