STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 5th Semester *MECHATRONICS* (wef 2021-22)

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		Micro Processor & Micro Controller	4		-	20	80	3	100
Th.3		Industrial ETC	4		-	20	80	3	100
Th.4		Vetronics	4		-	20	80	3	100
Th.5		Pneumatics And Hydraulics	4		-	20	80	3	100
		Total	20			100	400	-	500
		Practical							
Pr.1		Measuring System & Micro Processor Lab	-	-	4	25	50	3	75
Pr.2		Pneumatics, Hydraulics & Automation Lab	-	-	4	25	50	3	75
Pr.3		Industrial ETC Lab	-	-	4	25	25	3	50
Pr.4		Project Phase-I	-	-	4	50	-	-	50
		Student Centred Activities(SCA)			3				
		Total	-	-	19	125	125	-	250
		Grand Total	20		19	225	525	-	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.
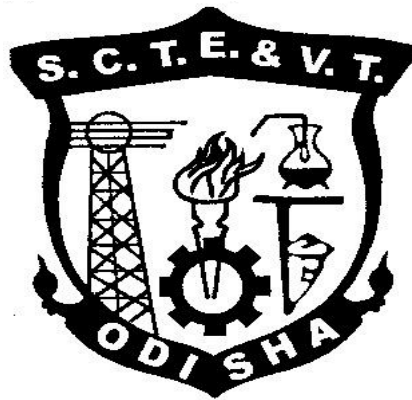
There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional: Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester

CURRICULLUM OF 5ᵀᴴSEMESTER

For

DIPLOMA IN MRCHATRONICS ENGINEERING

(Effective FROM 2021-22Sessions)

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

SI 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 MICROPROCESSOR & MICRO CONTROLLER

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:		Semester	5TH
Total Period:	60	Examination	3hrs
Theory periods:	4P/W	Internal Assessment:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONALE:
Microprocessors and microcontrollers are widely used for industrial automation. Microcontroller has already replaced by the robust controllers.

B. GENERAL OBJECTIVE:
At the end of the COURSE the student would be able to :
1. Describe architecture of 8085 Microprocessor.
2. Program the 8085 Microprocessor.
3. Interface 8085 with Memory & I/O Devices.
4. Use the Programmable Peripheral Devices.
5. Describe Advanced Microprocessor.
6. Understand the Applications of Microprocessor.
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C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction to Microprocessor	03
2	Study of Memory	03
3	8085 Microprocessor Architecture	10
4	Interrupts of 8085	04
5	Programming 8085	09
6	Interfacing of Memory & I/O Devices	09
7	Intel 8086 Microprocessor	05
8	Assembly Language Programming of 8086.	07
9	Introduction to Advanced Microprocessor	01
10	Microprocessor Applications	05
11	Introduction to Micro controller	04
	Total:	**60**

D. SUBJECT CONTENT:

1.0   INTRODUCTION TO MICROPROCESSOR
1.1   Introduction to Microprocessors & Microcomputers Evolution of Microprocessors.
1.2   Comparison of Microprocessors of Intel, Motorola and Zilog.

2.0   STUDY OF MEMORY
2.1   Basic Memory storage element 4x8 – Bit Register, R/W Memory Model, ROM Memory model.
2.2   Memory Map and Addresses Memory Classification, Memory Decoding.

3.0   8085 MICROPROCESSOR ARCHITECTURE
3.1   Pin Configuration.
3.2   Functional block diagram – registers, accumulator, flags, ALU, timing & control unit,
       instruction register / decoder, address / data buffer.
3.3   Timing diagram, instruction cycle, machine cycle memory read / white, opcode letch
       examples.

4.0   INTERRUPTS OF 8085
4.1   Vectored & Non-Vectored, Hardware & Software, Maskable& Non-Maskable
       Interrupts.
4.2   Interrupt Priority, Interrupt Restart Address, Interrupt Service, Subroutines.

5.0   PROGRAMMING 8085
5.1   8085 Addressing Modes
5.2   8085 Instruction Set
5.3   Assembly Language, Flow Chart & Simple Programs with 8085.
5.4   Stack & Sub-Routines.
5.5   Counters & time delays.

6.0   INTERFACING OF MEMORY & I/O DEVICES
6.1   Basic Concepts & Interfacing I/O devices.
6.2   Programmable Peripheral Interface – 8255.
6.3   Programmable Display / Keyboard Controller – 8279.
6.4   Programmable Interrupt Controller – 8254.
6.5   Programmable Interval Timer – 8253 / 8254.
6.6   Programmable Serial Interface – 8251.

7.0   INTEL 8086 MICROPROCESSOR
7.1   Architecture with Functional Block Diagram.
7.2   Pin Configuration & Memory Organization.
7.3   Interrupts of 8086.

8.0   ASSEMBLY LANGAUGE PROGRAMMING OF 8086
8.1   Addressing Modes of 8086.
8.2   Instruction Set of 8086.
8.3   Simple Programming (Five).
8.4   Stack & Subroutine.

9.0   INTRODUCTION TO ADVANCED MICROPROCESSOR
9.1   Introduction to 32/64 Bit Microprocessor.
9.2   Comparison of Microprocessors (8 bit, 16 bit & Advanced).

10.0   MICROPROCESSOR APPLICATIONS
10.1   Data Acquisition System.
10.2   Temperature Control System.
10.3   DC Motor Control
10.4   Traffic Light Control
10.5   Stepper Motor Control

11.0   Introduction to Micro controller
11.1   EvolutionMCS-51 Family Overview, Import features, Architecture

11.2   8051 pin functions, Architecture, Addressing modes, Instruction set,
11.3   Instruction Assembly Programming
11.4   Timer registers, Serial communication using 8051

Syllabus to be covered up to I.A.

Chapter: 1, 2, 3 ,4 and 5

Sl.No	Title of the Book	Name of Authors	Name of Publisher
Learning Resources:			
1	Microprocessor Architecture, Programming and Applications with 8085.	Ramesh S. Gaonkar	Upper saddle river, New jersey: prentice Hall
2	Fundamentals of Micro Processor and Micro Computers.	Badri Ram	Dhanpat Rai &Sons
3	The Intel Micro Processors 8086/88, 80186/188, 80286, 80386, 80486, Pentium and Pentium Processors.	Barry B. Brey	
4	The 8086 Micro Processors Programming & Interfacing the PC.	Kenneth J. Ayala	
5	The 8085/8086 Micro Processors	Leu & Gibson	
6	The 8085 Microprocessors Programming & Interfacing.	A.P. Godse	Technical Publication
7	Microprocessor & Interfacing	Hall	TMH
8	Advance Microprocessors & Peripherals	Ray	TMH

TH.3 INDUSTRIAL ELECTRONICS

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:		Semester	5TH
Total Period:	60	Examination	3hrs
Theory periods:	4P/W	Internal Assessment:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

This subject helps to understand the hardware of present controllers and application.

B. GENERAL OBJECTIVE:
After completion of this subject the student will be able to:
1   Design and troubleshot circuits for demagnetizing inductors with switch.
2   Selections of power switch for a given application.
3   To understand High Frequency Converters and to select the Components.
4   To understand the working of Drive Circuits.
5   To understand the working and specifications of UPS.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction	02
2	Power Semiconductor Devices	06
3	Electrical Vs Magnetic Circuits	06
4	Uncontrolled Rectifiers	06
5	Phase Controlled Rectifiers	06
6	Converters	06
7	Inverters	06
8	Protection Circuits	03
9	Thermal Management	03
10	Motor Drive Circuits	06
11	Power Supplies	06
12	Application Circuits	04
	Total:	**60**

D. SUBJECT CONTENT:

1.0   INTRODUCTION
1.1   Introduction
1.2   Power Electronics Vs Linear Electronics
1.3   Scope & Applications.

2.0   POWER SEMICONDUCTOR DEVICES
2.1   Introduction
2.2   Basic Structure, Characteristic Operation, Limitations
        Power Diodes
        BJTs & MOSFETs
        Thyristors,GTOs
        IGBTs
        Diac,Triac

3.0   ELECTRICAL VS MAGNETIC CIRCUITS
3.1   Introduction
3.2   Electric Circuits—Steady State Response
3.3   Magnetic Circuits.
3.4   Flux and Flux Density
3.5   Amperes Law, Right Hand Rule, Faradays Law.

4.0   UNCONTROIIED RECTIFIERS
4.1   Introduction.
4.2   Rectifiers Concepts
4.3   Single Phase & Three Phase Rectifiers & Comparison.

5.0   PHASE CONTROLLED RECTIFIERS
5.1   Introduction
5.2   Thyristor Circuits
5.3   Single Phase Converters.
5.4   Three Phase Converters

6.0   CONVERTERS
6.1   Introduction
6.2   Control of dc—converters.
6.3   Buck converter
6.4   Boost Converter
6.5   Buck—Boost Converter
6.6   Full Bridge dc—dc Converter
6.7   R to I Converter
6.8   mV to I converter
6.9   D.C voltage regulator, simple A/C voltage regulator.

7.0   INVERTERS
7.1   Introduction
7.2   Basic concepts of switch mode Inverters.
7.3   Single phase Half, Full Bridge, push-Pull Inverters
7.4   Three Phase Inverter

8.0   PROTECTION CIRCUITS
8.1   Snubber Circuits and their Functions
8.2   Turn OFF Snubhers.
8.3   Turn OnSnubbers
8.4   Over Voltage Snubbers.

9.0   THERMAL MANAGEMENT
9.1   Control of Temperature in Semiconductor Device

9.2   Heat Transfer Techniques
9.3   Heats Sinks—Need & Concept.

10.0   MOTPR DRIVE CIRCUITS
10.1   Introduction
10.2   Selection Criteria of Drive Components
10.3   Dc Motor—Equivalent dc Motors
10.4   Permanent—Magnet d Motors
10.5   Dc Servo Drives.
10.6   Induction Motor Operation—basic principles.
10.7   Variable Frequency Converters Classifications & Comparison
10.8   Synchronous Motor Drives &Cycloconverters.
10.9   Variable voltage & variable frequency drive.

11.0   POWER SUPPLIES
11.1   Introduction
11.2   Linear Power Supply.
11.3   Switching power Supply.
11.4   Protection Isolation and Specification.

12.0   APPLICATION CIRCUITS
12.1   Residential Application Circuit Examples
12.2   Industrial Application Circuits
12.3   Electricity Utility Application.

Syllabus to be covered up to I.A.

Chapter: 1, 2, 3 ,4 and 5

Sl.No	Title of the Book	Name of Authors	Name of Publisher
Learning Resources:			
1	Industrial Electronics .-	James T.Homphires&LestieP.sheets	Aziya Publisher
2	Power Electronics Circuits, Devices & Applications.--	M.H.Rashid	Pearson
3	Power Electronics..-	P.C.Sen, KjeldThorborg.	TMH
4	Power Electronics.-	M.D Singh & K.B Hassanchanda	TMH
5	Electrical Drives Concept & Application.	Subrahmanyam	TMH
6	Industrial Electronics .	G.k.Mythal.	Khanna Publishers
7	Power Electronics .- Subharamanyam	Subharamanyam	New Age International

TH.4   VETRONICS

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:		Semester	5th
Total Period:	60	Examination	3hrs
Theory periods:	4P/W	Internal Assessment:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

This a specialized curriculum helps to understand the recent trends in automobile technology by using smart sensors .
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B. GENERAL OBJECTIVE :

After completion of this subject the student will be able to:
1. Understand the basic concepts and components.
2. Understand different ignition systems.
3. Study about the lead acid battery ,testing and lighting system.
4. Study the sensor based electronics engine management and control development.
5. Study about advance Future Trends in Automobile Techniques

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Automobile fundamentals	14
2	Storage Battery ,charging and Lighting system	14
3	Sensors and Engine Management Systems	14
4	Automotive Control systems and Control Components	14
5	Recent Treads in Automobile technology	14
6	Test And Revision	5
	Total:	**60**

D. SUBJECT CONTENT:

1.0   AUTOMOBILE FUNDAMENTALS
The engine –components engine block, cylinder, crank shaft, piston ,cam shaft, valves , intake system, ignition, exhaust, cooling system- Lubrication System- fuel feed system ignition system-spark plug-high voltage circuit and distribution –compression ignition system-steering system, Ackerman steering mechanism, suspension system, fuel injection and ignition system, fuel injection –types –throltle body versus port injection – fuel injector-different types-High pressure diesel fuel injection –introduction to Electronic ignition system

2.0   STORAGE BATTERY ,CHARGING AND LIGHTING SYSTEM
Principle of lead acid cells, plates and their characteristics, construction, electrolyte, effect of temperature on electrolytes , specific gravity, capacity and efficiency, methods of charging from D.C. mains, defects and remedies of batteries ,care of idle and new

batteries, Recycling process- recent developments. D.C. Generators, Alternators –their characteristics control, cutout, Electrical, Electro-mechanical and electronics regulators, procedure for charging ,details of head light and side light, LED lighting system, head light dazzling and preventive methods , static and Dynamic Bending lights .

3.0   SENSORS AND ENGINE MANAGEMENT SYSTEMS

Introduction to sensors and transducers-Types –Air flow rate sensor, Engine crankshaft angular position sensor, engine speed sensor, Timing sensor, Throttle angle sensor, Pressure sensor, Temperature sensors, Pressure sensor-Flow sensor, Exhaust gas oxygen sensors, Knock sensor, Engine torque sensors, Automotive engine control actuators, Exhaust gas recirculation actuator.

Electronics engine management system, Brake actuation warning system, flash system, Oil pressure warning system, engine over heat warning system, air pressure warning system speed warning system, door lock indicators, neutral gear indicator, horn design, permanent magnet horn, air & music horns, wind shield wiper, Window washer, electronics instruments, dash board illumination and MIL

4.0   AUTOMOTIVE CONTROL SYSTEMS AND CONTROL COMPONENTS

Engine control Objectives, Engine control functions, fuel delivery systems, Electronics fuel Ignition Systems- Emission control, Automotive Transmission control system(ABS),Tire-slip control, Active suspension, Traction Control, Electronics suspension system, Steering control, Stability control, Integrated engine control, Central locking ,Air bags and seat belt tensioners, Voice warning system, Travel information system, GPS.
Introduction to micro chip-micro controller-block diagram-architecture-
Introduction to AVR family IC –features block diagram, architecture, basic of embedded control and software.

5.0   RECENT TREADS IN AUTOMOBILE TECHNOLOGY

Electrical and Hybrid vehicles, Introduction –Electric vehicle development –system layout –basic system components-Electric battery solar cells –Rapid charging system – Motor drive system-fuel cell Electric vehicle-Hybrid vehicles-parallel Hybrid vehicle-CNG Electric hybrid vehicle.
Vehicle Intelligence
Introduction –Base structure-Vision based autonomous road vehicles- Architecture for vision system- features applications-image processing-Intelligent robot vehicles-obstacle detection, collision warning and avoidance system

Syllabus to be covered up to I.A.

Chapter: 1, 2, 3 ,4 and 5

Learning Resources:			
Sl.No	Title of the Book	Name of Authors	Name of Publisher
1	Automobile Engineering Vol-1,Vol-2	Kirpal Singh	Standard Publishers distributors New Delhi
2	Automobile Engineering	G,B.S. Narang	Khanna publishers, New Delhi
3	Understanding Automotive Electronics	William b. ribben	6th edition Elsevier Science-2003
4	Vehicle and engine technology VOl-1	Heinz Heisler	ELBS
5	Automobile Engineering	R.B.Gupta,	Satya Prakashan,Newdelhi
6	Understanding Automotive	William B.Ribbens	Jonathan

	Electronics, Fourth edition		Simpson
7	Sensor and Transducers	Ronald K.Jurgen,	SAE-2003
8	Electic and Hybrid –Electric Vehicle	Ronald K.Jurgen	SAE-2002

TH.5 PNEUMATICS AND HYDRAULICS

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:		Semester	5th
Total Period:	60	Examination	3hrs
Theory periods:	4P/W	Internal Assessment:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

This subject helps to understand the conventional controlling system and its components.

B. GENERAL OBJECTIVE :
After completion of this subject the student will be able to:
1. Introduction to Fluid and properties of Fluids.
2. Industrial application of pneumatic and Hydraulic powers.
3. Compressed Air.
4. Pneumatic Circuits.
5. Basic pneumatic Circuits.
6. Hydraulic Working Elements.
7. Basic Hydraulic Circuits.
8. Hydro Pneumatic System.
9. Electrical Controls in Pneumatics and Hydraulics.
10. Maintenance and Troubleshooting**.**

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction to Fluid Power & Pneumatic Power	04
2	Properties of Fluids	06
3	Compressed Air Production and Preparation	09
4	Pneumatic working elements	09
5	basic Pneumatic Circuits	07
6	Hydraulic working Elements	09
7	Basic Hydraulic Circuits	04
8	Hydro pneumatic systems	04
9	Electrical control in pneumatics and Hydraulics	04
10	Maintenance and Trouble shooting	04
	Total:	**60**

D. SUBJECT CONTENT:

1.0   Introduction to Fluid Power & Pneumatic Power.
1.1   Fluid power—History, advantages, disadvantages and application.
1.2   Pneumatic power—History, advantages, disadvantages and application.

2.0 Properties of Fluids

2.1 Properties of Fluids—Properties of fluids like density, specific volume, specific weight, relative density ,atmospheric pressure ,gauge, absolute Pressure , viscosity.

2.2 Hydro statics—determination of pressure at a depth below free surface of a Liquid, Pascal's law definition and its application.

2.3 Hydrodynamics—Bernoulli's theorem—Practical application of law of volume of flow.

2.4 Gas laws—Boyle's law, charle's law, Gay Lussac's Law, problem.

3.0 Compressed Air Production and Preparation.

3.1 Characteristic—Positive and negative characteristics.

3.2 Compressor types.

3.3 Oil free compressor.

3.4 Terms associated with compressor—delivery volume, theoretical and effective working pressure, operation pressure, pressure losses.

3.5 Cooling of compressor—needs, methods, fines, fans, water cooling.

3.6 Regulation of compressors—no load regulation, low speed regulation, on/off Regulation.

3.7 Compressed air receiver—need, selection, delivery volume, pressure, drive, Cooling method, regulation,   determination of receiver size.

3.8 Compressed air preparation—need functions of suction air fitter, functions of intercooler functions of air filter, requirements of air filter, functions of pressure regulators, functions of all lubricator, functions of service unit,Requirement of drive.

3.9 Distribution of compressed air—System of distribution, criteria for selecting Pipe diameter, flow volume, pipe length, pressure drop, working pressure pipe diameter calculation, pipe material.

4.0 Pneumatic working elements.

4.1 Pneumatic cylinders—construction details and working of SAC,DAC diaphragm cylinders, rolling diaphragm cylinders with end position Cushioning, cylinders with double sided piston rod, tandem cylinder, multiPosition cylinders, impact cylinder, rotary cylinder, constructional features of Pneumatic cylinders, calculation for cylinders, piston force, air consumption.

4.2 Pneumatic motors—characteristics of pneumatic motor, working of sliding Vane motor, gear motor.

4.3 Pneumatics valves—constructional details and functioning of directional Control valves, non return valves, pressure control valves, shutoff control valve, quick exhaust valve, sequence control valves, time delay valves, Representation of pneumatic valves with symbols.

4.4 Symbols used in Pneumatics (ISO 1219/DIN 24300).

5.0 Basic Pneumatic Circuits

5.1 Design of basic pneumatic circuits employing SAC, design of basic pneumatic circuits employing DAC, rigging up circuits.

6.0 Hydraulic working Elements.

6.1 Hydraulic pumps—Constructional details of gear pump, functions of gear Pump.

6.2 Hydraulic cylinders—Constructional details and working of SAC, DAC,DAC With double piston rod, cylinder with end position cushioning, telescopic Cylinders, tandem cylinders, determination of force developed by cylinders.

6.3   Hydraulic motors—working of basic hydraulic motor and cam type axial Piston motor.
6.4   Hydraulic filters—Functions of filter, air breather filter, suction line filter, Pressure line filter and return line filter.
6.5   Hydraulic valves –Construction and function of pressure relief valves , Directional valve, flow control valve, representation of various hydraulic valves With symbols.

7.0   Basic Hydraulic Circuits.
7.1   Design of basic hydraulic circuits employing DAC, rigging up circuits.

8.0   Hydro pneumatic systems
8.1   Principle of hydro-pneumatic systems, advantages, pressure converter, Pressure intensifier,functions of feed units functioning of hydraulic Accumulators and hydraulic intensifiers.

9.0   Electrical control in pneumatics and Hydraulics.
9.1   Electro-pneumatics, actuating magnets, relays, limit switches, application of Switching functions, circuits.

10.0   Maintenance and Trouble shooting.
10.1   Maintenance of pneumatic system, common problems in pneumatic system Seals failure, maintenance of compressor.
10.2   Instruction for removal of operating troubles of air compressor.

Syllabus to be covered up to I.A.

Chapter: 1, 2, 3 ,4 and 5

Sl.No	Title of the Book	Name of Authors	Name of Publisher
Learning Resources:			
1	Fundamentals of pneumatic Control Engineering	J.P.hasebrink	Festo Didactic
2	Introduction to Pneumatics		Festo Didactic
3	Fluid Mechanics and Hydraulics	Dr.Jagdish Lal	Metropolitan
4	Hydraulic and Pneumatic Power for Production	Harry L.Stewart	Industrial press
5	Pneumatic system principle & maintenance	S.R.Majumdar	TMH
6	Fluid mechanics & machinery	N.S.Govind Rao	TMH
7	Oil Hydraulic system	S.R.Majumdar	TMH

PR.1 MEASURING SYSTEM & MICROPROCESSOR LAB

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:		Semester	5TH
Total Period:	60	Examination	3hrs
Lab periods:	4 P/W	Sessional	25
Maximum marks:	75	End Semester Examination:	50

RATIONALE:

The knowledge gain to partial by making small models using different electronics and instrumentation components.

GENERAL OBJECTIVE:
1. To design the circuits.
2. To understanding their working
3. To verify their truth tables or outputs.

Sl. No	Major Topics	Time allotted Total periods :60
1	Converters	04
2	Thermocouples & RTD	04
3	Sensors	05
4	Temperature Controllers	04
5	Pressure gauges	04
6	Measurement of displacement	02
7	Design of Counter	06
8	Measurement of Load	03
9	Measurement of Speed	02
10	Familiarization of Proximity, switch	06
11	8085 Micro Processor Kit	07
12	8086 Micro Processor Kit	07
13	Interfacing 8085 / 8086 with the modules	06

SUBJECT CONTENT:

1. V to F Converter using ICL 8038.

2. F to V Converter using LM 2907.

3. Study of types of Thermocouple and characteristics of Thermocouple.

4. Study of RTD and characteristics of RTD.

5. Temperature sensing using Diodes.

6. Using LM 35 and AD 590 as temperature sensor.

7. Study of ON OFF control using temperature controller using Thermocouple and RTD.

8. Finding error in the given pressure gauge with respect to Digital Gauge.

9. Finding error in the given pressure gauge with respect to Dead Weight.

10. Measurement of Displacement using LVDT.

11. Designing a counter circuit using Proximity Sensor.

12. Measurement of load by using load cell.

   (a) Expansion Method.

   (b) Compression Method

13. Measurement of Speed using

   (a) Contact type (Tachometer)

   (b) Non-contact tyre (Proximity Sensor & Stroboscope).

14. Familiarization of Inductive Proximity, Capacitive Proximity, IR and Reed Switch.

8085 Micro Processor Kit :

1. Familiarization of 8085 Micro Processor Kit.

2. Loading of four byte s in the Registers A, B, C, D &Moving them to consecutive location 8000H through 8003H.

3. Add two 8-but numbers, without carry, storing the result in location 9000H.

4. Add of two 16-bit numbers, with carry, storing the result in location 9010H (LSB) and 9011H (MSB).

5. Subtract an 8-bit number from another 8-bit number and store the difference in location 9000H.

6. Perform the decimal addition of two 8-bit numbers, storing the sum in decimal system in the location 9100H.

7. Multiplication of two 8-bit numbers and storing the result in register DE as well as in the location 9000H (LSB) and 9001H (MSB).

8. Division of a 16-bit number with an 8-bit number.

9. Find 1's complement of a 16-bit number and place the result in 9000H.

10. Find 2's complement of an 8-bit number and storing it in 9000H.

11. Shift an 8-bit number to the left by 2 bits and storing it in 9000H.

12. Mask off the most significant 4 bits of an 8-bit and storing it in 9000H.

13. Find the square of a given positive number using look-up table. Store the values of squares starting from address 9500H.

14. Find the larger of the given two 8-bit numbers, placing the bigger number in 9000H.

15. Find the even, odd, +Ve and –Ve numbers present in the given array and make separate group for each type to store them.

16. Add 'N' 8-bit numbers stored in memory location 9500H through (9500+N)H and store the sum in location 9000H (LSB) and 9001H (MSB).

17. Arrange the given array of numbers present in memory location 9500H through (9500+N)H, in ascending order and store it with starting memory location 9100H.

18. Arrange the given array of numbers present in memory location 9500H through (9500+N)H, in descending order and store in with starting memory location 9001H.

19. Store the largest in 9100H and smallest in 9101H of the bytes of array stored in the location 9000H and 9010H.

20. Find the square root of a given number and store it in location 9100H.

21. Perform the addition of two 8-bit numbers in sign magnitude form placing the result in 9000H.

22. Find the SUM of a series of 8-bit numbers, SUM : 16 BIT.

23. Find the SUM of a series of 8-bit Decimal numbers, SUM : 16 BIT>

24. Move a block of 'N' Bytes from location 9000H to 9500H.

25. Multibyte addition – eg : Add to 4 byte numbers.

26. Generate a train of square wave using SOD lines of 8085.

8086 Micro Processor Kit :

1. Familiarization of 8086 Micro Processor Kit.

2. Exchange the two blocks of data of location 9000H & 9010H through 9019H.

3. Find the Factorial of the Byte in 9000H and store the result in 9100H.

4. Increment the register CX from a count 0000H until it equals the number present in register DX.

5. Find the value of X, where X = A + B + C + D

   A, B, C, D are the inputs to memory location 9000H through 9003H.

INTERFACING 8085 / 8086 WITH THE MODULES :

1. Traffic Light Control Module.

2. Stepper Motor Control Module.

3. Elevator Control Module.

4. Keyboard Control Module.

5. ADC & DAC.

PR.2 PNEUMATICS, HYDRAULICS AND AUTOMATION LAB

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:		Semester	5TH
Total Period:	60	Examination	3hrs
Lab periods:	4 P/W	Sessional	25
Maximum marks:	75	End Semester Examination:	50

A. RATIONAL:

. This subject helps to understand the different final control elements

B. COURSE OBJECTIVES:-

This will become helpful to know about practical use of different types of electrical machines and will compare the theoretical response from its practical output.

Sl. No	Major Topics	Time allotted
		Total periods :75
01	**PNEUMATICS**	**43**
	Exercise on Direction Control	14
	Exercise on flow control	05
	Logical conditions	08
	Advanced circuit Design	08
	Electro—Pneumatics	08
02	**HYDRAULICS**	**14**
03	**AUTOMATION**	**18**

SUBJECT CONTENT:

1.0 PNEUMATICS   (Period-43)

1.1 Exercise on Direction Control   (Period-14)

1.1.1 Actuation of single acting cylinder by 3/2 D.C valve.

1.1.2 Actuation of double acting cylinder by 5/2 D.C valve

1.1.3 Direct control of DCA by 5/2 D.C valve

1.1.4 Indirect control of DAC by 5/2 D.C valve.

1.2 EXERCISE ON FLOW CONTROL   (Period-05)

1.2.1 Speed control of SAC by through valve

1.2.2 Speed control of DAC by flow control valve.

1.2.3 Speed control of DAC by quick exhaust valve.

1.3 LOGICAL CONDITIONS   (Period-08)

1.3.1 Use of OR logic to actuate SAC

1.3.2 Use of AND logic to actuate SAC

1.3.3 Circuits using logical conditions

1.4 Advanced circuit Design   (Period-08)

1.4.1 Retraction of DAC after preset pressure is reached

1.4.2 Memory circuit and speed control of DAC.

1.4.3 Examples for using Time delay valve.

1.5 Electro—Pneumatics   (Period-08)

1.5.1 Actuation of SAC by solenoid operated valves.

1.5.2 Sequence control by solenoid operated valves.

2.0 HYDRAULICS (Period-14)

2.1 Use of pressure relief valve in DAC

2.2 Use of pressure regulating valve in DAC

3.0 AUTOMATION (Period-18)

3.1 Micro controller Based pressure controller of a tank through a valve.

3.2 Micro Controller based temperature controller.

3.3 Micro processor based water level controller.

3.4 SCADA software based speed controller of a DC motor.

3.5 Micro controller based Temperature ON/Off controller by universal input controller.

3.6 Pressure controlling of a tank by PID controller.

3.7 Electrical valve operated pressure controller using PID controller.

PR.3 INDUSTRIAL ELECTRONICS LAB

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:		Semester	5TH
Total Period:	60	Examination	3hrs
Lab periods:	4 P/W	Sessional	25
Maximum marks:	50	End Semester Examination:	25

A. RATIONAL:

The real hardware practical used for industrial control.

B. COURSE OBJECTIVES:-

The course objective is to acquaint the students with industrial control components and its applications

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SI. No	Major Topics	Time allotted Total periods :60
01	Switching characteristics of Diode.	3
02	Switching characteristics of BJT	3
03	Switching characteristics of MOSFET	3
04	Inductor Design, Calculation and Winding Exercises	6
05	Inductor Switching Circuits	6
06	Switching Characteristics of SCR	6
07	Triggering of SCR.	3
08	Case Study of Pulse Transformer driving of SCR.	3
09	Case Study of SCR Controlled Full Bridge Rectifier	3
10	Familiarization of PWM IC-SG 3524	3
11	Case Study of Buck Converter	3
12	Case Study of Boost Converter	3
13	Familiarization of TCA 785	3
14	Case Study of SCR Controlled DC Drive	6
15	Familiarization of an UPS Control Circuit	6

C. SUBJECT CONTENT :

SI.No.   **List of Experiments**

1. Switching characteristics of Diode.

2. Switching characteristics of BJT

3. Switching characteristics of MOSFET

    (a)   Non-Isolated Gage Drive

    (b)   Isolated Gate Drive

4. Inductor Design, Calculation and Winding Exercises.

5. Inductor Switching Circuits
   (a)   With Resistor
   (b)   With Diode
   (c)   With Zener
6. Switching Characteristics of SCR.
7. Triggering of SCR.
   (a)   With Resistor.
   (b)   With R and C
8. Case Study of Pulse Transformer driving of SCR.
9. Case Study of SCR Controlled Full Bridge Rectifier.
10. Familiarization of PWM IC-SG 3524.
11. Case Study of Buck Converter
    (a)   Open Loop
    (b)   Closed Loop
12. Case Study of Boost Converter
    (a)   Open Loop
    (b)   Closed Loop
13. Familiarization of TCA 785
14. Case Study of SCR Controlled DC Drive.
15. Familiarization of an UPS Control Circuit.

Pr 4. PROJECT WORK (Phase-I)

Name of the Course: Diploma in MOM			
Course code:		Semester	5th
Total Period:	60	Examination :	-
Theory periods:	4P / week	Sessional Marks	50
EXAMS	-	TOTAL Marks	50

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 prime emphasis of the project work is to understand and apply the basic knowledge of the principles of MECHATRONICS and practices in real life situations, so as to participate and manage a large organization and projects, 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*.

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
- 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.
- To achieve real life experience of working in a work place.
- To develop the skill of writing Project Report

General Guidelines

The individual students have different aptitudes and strengths and also areas of interest. Project work, therefore, should match the strengths and interest of the 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/organisation 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:

Sl. 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 organisations of area of subject to such an exhibition.

Project Phase-I and Phase-II

The Project work duration shall cover 2 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. Requirements specification and Preliminary work of the system have to be complete in Phase-I. Project Milestones are to be set so that progress can be tracked . In Phase-II Detailed work, Documentation have to be complete. *Project Report have to be prepared and 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 components of Task and schedule.

At the end of Project Phase-I in 5th semester there shall be one presentation by each group to mark to progress and also to judge whether the Project is moving in right direction as per the objective of the Project.