

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 5th Semester (Electrical and Mechanical Engineering) (wef 2020-21)

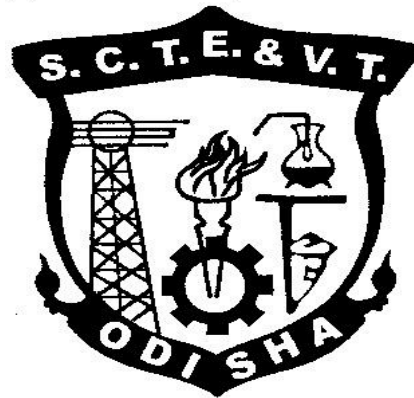
Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	End Sem Exams	Exams (Hours)	Total
Theory									
Th.1		Entrepreneurship and Management & Smart Technology	4	-	-	20	80	3	100
Th.2		Industrial Engineering & Quality Control	4	-	-	20	80	3	100
Th.3		Theory of Machines	4	-	-	20	80	3	100
Th.4		Strength of Material	4	-	-	20	80	3	100
Th.5		Power Electronics & PLC*	4	1		20	80	3	100
		<i>Total</i>	20	1		100	400	-	500
Practical									
Pr.1		Power Electronics & PLC Lab			6	50	50	3	100
Pr.2		Theory of machines and measurements lab			6	50	50	3	100
Pr.3		Project Phase – I			3	50	-		50
		Student Centered Activities(SCA)			3				
		<i>Total</i>			18	150	100		250
		Grand Total	20	1	18	250	500	-	750
Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration									
Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%									
SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.									
There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester									

CURRICULLUM OF 5TH SEMESTER

For

DIPLOMA IN ELECTRICAL AND MECHANICAL ENGINEERING

(Effective from 2020-21 Sessions)



**STATE COUNCIL FOR TECHNICAL
EDUCATION & VOCATIONAL TRAINING,
ODISHA, BHUBANESWAR**

Th1. ENTREPRENEURSHIP and MANAGEMENT & SMART TECHNOLOGY
(Common to all Branches)

Theory	4 Periods per week	Internal Assessment	20 Marks
Total Periods	60 Periods	End Sem Exam	80 Marks
Examination	3hours	Total Marks	100Marks

Topic Wise Distribution of Periods

Sl No.	Topic	Periods
1	Entrepreneurship	10
2	Market Survey and Opportunity Identification(Business Planning)	8
3	Project report Preparation	4
4	Management Principles	5
5	Functional Areas of Management	10
6	Leadership and Motivation	6
7	Work Culture, TQM & Safety	5
8	Legislation	6
9	Smart Technology	6
	TOTAL	60

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students, so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. It may be further added that an entrepreneurial mind set with managerial skill helps the student in the job market. The students can also be introduced with Startup and Smart Technology concept, which shall radically change the working environment in the coming days in the face of Industry 4.0

In this subject, the Students shall be introduced/ exposed to different concepts and Terminologies in brief only, so that he/she can have broad idea about different concepts/items taught in this subject. Solving numerical problem on any topic/item is beyond the scope of this subject.

OBJECTIVES

After undergoing this course, the students will be able to :

- Know about Entrepreneurship, Types of Industries and Startups
- Know about various schemes of assistance by entrepreneurial support agencies

- Conduct market survey
- Prepare project report
- know the management Principles and functional areas of management
- Inculcate leadership qualities to motivate self and others.
- Maintain and be a part of healthy work culture in an organisation.
- Use modern concepts like TQM
- Know the General Safety Rules
- Know about IOT and its Application in SMART Environment.

DETAILED CONTENTS

1. **Entrepreneurship**
 - Concept /Meaning of Entrepreneurship
 - Need of Entrepreneurship
 - Characteristics, Qualities and Types of entrepreneur, Functions
 - Barriers in entrepreneurship
 - Entrepreneurs vrs. Manager
 - Forms of Business Ownership: Sole proprietorship, partnership forms and others
 - Types of Industries, Concept of Start-ups
 - Entrepreneurial support agencies at National, State, District Level(Sources): DIC, NSIC, OSIC, SIDBI, NABARD, Commercial Banks, KVIC etc.
 - Technology Business Incubators (TBI) and Science and Technology Entrepreneur Parks
2. **Market Survey and Opportunity Identification (Business Planning)**
 - Business Planning
 - SSI, Ancillary Units, Tiny Units, Service sector Units
 - Time schedule Plan, Agencies to be contacted for Project Implementation
 - Assessment of Demand and supply and Potential areas of Growth
 - Identifying Business Opportunity
 - Final Product selection
3. **Project report Preparation**
 - Preliminary project report
 - Detailed project report, Techno economic Feasibility
 - Project Viability
4. **Management Principles**
 - Definitions of management
 - Principles of management
 - Functions of management (planning, organising, staffing, directing and controlling etc.)
 - Level of Management in an Organisation
5. **Functional Areas of Management**
 - a) Production management
 - Functions, Activities

- Productivity
 - Quality control
 - Production Planning and control
 - b) Inventory Management
 - Need for Inventory management
 - Models/Techniques of Inventory management
 - c) Financial Management
 - Functions of Financial management
 - Management of Working capital
 - Costing (only concept)
 - Break even Analysis
 - Brief idea about Accounting Terminologies: Book Keeping, Journal entry, Petty Cash book, P&L Accounts, Balance Sheets(only Concepts)
 - d) Marketing Management
 - Concept of Marketing and Marketing Management
 - Marketing Techniques (only concepts)
 - Concept of 4P s (Price, Place, Product, Promotion)
 - e) Human Resource Management
 - Functions of Personnel Management
 - Manpower Planning, Recruitment, Sources of manpower, Selection process, Method of Testing, Methods of Training & Development, Payment of Wages
6. **Leadership and Motivation**
- a) Leadership
 - Definition and Need/Importance
 - Qualities and functions of a leader
 - Manager Vs Leader
 - Style of Leadership (Autocratic, Democratic, Participative)
 - b) Motivation
 - Definition and characteristics
 - Importance of motivation
 - Factors affecting motivation
 - Theories of motivation (Maslow)
 - Methods of Improving Motivation
 - Importance of Communication in Business
 - Types and Barriers of Communication
7. **Work Culture, TQM & Safety**
- Human relationship and Performance in Organization
 - Relations with Peers, Superiors and Subordinates
 - TQM concepts: Quality Policy, Quality Management, Quality system
 - Accidents and Safety, Cause, preventive measures, General Safety Rules , Personal Protection Equipment(PPE)
8. **Legislation**

- a) Intellectual Property Rights(IPR), Patents, Trademarks, Copyrights
- b) Features of Factories Act 1948 with Amendment (only salient points)
- c) Features of Payment of Wages Act 1936 (only salient points)

9. **Smart Technology**

- Concept of IOT, How IOT works
- Components of IOT, Characteristics of IOT, Categories of IOT
- Applications of IOT- Smart Cities, Smart Transportation, Smart Home, Smart Healthcare, Smart Industry, Smart Agriculture, Smart Energy Management etc.

Syllabus to be covered before IA: Chapter 1,2,3,4

RECOMMENDED BOOKS

1. Entrepreneurship Development and Management by R.K Singhal, Katson Books., New Delhi
2. Entrepreneurship Development and Management by U Saroj and V Mahendiratta, Abhishek Publications, Chandigarh
3. Entrepreneurship Development and Management by Vasant Desai, Himalaya Pub.House
4. Industrial Engineering and Management by O.P Khanna ,Dhanpat Rai and Sons
5. Industrial Engineering and Management by Banga and Sharma, Khanna Publications
6. Internet of Things by Jeeva Jose, Khanna Publications, New Delhi
7. Online Resource on Startups and other concepts
8. <https://www.fundable.com/learn/resources/guides/startup>

TH.2 INDUSTRIAL ENGINEERING & QUALITY CONTROL

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Th.2	Semester	5 th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Internal Assessment:	20
Tutorial:	--	End Semester Examination:	80
Maximum marks:	100		

A. RATIONALE:

Main objective of Mechanical Engineering is to produce goods and services for benefit to mankind. Such productions are done utilizing various resources like Men, Materials, machines and Money. Industrial engineering and quality control is the subject which allows optimized use of such resources and hence very important for a mechanical engineering.

B. OBJECTIVE:

1. Identification of place for a new plant set up and systematic arrangement of machinery and shop for smooth production.
2. Understanding of stock management and maintenance to reduce plant ideal time.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Plant location and Layout	08
2	Operations Research	12
3	Inventory Control	10
4	Plant maintenance	10
5	Inspection and Quality Control	12
6	Contemporary Quality Management concepts	08
	Total:	60

D. COURSE CONTENTS

1.	<p>Plant location and Layout</p> <p>1.1 Describe the features governing plant location.</p> <p>1.2 Define plant layout.</p> <p>1.3 Describe the objective and principles of plant layout.</p> <p>1.4 Explain Process Layout, Product Layout and Combination Layout.</p>
2.	<p>Operations Research</p> <p>2.1. Introduction to Operations Research and its applications</p> <p>2.2. Define Linear Programming Problem, Solution of L.P.P. by graphical method</p> <p>2.3. Evaluation of Project completion time by Critical Path Method and PERT (Simple problems)-</p> <p>2.4. Explain distinct features of PERT with respect to CPM</p>

3.	<p>Inventory Control:</p> <p>3.1. Classification of inventory. 3.2. Objective of inventory control. 3.3. Describe the functions of inventories. 3.4. Explain and Derive economic order quantity for Basic model. (Solve numerical) 3.5. Define and Explain ABC analysis</p>
4.	<p>Plant maintenance:</p> <p>4.1. Describe the objectives of plant maintenance. 4.2. Describe the duties, functions and responsibilities of plant maintenance department. 4.3. Describe the types of maintenance: Preventive, Breakdown, Scheduled and Predictive maintenance.</p>
5.	<p>Inspection and Quality Control:</p> <p>5.1 Define Inspection and Quality control. 5.2 Describe planning of inspection. 5.3 Describe types of inspection. 5.4 Study of factors influencing the quality of manufacture. 5.5 Explain the Concept of statistical quality control, Control charts (X, R, P and C - charts). Solve related problems.</p>
7.	<p>Contemporary Quality Management concepts</p> <p>6.1 Concept of total quality management (TQM) 6.2 ISO-9000/14000, concept & its evolution & implications. JIT, Six Sigma, 7S, Lean manufacturing</p>

Syllabus coverage up to Internal assessment

Chapters: 1, 2 and 3.

Learning Resources:

SI.No.	Title of the Book	Name of Authors	Name of Publisher
1	Industrial Engineering & Management	O.P.Khanna	Dhanpat Rai & Sons
2	Industrial Engg & Production Management	Telsang	S. Chand
3	Statistical Quality Control	M.Mahajan	Dhanpat Rai & Sons

TH.3 THEORY OF MACHINE

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Th.3	Semester	5 th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Internal Assessment:	20
Tutorial:	--	End Semester Examination:	80
Maximum marks:	100		

A. OBJECTIVE:

Students will develop an ability towards

- Understanding machine as a system consisting of different link assemblies as components
- Comprehending Working principle of machine components such as clutch, brakes, bearings based on friction
- Comprehending working principles related to power transmission systems and predicting the work involved and efficiency
- Comprehending working principles in speed and torque regulating devices such as governor and flywheels
- Determination of amount and position of masses required towards static and dynamic balancing
- Comprehending types and causes of vibration in machines and predicting remedial measures

B. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	<i>Simple mechanism</i>	08
2	Friction	12
3	Power Transmission	12
4	Governors and Flywheel	12
5	Balancing of Machine	08
6	Vibration of machine parts	08
Total:		60

C. COURSE CONTENTS

1.	<p><i>Simple mechanism</i></p> <p>1.1 Link, kinematic chain, mechanism, machine</p> <p>1.2 Inversion, four bar link mechanism and its inversion</p> <p>1.3 Lower pair and higher pair</p> <p>1.4 Cam and followers</p>
2.	<p>Friction</p> <p>2.1 Revision of topic previously taught</p> <p>2.2 Friction between nut and screw for square thread, screw jack</p> <p>2.3 Bearing and its classification, Description of roller, needle roller & ball bearings.</p>

	<p>2.4 Torque transmission in flat pivot & conical pivot bearings.</p> <p>2.5 Flat collar bearing of single and multiple types.</p> <p>2.6 Torque transmission for single and multiple clutches</p> <p>2.7 Working of simple frictional brakes.</p> <p>2.8 Working of Absorption type of dynamometer</p>
3.	<p>Power Transmission</p> <p>3.1 Concept of power transmission</p> <p>3.2 Type of drives, belt, gear and chain drive.</p> <p>3.3 Computation of velocity ratio, length of belts (open&cross) with and without slip.</p> <p>3.4 Ratio of belt tensions, centrifugal tension and initial tension.</p> <p>3.5 Power transmitted by the belt.</p> <p>3.6 V-belts and V-belts pulleys.</p> <p>3.7 Concept of crowning of pulleys.</p> <p>3.8 Gear drives and its terminology.</p> <p>3.9 Gear trains, Working principle of simple, compound, reverted and epicyclic gear trains.</p>
4.	<p>Governors and Flywheel</p> <p>4.0 Function of governor</p> <p>4.1 Classification of governor</p> <p>4.2 Working of Watt, Porter, Proel and Hartnel I governors.</p> <p>4.3 Conceptual explanation of sensitivity, stability and isochronism .</p> <p>4.4 Function of flywheel.</p> <p>4.5 Comparison between flywheel & governor.</p> <p>4.6 Fluctuation of energy and coefficient of fluctuation of speed.</p>
5.	<p>Balancing of Machine</p> <p>5.0 Concept of static and dynamic balancing.</p> <p>5.1 Static balancing of rotating parts.</p> <p>5.2 Principles of balancing of reciprocating parts.</p> <p>5.3 Causes and effect of unbalance.</p> <p>5.4 Difference between static and dynamic balancing</p>
6.	<p>Vibration of machine parts</p> <p>6.1 Introduction to Vibration and related terms (Amplitude, time period and frequency, cycle)</p> <p>6.2 Classification of vibration.</p> <p>6.3 Basic concept of natural, forced & damped vibration</p> <p>6.4 Torsional and Longitudinal vibration.</p> <p>6.6 Causes & remedies of vibration.</p>

Syllabus coverage up to Internal assessment

Chapters: 1, 2, and 3.

Learning Resources:

Sl.No.	Title of the Book	Name of Authors	Name of Publisher
1	Theory of Machines	R S Khurmi	
2	Theory of Machines	R K Rajput	
3	Theory of Machines	S R Rattan	
4	Theory of Machines	P L Ballaney	

TH.4 STRENGTH OF MATERIAL

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Th.4	Semester	5 th
Total Period:	60	Examination	3 hrs
Theory periods:	4P / week	Internal Assessment:	20
Maximum marks:	100	End Semester Examination:	80

A. OBJECTIVE:

Students will develop ability towards

1. Determination of stress, strain under uniaxial loading (due to static or impact load and temperature) in simple and single core composite bars.
2. Determination of stress, strain and change in geometrical parameters of cylindrical and spherical shells due to pressure
3. Realization of shear stress besides normal stress and computation of resultant stress in two dimensional objects.
4. Drawing bending moment and shear force diagram and locating points in a beam where the effect is maximum or minimum.
5. Determination of bending stress and torsion stress in simple cases
6. Determination of critical load in slender columns thus realizing combined effect of axial and bending load.

B. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Simple stress & strain	12
2	Thin cylinder and spherical shell under internal pressure	07
3	Two dimensional stress systems	10
4	Bending moment & shear force	10
5	Theory of simple bending	10
6	Combined direct & Bending stresses	07
7	Torsion	04
Total:		60

C. COURSE CONTENTS

1.	<p>Simple stress & strain</p> <p style="padding-left: 40px;">1.1 Types of load, stresses & strains, (Axial and tangential) Hookes law, Young's modulus, bulk modulus, modulus of rigidity, Poisson's ratio, derive the relation between three elastic constants,</p> <p style="padding-left: 40px;">1.2 Principle of super position, stresses in composite section</p>
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	<p>1.3 Temperature stress, determine the temperature stress in composite bar (single core)</p> <p>1.4 Strain energy and resilience, Stress due to gradually applied, suddenly applied and impact load</p> <p>1.5 Simple problems on above.</p>
2.	<p>Thin cylinder and spherical shell under internal pressure</p> <p>2.1 Definition of hoop and longitudinal stress, strain</p> <p>2.2 Derivation of hoop stress, longitudinal stress, hoop strain, longitudinal strain and volumetric strain</p> <p>2.3 Computation of the change in length, diameter and volume</p> <p>2.4 Simple problems on above</p>
3.	<p>Two dimensional stress systems</p> <p>3.1 Determination of normal stress, shear stress and resultant stress on oblique plane</p> <p>3.2 Location of principal plane and computation of principal stress</p> <p>3.3 Location of principal plane and computation of principal stress and maximum shear stress using Mohr's circle</p>
4.	<p>Bending moment & shear force</p> <p>4.1 Types of beam and load</p> <p>4.2 Concepts of Shear force and bending moment</p> <p>4.3 Shear Force and Bending moment diagram and its salient features illustration in cantilever beam, simply supported beam and over hanging beam under point load and uniformly distributed load</p>
5.	<p>Theory of simple bending</p> <p>5.1 Assumptions in the theory of bending,</p> <p>5.2 Bending equation, Moment of resistance, Section modulus & neutral axis.</p> <p>5.3 solve simple problems</p>
6.	<p>Combined direct & Bending stresses</p> <p>6.1 Define column</p> <p>6.2 Axial load, Eccentric load on column,</p> <p>6.3 Direct stresses, Bending stresses, Maximum & Minimum stresses. Numerical problems on above.</p> <p>6.4 Buckling load computation using Euler's formula (no derivation) in columns with various end conditions</p>
7.	<p>Torsion</p> <p>7.1 Assumption of pure torsion</p> <p>7.2 The torsion equation for solid and hollow circular shaft</p>

	7.3	Comparison between solid and hollow shaft subjected to pure torsion
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Syllabus coverage up to Internal assessment

Chapters: 1, 2, 3 and 4.

Learning Resources:

SI.No.	Title of the Book	Name of Authors	Name of Publisher
1	Strength of Materials	S Ramamrutham	
2	Strength of Materials	R K Rajput	
3	Strength of Materials	R Subramanian	
4	Strength of Materials	G H Rhyder	
5	Mechanics of Materials	R C Hibbler	

TH.5 POWER ELECTRONICS AND PLC

(Common to Electrical and ETC)

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Th.5	Semester:	5 th
Total Period:	60 Periods	Examination:	3 Hrs
Theory periods:	4 P / Week	Internal Assessment:	20
Tutorial:	1 P / Week	End Semester Examination:	80
Maximum marks:	100		

A. Rationale:

The development of high power semiconductor devices has facilitated electronic control techniques for electrical power control in a simple, economic and efficient manner. Thus a new area of power electronics has now emerged which replaced the old and bulky method of power control through the use of small electronic devices. Power electronics application has occupied an indispensable position in industrial applications like heating, welding, uninterrupted power supply, battery charging etc. Industrial drives, lighting control are most efficiently controlled by power electronics devices to achieve optimum performance. The objective of this paper is to familiar students with the principles and operations of Power electronics devices in Industrial applications with drives control.

B. Objectives:

After completion of this subject the student will be able to:

1. Understand construction, working principle & application of various power electronics devices.
2. Know different gate triggering circuits and commutation methods.
3. Understand working principle of phase controlled rectifier.
4. Know the types and working principle of inverter.
5. Understand working principle and voltage control of chopper.
6. Understand frequency variation using Cyclo-converter.
7. Understand control principle of AC & DC industrial drive.
8. Know different application of SCR / Thyristor.
9. Concept in PLC & its Programming

C. TOPIC WISE DISTRIBUTION OF PERIODS

Sl. No.	Topics	Periods
1.	Understand The Construction And Working Of Power Electronic Devices	18
2.	Understand The Working Of Converters, Ac Regulators And Choppers.	12
3.	Understand The Inverters And Cyclo-Converters	08
4.	Understand Applications Of Power Electronic Circuits	10
5.	PLC And Its Applications	12
	Total	60

D. COURSE CONTENT:

1. UNDERSTAND THE CONSTRUCTION AND WORKING OF POWER ELECTRONIC DEVICES

- 1.1 Construction, Operation, V-I characteristics & application of power diode, SCR, DIAC, TRIAC, Power MOSFET, GTO & IGBT
- 1.2 Two transistor analogy of SCR.
- 1.3 Gate characteristics of SCR.
- 1.4 Switching characteristic of SCR during turn on and turn off.
- 1.5 Turn on methods of SCR.
- 1.6 Turn off methods of SCR (Line commutation and Forced commutation)
 - 1.6.1 Load Commutation
 - 1.6.2 Resonant pulse commutation
- 1.7 Voltage and Current ratings of SCR.
- 1.8 Protection of SCR
 - 1.8.1 Over voltage protection
 - 1.8.2 Over current protection
 - 1.8.3 Gate protection
- 1.9 Firing Circuits
 - 1.9.1 General layout diagram of firing circuit
 - 1.9.2 R firing circuits
 - 1.9.3 R-C firing circuit
 - 1.9.4 UJT pulse trigger circuit
 - 1.9.5 Synchronous triggering (Ramp Triggering)
- 1.10 Design of Snubber Circuits

2. UNDERSTAND THE WORKING OF CONVERTERS, AC REGULATORS AND CHOPPERS.

- 2.1 Controlled rectifiers Techniques (Phase Angle, Extinction Angle control), Single quadrant semi converter, two quadrant full converter and dual Converter
- 2.2 Working of single-phase half wave controlled converter with Resistive and R-L loads.
- 2.3 Understand need of freewheeling diode.
- 2.4 Working of single phase fully controlled converter with resistive and R- L loads.
- 2.5 Working of three-phase half wave controlled converter with Resistive load
- 2.6 Working of three phase fully controlled converter with resistive load.
- 2.7 Working of single phase AC regulator.
- 2.8 Working principle of step up & step down chopper.
- 2.9 Control modes of chopper
- 2.10 Operation of chopper in all four quadrants.

3. UNDERSTAND THE INVERTERS AND CYCLO-CONVERTERS

- 3.1 Classify inverters.
- 3.2 Explain the working of series inverter.
- 3.3 Explain the working of parallel inverter
- 3.4 Explain the working of single-phase bridge inverter.

- 3.5 Explain the basic principle of Cyclo-converter.
- 3.6 Explain the working of single-phase step up & step down Cyclo-converter.
- 3.7 Applications of Cyclo-converter.

4. UNDERSTAND APPLICATIONS OF POWER ELECTRONIC CIRCUITS

- 4.1 List applications of power electronic circuits.
- 4.2 List the factors affecting the speed of DC Motors.
- 4.3 Speed control for DC Shunt motor using converter.
- 4.4 Speed control for DC Shunt motor using chopper.
- 4.5 List the factors affecting speed of the AC Motors.
- 4.6 Speed control of Induction Motor by using AC voltage regulator.
- 4.7 Speed control of induction motor by using converters and inverters (V/F control).
- 4.8 Working of UPS with block diagram.
- 4.9 Battery charger circuit using SCR with the help of a diagram.
- 4.10 Basic Switched mode power supply (SMPS) - explain its working & applications

5. PLC AND ITS APPLICATIONS

- 5.1 Introduction of Programmable Logic Controller(PLC)
- 5.2 Advantages of PLC
- 5.3 Different parts of PLC by drawing the Block diagram and purpose of each part of PLC.
- 5.4 Applications of PLC
- 5.5 Ladder diagram
- 5.6 Description of contacts and coils in the following states
i) Normally open ii) Normally closed iii) Energized output iv) latched Output v) branching
- 5.7 Ladder diagrams for i) AND gate ii) OR gate and iii) NOT gate.
- 5.8 Ladder diagrams for combination circuits using NAND, NOR, AND, OR and NOT
- 5.9 Timers- i) T ON ii) T OFF and iii) Retentive timer
- 5.10 Counters-CTU, CTD
- 5.11 Ladder diagrams using Timers and counters
- 5.12 PLC Instruction set
- 5.13 Ladder diagrams for following
(i) DOL starter and STAR-DELTA starter (ii) Stair case lighting (iii) Traffic light Control (iv) Temperature Controller
- 5.14 Special control systems- Basics DCS & SCADA systems
- 5.15 Computer Control–Data Acquisition, Direct Digital Control System (Basics only)

Syllabus coverage up to Internal assessment

Chapters: 1 and 2.

Learning Resources:			
Sl.No	Title of the Book	Name of Authors	Name of the Publisher
1.	Power Electronics	Dr. P. S. Bhimbhra	Khanna Publisher
2.	Modern Power Electronics	B.K.Bose	PHI Publisher

	<i>and AC Drives</i>		
3.	<i>Power Electronics</i>	<i>M. D. Singh and K.B Khanchandani</i>	<i>TMH</i>
4.	<i>Power Electronics</i>	<i>M H Rashid</i>	<i>PHI Publisher</i>
5.	<i>Power Electronics</i>	<i>P C Sen</i>	<i>TMH</i>
6.	<i>Power Electronics</i>	<i>N Mohan</i>	<i>Willey (India)</i>
7.	<i>Programmable logic Controllers</i>	<i>Frank D. Petruzela</i>	<i>TMH</i>
8.	<i>Programme logic controller</i>	<i>Dr.M.Mitra&Dr.S.Sengupta</i>	<i>Penram</i>

Pr.1 POWER ELECTRONICS & PLC LAB

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Pr.1	Semester	5 th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P / week	Term Work	50
Maximum marks:	100	End Semester Examination:	50

A. RATIONALE: The sole objective of the subject is to be familiar with solid state devices used in power system. To perform experiments for determining the characteristics of components and become fit to meet the challenges in practical implementation.

B. OBJECTIVE:

After completion of this laboratory the student will be able to:

1. Determine characteristic of semiconductor devices.
2. Develop ability to design drive circuit for above.
3. Design low voltage power circuit to be used in electronics circuit.

C. LIST OF EXPERIMENTS

(I) Power Electronics

1. Study of switching characteristics of a power transistor.
2. Study of V-I characteristics of SCR.
3. Study of V-I characteristics of TRIAC.
4. Study of V-I characteristics of DIAC.
5. Study of drive circuit for SCR & TRIAC using DIAC.
6. Study of drive circuit for SCR & TRIAC using UJT.
7. To study phase controlled bridge rectifier using resistive load.
8. To study series Inverter.
9. Study of voltage source Inverter.
10. To perform the speed control of DC motor using Chopper.
11. To study single-phase Cyclo-converter

(II) PLC Programming

1. Introduction/Familiarization PLC Trainer & its Installation with PC
 - (a) Learn the basics and hardware components of PLC
 - (b) Understand configuration of PLC system
 - (c) Study various building blocks of PLC
 - (d) Determine the No. of digital I/O & Analog I/O
2. Execute the different Ladder Diagrams
 - (a) Demonstrate PLC and Ladder diagram-Preparation downloading and running
 - (b) Execute Ladder diagrams for different Logical Gates
 - (c) Execute Ladder diagrams using timers & counters
3. Execute the Ladder Diagrams with model applications
 - (i) DOL starter (ii)Star- Delta starter
4. Execute Ladder diagrams with model applications (i) Stair case lighting (ii) Traffic light controller

Pr.2 THEORY OF MACHINES AND MEASUREMENTS LAB

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Pr.2	Semester	5 th
Total Period:	90	Examination	3 hrs
Lab. periods:	6 P / week	Term Work	50
Maximum marks:	100	End Semester Examination:	50

- 1 Determination of centrifugal force of a governor (Hartnell / Watt/Porter).
- 2 Study & demonstration of static balancing apparatus.
- 3 Study & demonstration of journal bearing apparatus.
- 4 Study of different types of Cam and followers.
- 5 Study & demonstration of epicyclic gear train.
- 6 Determination of the thickness of ground M.S flat to an accuracy of 0.02mm using Vernier Caliper.
- 7 Determination of diameter of a cylindrical component to an accuracy of 0.01mm using micrometer.
8. Determine the heights of gauge blocks or parallel bars to accuracy of 0.02mm using Vernier height gauge.
9. Determine the thickness of ground MS plates using slip gauges.
10. Determination of angel of Machined surfaces of components using sin bar with slip gauges.

Pr.3 PROJECT Phase- I

Name of the Course: Diploma in Electrical and Mechanical Engineering			
Course code:	Pr.3	Semester	5 th
Total Period:	45	Examination	-
Lab. periods:	3 P / week	Sessional	50
Maximum marks:	50		

A. RATIONALE

Students' Project Work aims at developing innovative skills in the students whereby they apply the knowledge and skills gained through the course covered in many subjects and Labs, by undertaking a project. The individual students have different aptitudes and strengths. Project work, therefore, should match the individual strengths of students. The prime emphasis of the project work is to understand and apply the basic knowledge of the principles of software engineering/ Hardware design and practices in real life situations, so as to participate and manage a large software engineering projects and /or appropriate Hardware with embedded software in future.

Entire Project shall spread over 5th and 6th Semester. Part of the Project covered in 5th Semester shall be named as Project Phase-I and balance portion to be covered in 6th Semester shall be named as Project Phase-II.

B. OBJECTIVES

After undergoing the Project Work, the student will be able to:

- Implement the theoretical and practical knowledge and skills gained through various subjects/courses into an application suitable for a real practical working environment, preferably in an industrial environment.
- Develop software packages or applications and implement these for the actual needs of the community/industry.
- Identify and contrast gap between the technological knowledge acquired through curriculum and the actual industrial need and to compensate it by acquiring additional knowledge as required.
- Carry out cooperative learning through synchronous guided discussions within the class in key areas, asynchronous document sharing and discussions, as well as prepare collaborative edition of the final project report.
- Field computing and to achieve real life experience in software/hardware design.

C. GENERAL GUIDELINES

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (right from beginning of 5th semester). Students should be allotted a problem of interest to him/her as a project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. Preferably there should not be more

than 5 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

A suggestive criterion for assessing student performance by the external (preferably person from industry) and internal (teacher) examiner is given in table below:

SI. No.	Performance Criteria
1.	Selection of project assignment
2.	Planning and execution of considerations
3.	Quality of performance
4.	Providing solution of the problems or production of final product
5.	Sense of responsibility
6.	Self-expression/ communication/ Presentation skills
7.	Interpersonal skills/human relations
8.	Report writing skills
9.	Viva voce

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organizations to such an exhibition.

D. PROJECT PHASE-I AND PHASE-II

The Project work duration shall cover two semesters (5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group shall be done in the beginning of 5th sem under Project Phase-I. The students may be allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system have to be complete in Phase-I. Execution of work/modelling/simulation/experiment/feasibility can also begin in this phase. Project Milestones are to be set so that progress can be tracked. In Phase-II Detailed work, Testing, Documentation have to be complete. Project Report have to be complete in Phase-II. All Project reports should be organized uniformly in proper order, irrespective of group. Teacher Guides can make suitable alteration in the schedule. There shall be one presentation at the end of Phase-I to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.

EQUIPMENT LIST

1. Power Electronics trainer kit to perform (a) switching characteristics of a power transistor (b) V-I characteristics of SCR, TRIAC, DIAC (c) Drive circuit for SCR & TRIAC using DIAC & UJT (d) phase controlled bridge rectifier using resistive load (e) series Inverter (f) voltage source Inverter (g) speed control of DC motor using Chopper (h) single-phase Cyclo-converter
2. PLC trainer kit
3. Other Lab Equipment are as corresponding Lab of Mechanical engineering