STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 4TH SEMESTER (*MECHATRONICS*) (w.e.f. 2019-20)

| Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional:	End Sem Exams	Exams (Hours)	Total
		Theory							
Th.1		Mechanical Engg. Sc	4		-	20	80	3	100
Th.2		Data Communication and Computer Network *	4		-	20	80	3	100
Th.3		Applied Electrical & Electronics Measurement System	4		-	20	80	3	100
Th.4		Mechatronics System & Advanced Manufacturing	4		-	20	80	3	100
		Total	16			80	320	-	400
		Practical							
Pr.1		Electronics Lab-II	-	-	5	25	25	3	50
Pr.2		Networking Lab	-	-	4	25	50	3	75
Pr.3		Advanced CAD & Engg.Drawing	-	-	6	50	100	3	150
Pr.4		Digital ETC lab	-	-	5	25	50	3	75
		Student Centered Activities			3				
		Total	-	-	23	125	225	-	350
		Grand Total	**16**		**23**	**205**	**545**	**-**	**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 4TH SEMESTER

FOR

DIPLOMA IN MECHATRONICS ENGINEERING

(Effective FROM 2019-20 Sessions)
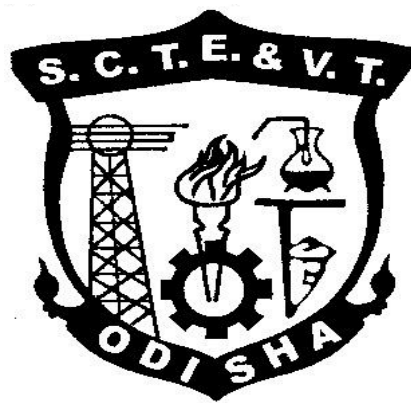
STATE   COUNCIL   FOR   TECHNICAL EDUCATION & VOCATIONAL TRAINING, ODISHA, BHUBANESWAR

Th1. MECHANICAL ENGG.SCIENCE

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course Code:	MCT 401	Semester	4th
Total Period:	60	Examination	3hrs
Theory Periods:	4 P/W	Teacher's Assessment:	20
Maximum Marks:	100	End Semester Examination:	80

A. RATIONAL:

This is the basic course used of construction and development to produce components machines and complex systems with its product development.

B. COURSE OBJECTIVES :

Trainees will be able to understand the mechanical concepts used in various machine.
1. To understand various manufacturing methods to used in a company.
2. To understand the concepts of heat treatment.
3. To understand power transmission elements.
4. Will able to select right type of bearings and its lubrication.
5. To understand an overview on steam turbines and IC engines.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Manufacturing methods.	12
2	Super finishing operation.	02
3	Heat treatment.	05
4	Process planning.	07
5	Bearing materials and antifriction bearings.	06
6	Lubricants.	03
7	An overview on steam turbine, IC engines, refrigeration.	12
8	Jigs and fixtures.	10
9	Information on non conventional machining.	03
	Total:	**60**

D. SUBJECT CONTENT:

UNIT-1

1.0 MANUFACTURING METHODS 12
1.1 Introduction to various methods of manufacturing like forming Machining, joining methods (fabrication). 04
1.2 Forming process-An over view on casting, forging, rolling, drawing Power material technology etc. 02
1.3 Joining methods—Temporary joints like screws, bolts, Rivets—Types of riveted joints, Soldering, brazing, Arc and Gas welding, Types of welding like spot welding, seam welding butt welding etc. Welding like TIG, MIG and continuous welding process. 06
2.0 SUPER FINISHING OPERATIONS 02
2.1 An over view of various super finishing operations like honing lapping, its process advantages and disadvantages. 02
3.0 HEAT TREATMENT 05
3.1 Principle of heat treatment, phase transformation in steel during heating. 02

| 3.2 | Heat treatment process—Annealing, normalizing hardening, Tempering case hardening surface hardening, vacuum hardening and induction hardening. | 02 |
| 3.2 | Defects in Hardening. | 01 |

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UNIT-2

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4.0	**PROCESS PLANNING**	**07**
4.1	Definition and Objective	01
4.2	Materials for the screw, nut, bolt, washer and shaft	03
4.3	Manufacturing Process of screw, nut, bolt, washer and shaft.	03

5.0	**BEARING MATERIALS AND ANTIFRICTION BEARINGS**	**06**
5.1	Introduction of bearings, characteristics ,types, composition of Common bearing materials like white metal (Babbitt), bronze, brass, aluminum alloys, cadmium, alloys etc, bimetal and tri Metal bearings.	02
5.2	Types of anti frication bearings, designation of each type, ball bearing, roller bearings and needle bearings, preloading of angular contact bearing	04

6.0	**LUBRICATION**	**03**
6.1	Characteristics of lubrication, types of lubrication	01
6.2	Methods of lubrication—self lubrication, manual feed, auto feed and aerosol lubrication, auto lubrication systems--time and motion based.	02

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UNIT-3

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7.0	**AN OVERVIEW ON STEAM TURBINE,IC ENGINES, REFRIGERATION**	**12**
7.1	Working principles of boilers and turbines, types of IC engines Construction , classification—two stroke and four stroke petrol and diesel engines, thermal engines efficiency and mechanical efficiency.	04
7.2	Rankine cycle, auto cycle, diesel cycle & carnot cycle.	02
7.3	Properties of water and steam. Use of steam table and mollier chart.	03
7.4	Refrigeration concepts, functionsand types. Vapor compression and Vapor absorption, refrigerants and principles of air conditioning.	03

8.0	**JIGS AND FIXTURES**	**10**
8.1	Introduction to jigs and Fixtures and advantages	01
8.2	Planes of movement degrees of freedom	01
8.3	Methods of location, different types of clamps and clamping ,devices drill bushes and supports.	02
8.4	Types of jigs and fixtures.	02
8.5	Types of locators and location methods .	02
8.6	Jigs and Fixtures design—elements factors to be considered With examples.	02

9.0	**INFORMATION ON NON CONVENTIONAL MACHINING**	**03**
9.1	Chemical etching, ultrasonic machining, electro chemical machining	01
9.2	Electrical discharge machining, wire cut	01
9.3	Plasma arc machining, laser beam machining, water jet Machining and abrasive Machining	01

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	Modern Workshop practice	Wright Bake	
2	Machine Technology Vol.1.2.3	P.M.Johnston	
3	Manufacturing Technology Vol-I & II	GanesanI.C.Engine Rao	
4	Workshop Technology (part 1 & part2)	W.A.J Chapman	
5	Workshop Technology (part1 & part2)	Hazar Choudhury.	
6	All about Machine Tools	H.Gerling	

Learning Resources:			
Sl.No	Title of the Book	Name of Authors	Name of Publisher

TH-2 DATA COMMUNICATION & COMPUTER NETWORK

(Common to CSE/IT/ETC/AEI)

Theory	: 4 Periods per week	I.A.	:20 Marks
Total Periods	:60 Periods	Term End Exam	: 80 Marks
Examination	: 3 Hours	TOTAL MARKS	: 100 Marks

Chapter wise Distribution of periods with Total periods

Sl. No.	Topics	Periods
1	NETWORK& PROTOCOL	08
2	DATA TRANSMISSION & MEDIA	08
3	DATA ENCODING	08
4	DATA COMMUNICATION & DATA LINK CONTROL	08
5	SWITCHING & ROUTING	10
6	LAN TECHNOLOGY	10
7	TCP/IP	08
	TOTAL	**60**

RATIONALE:

Now a days the growth of data communication technology has become very fast in development of various application areas. This subject will expose the learner to have an idea about the architecture computer network and different protocols to be followed to communicate. Further they will have an idea about different mode of communication.

Objective:

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

- Know the concepts of Data Communication, networking, protocols, and networking models
- Know the various transmission Medias
- Understand the concepts of switching
- Understand various Error detection and correction methods
- Know about data flow and error control
- Know about data link control
- Understand multiple access
- Learn the concepts of wired LANs and Ethernet
- Compare various connecting devices
- Know the concepts of network layer, logical addressing, IP, Forwarding and routing
- Understand brief concept on TCP/IP

Detailed Contents:

Unit-1. Network& Protocol
  1.1 Data Communication
  1.2 Networks
  1.3 Protocol & Architecture, Standards, OSI, TCP/IP

Unit-2. Data Transmission & Media
  2.1 Data transmission Concepts and Terminology
  2.2 Analog and Digital Data transmission
  2.3 Transmission impairments, Channel capacity
  2.4 Transmission media, Guided Transmission, Wireless Transmission

Unit-3. Data Encoding
  3.1 Data encoding,
  3.2 Digital data digital signals,
  3.3 Digital data analog signals
  3.4 Analog data digital signals
  3.5 Analog data analog signals

Unit-4. Data Communication & Data link control
  4.1 Asynchronous and Synchronous Transmission
  4.1 Error Detection
  4.3 Line configuration
  4.4 Flow Control,
  4.5 Error Control
  4.6 Multiplexing
  4.7 FDM synchronous TDM

4.8 Statistical TDM

Unit-5.   Switching & Routing

5.1 Circuit Switching networks

5.2 Packet Switching principles

5.3 X.25

5.4 Routing in Packet switching

5.5 Congestion

5.6 Effects of congestion, congestion control

5.7 Traffic Management

5.8 Congestion Control in Packet Switching Network.

Unit-6. LAN Technology

6.1. Topology and Transmission Media

6.2 LAN protocol architecture

6.3. Medium Access control

6.4 Bridges, Hub, Switch

6.5 Ethernet (CSMA/CD), Fiber Channel

6.6 Wireless LAN Technology..

Unit-7. TCP/IP

7.1 TCP/IP Protocol Suite

7.2 Basic Protocol functions

7.3 Principles of Internetworking

7.3 Internet Protocol operations

7.4 Internet Protocol

Coverage of Syllabus upto Internal Exams(I.A.)
Chapter 1,2,3,4

Books Recommended

Sl.No	Name of Authors	Title of the Book	Name of the publisher
01	W.Stallings	Data Communication &Computer Networks	PHI
02	M.Bhatia	Introduction to Comp. Network	Unv. S. Press
03	Forouzen	Data Communication & Network	TMH

Th3. APPLIED ELECTRICAL & ELECTRONICS MEASUREMENT SYSTEM

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course Code:	ELT 421	Semester	4th
Total Period:	60	Examination	3hrs
Theory Periods:	4 P/W	Teacher's Assessment:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

This subject helping to understand application of electronics and instrumentation in the practical fields.

B. GENERAL OBJECTIVE:
After completion of this subject the student will be able to:
1. To get an overview of various industrial instrumentation and its utility.
2. To understand various sensors/transducers
3. To understand different electronics measuring instruments.
4. To understand ultrasonic/optical measurement and usages.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction	05
2	Electronics instrumentation	04
3	Level measurement	10
4	Temperature measurement	10
5	Pressure measurement	04
6	Displacement and Acceleration measurement	09
7	Force, weight and flow measurement	10
8	Vibration and ultrasonic measurement	08
	Total:	**60**

D. SUBJECT CONTENT:--
  1. INTRODUCTION
    1.1   Definition of measurement system
    1.2   Measurement system and it's constituent elements.
    1.3   Sensors and transducers.
    1.4   Performance Terminology.
    1.5   Static and Dynamic characteristics.

  2. **ELECTRONIC INSTRUMENTATION**.
    2.1   V-F Converts.
    2.2   F-V Converter.

  3. LEVEL MEASUREMENT
    3.1   D.P type level measurement.
    3.2   Displacer type measurement.
    3.3   Float type measurement.
    3.4   Ultrasonic type measurement.

4. **TEMPERATURE MEASUREMENT**
   4.1   Introduction to Temperature Measurement.
   4.2   Thermo couples, principle, Types, selection, standard table of thermo couples And signal condition circuits.
   4.3   RTD principle, Types, Selection of RTD and conditioning circuits.
   4.4   Thermistor and Bimetallic Strip.
   4.5   Measurement of temperature using Diodes.
   4.6   IC temperature Transducer using LM35 and AD590.
   4.7   Pyrometer (optical and Infrared).

5. **PRESSURE MEASUREMENT**
   5.1   Introduction to pressure measurement
   5.2   Pressure Standards
   5.3   Conventional pressure sensors
   5.4   Electrical and Electronic pressure transducers.
   5.5   Introduction to Calibration and Calibration of pressure Gauge.
   5.6   P/I & I/P converter.
   5.7   Pressure transmitter, water manometer, mercury manometer.

6. **DISPLACEMENT AND ACCELERATION MEASUREMENT**
   6.1   Introduction to displacement measurement.
   6.2   Potentiometer sensor, Capacitive sensor, Types, Construction, Operation and Errors.
   6.3   LVDT, Principle, Operation and Application Inductive proximity Switch.
   6.4   Digital Encoder: Contact. Magnetic and Optical Encoder.
   6.5   Rotational Displacement/Angular position: Using optical and Signal Conditioning circuits.
   6.6   Introduction, characteristics and types of Accelerometer.

7. **FROCE WEIGHT AND FLOW MEASUREMENT**
   7.1   Introduction to force weight and flow measurement.
   7.2   Strain gauge and its function.
   7.3   Load Cell, principle and operation of load cell.
   7.4   Weight measurement by static, dynamic and in motion method.
         Orifice, venture flow nozzle, pitot tube.
   7.5   Flow measurement by D.P type, turbine flow type, magnetic flow type, Ultrasonic type.

8. **VIBRATION AND ULTRASONIC MEASUREMENT**
   8.1   Introduction, characteristics.
   8.2   Vibration measurement by Eddy current method, Piezo sensor
   8.3   Basic Ultrasonic Transmission Link, piezoelectric, ultrasonic, transmitter and receiver, principle and example.

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	Mechatronics	Bolton Pearson	Education Asia
2	Principle of measurement	JP Bentlley	
3	Systems 2000	Addition Wesley	
4	Industrial Control Electronics	J.Michael Jacob	
5	Mechanical and Industrial Measurement	R.K .Jain	Khanna Publication
6	Instrumentation and Control System	Bhasker	Anuradha Agencies
7	Electronic Instrumentation	Kali	
8	Instrumentation Devices & System	Rangan	

Th4. MECHATRONICS SYSTEM & ADVANCED MANUFACTURING

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:	MCT 403	Semester	4th
Total Period:	60	Examination	3hrs
Theory periods:	4 P/W	Teacher's Assessment:	20
Maximum marks:	100	End Semester Examination:	80

A. RATIONAL:

This curriculum becomes helpful to understand about multi disciplinary subjects in the industry automation.

B. GENERAL OBJECTIVE:

After completion of this subject the student will be able to
1. To understand the Mechatronics concept.
2. To understand the mechatronics approach.
3. To understand the actuation system.
4. To know the assembly technique.
5. To know about the data presentation techniques.
6. To understand the motion control & rotational drives.
7. To study about advanced manufacturing.

C. Topic wise distribution of periods:

Sl. No.	Topics	Period
1	Introduction to Mechatronics	05
2	Mechatronics elements	12
3	Assembly technique	08
4	Data presentation system	05
5	Actuation system	15
6	Motion control & Rotational drives	08
7	Cellular manufacturing	01
8	Flexible manufacturing system	06
	Total:	**60**

D. SUBJECT CONTENT:--

1.0   Introduction to mechatronics

1.1   What is mechatronics, system, measurement system.
1.2   Control system, microprocessor based controllers.
1.3   Mechatronics in manufacturing the products.
1.4   Conventional vs mechatronics.

2.0   Mechatronics elements

2.1   Introduction, machine structure
2.2   Guide ways-- classification**,** friction, antifriction guide ways & other guide ways.

2.3   Drive system—Servo principle, servo motors, drive optimization, Drive
        Protection, selection criteria for drives, power supply for CNC, electric
        Panel cooling.
2.4   Mechanical transmission system
2.5   Mechanism to convert rotary motion to the linear motion.
2.6   Torque transmitting elements.
2.7   Spindle bearing, antifriction bearing hydrostatic bearing and
        hydrodynamic bearing.
2.8   Direct and indirect measuring system.
2.9   Tool monitoring & changing system.

3.0   Assembly Technique.

3.1   Introduction, guideways-Lm guideways, tychoways, rolling elements,
        Aerostatic & Hydrostatic guideways—the assembly precautions.
3.2   Ball screw & nut—assembly technique alignment, fitting and displacement.
3.3   Feedback elements—Preffered linear scale assembly, incremental encoder, Assembly
        care of mounting of proximity switch.
3.4   Spindle bearings—general assembly precautions, misalignment, noise and
        vibrations.

4.0   Data presentation system.

4.1   Loading and data presentation elements.
4.2   Magnetic recordings & data acquisition system.
4.3   Displays.
4.4   Data acquisition systems.

5.0   Actuation system.

5.1   Pneumatic & Hydraulic system.
5.2   Cylinders.
5.3   Process control valves.
5.4   Examples of fluid control system rotary actuators.
5 5   Mechanical systems—Types of motion—freedom and constraints
        Loading—QRM
5.6   Cams—gear trains-Ratchet & pawl.
5.7   Bearings—plain journal bearing—Ball & roller bearing—selection of bearing.
5.8   Mechanical aspects of motor selection—moment of inertia Torque.
5.9   Electrical systems—mechanical switches—solid state switches.
5.10   Control of D.C motors—stepper motor control.

6.0   Motion control & rotational drives.

6.1   Linear systems—pneumatics rams rod & rod less type.
6.2   Electrical actuators
6.3   Solenoid & other forms of electrical actuators.
6.4   Pneumatic motors, continuous and limited rotations.
6.5   Hydraulic motors, continuous and limited rotations.

7.0   Cellular manufacturing.

7.1   Introduction, types & benefits.
7.2   Cell layout & design
7.3   Application.

8.0   Flexible manufacturing system.
8.1   FMS—Introduction, benefits, meaning, major elements and their role.
8.2   FMS—Layout concept, system, tool handling system material handling
        Principle & system.

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	System design	Devdas Shetty & Richard Akolk	PWS Publication
2	Mechatronics -- Electronics control systems in Mechanical Engineering	W.Bolton	2ndEdition Pearson Educational
3	Mechatronics	Prof. C.R.Venkataramana	Sapna book house,First Edition,
4	Mechatronics- Electronics in product & process	D.A.Bradley, D.Dawson,N.C. Burd and A.J.Loader Nelson Thomes Ltd	
5	Introduction to mechatronics & measuring system	Alciatore	TMH
6	Machine Design	Hall	
7	Mechatronics Principles, concept & Applications	Mahalik	TMH
8	Pneumatic system principle & maintenance	Majumdar	

Pr1. ELECTRONICS LAB –II

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:	ETP 421	Semester	4TH
Total Period:	75	Examination	4hrs
Lab periods:	5 P/W	Sessional	25
Maximum marks:	50	End Semester Examination:	25

RATIONALE:

In this lab students learn the application of complex electronic circuits applied in mechatronics science.

Sl.no.	Topics	Periods
1	DC analysis of a Differential Amplifiers	06
2	Familiarization of IC 741 & Verification of its Parameters	06
3	Op. Amp. Applications – Voltage Follower, Summing Amplifier	05
4	Design and Verification of Inverting Amplifier Circuit	05
5	Design and Verification of Inverting Amplifier Circuit	05
6	Op. Amp As Instrumentation Amplifier – Verification of gain and CMRR	06
7	Op Amp as Integrator and Differentiator	05
8	Op Amp as Integrator and Differentiator	05
9	Op Amp as Schmitt Trigger.	05
10	Op Amp as Filter Circuits and Study of Frequency Response (LPF, HPF, BPF)	06
11	Op Amp as RC phase shift Oscillator.	06
12	Monostable Multivibrators using IC 555	05
13	Astable Multivibrators using IC 555.	05
14	Familiarization of Fixed Regulators – 7805, 7905	02
15	Familiarization of Variable Regulators – 1M, 371	03

Pr.2- NETWORKING LAB
(Common to CSE,IT ETC , AE&I)

Practical   : 4 Periods per week   Sessional   :25Marks
Total Periods :60 Periods   Term End Exam   :50 Marks
Examination   : 3 Hours   TOTAL MARKS   :75 Marks

LIST OF PRACTICALS:-
1. Recognize the physical topology and cabling (coaxial, OFC, UTP, STP) of a network.

2. Recognition and use of various types of connectors RJ-45, RJ-11,BNC and SCST

3. Making of cross cable and straight cable

4. Install and configure a network interface card in a workstation.

5. Identify the IP address of a workstation and the class of the address and configure the
IP Address on a workstation

6. Managing user accounts in windows and LINUX

7. Sharing of Hardware resources in the network.

8. Use of Netstat and its options.

9. Connectivity troubleshooting using PING, IPCONFIG

10. Installation of Network Operating System(NOS)

11. Create a network of at least 6 computers.

12. Study of Layers of Network and Configuring Network Operating System

13. Study of Routing and Switching, configuring of Switch and Routers, troubleshooting of
 networks

14. Study of Scaling of Networks, Design verities of LAN and forward of Traffic

15. Study WAN concepts and Configure and forward Traffic in WAN

16. Configure IPv4 and IPv6 and learn Quality, security and other services

17. Learn Network programming

18. Troubles shoot Networks.

Pr3. ADVANCED CAD & ENGINEERING DRAWING

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:	MCP 401	Semester	4TH
Total Period:	90	Examination	4hrs
Lab periods:	6 P/W	Sessional	50
Maximum marks:	150	End Semester Examination:	100

RATIONAL:

This lab will help the students to design ,develop and assembly of job pieces and its production. Further the students will acquire knowledge about difference design and function of the machinery, equipments & automobile components.

GENERAL OBJECTIVE :

Comprehending geometrical constraints and function of components in assemblies such as bearing and screw jack.

Further the trainees should be exposed to solid modeling, assembly, Drafting, 3-D wire frame geometry and surfacing using PRO-ENGINEERING Willfire-3 Software.

Sl.no.	Topics	Periods 50
1	Introduction to CAD	04
2	Constraining Geometry and Dimensional	05
3	Construction Tools	02
4	Construction Features	04
5	Local Operation	02
6	Datum	02
7	Advanced Modeling Technique	08
8	Duplication Features	04
9	Master Surfacing Creating Surfaces	05
10	Manipulation of Surfaces	05
11	Assembly	05
12	Drafting	04

SUBJECT CONTENT :

1. Introduction to CAD.
2. **Constraining Geometry –** Types of geometry constrains, using geometry constrains, Dimensional constraints – Creating Dimension, Modifying Dimensions.
3. **Construction Tools –** Fillet, Offset, Trim / Extend, Mirror.
4. **Construction Features –** Extrude, Revolve.
5. **Local operation –** Filler / Shell / Draft / Chamfer / Hole
6. **Datum –** Datum Planes / Datum Axis.
7. **Advanced Modeling Techniques –** Sweep / Blend / Slept Blunt / Variable Section Sweep.
8. **Duplication Features –** Copy / Pattern.
9. **Master Surfacing – Creating Surfaces –** Extrusion / Revolve / Sweep / Boundary blend, style / extend / offset surface. Manipulation of Surfaces – Stitch surfaces / Extend surfaces / Bridge / Fillet / Offset surfaces / Mid surfaces.
10. **Assembly** – Constrains / Patters / Creating components within assembly / Cloning assembling / Substituting components.
11. **Drafting** – Detailing.

Mechanical Engineering Drawing:

Sl.no.	Topics	Hours 40
1	Conventional representations	06
2	Engineering drawing of fastening elements in first angle of orthographic projection	15
3	Details of assembly	08
4	Assembly to details	11

SUBJECT CONTENT:

1. **Conventional representations**
    1.1   Standard Convention(SP-46):
    1.2   Materials (CI,MS, Brass, Bronze ,Aluminum, Wood, Glass, Concrete and Rubber)
    1.3   Tapers
    1.4   Surface roughness
    1.5   Geometrical tolerances
    1.6   General welding
2. **Engineering drawing of fastening elements in first angle of orthographic projection**
    2.1   Bolt, nut and threads
    2.2   Screws and rivets
    2.3   Cotter joint
    2.4   Knuckle joints
    2.5   Screw joint
    2.6   Universal joint
3. **Details of assembly**
    3.1   Rigid pedestal bearing
    3.2   Frictionless Bearing
4. **Assembly to details**
    4.1   Connecting rod of IC Engine
    4.2   Flat belt pully

Learning Resources:
Text Books;   Machine Drawing by N D Bhatt
                  Machine Drawing by T Jones
                  Machine Drawing by R K Dhawan

Pr4. DIGITAL ETC LAB

Name of the Course: Diploma in MECHATRONICS ENIGINEERING			
Course code:	ETP 422	Semester	4TH
Total Period:	75	Examination	4hrs
Lab periods:	5 P/W	Sessional	25
Maximum marks:	75	End Semester Examination:	50

RATIONAL:

This course will become helpful for complex digital circuits and its application in industry.

GENERAL OBJECTIVE:

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

Sl.no.	Topics	Periods 60
1	Familiarization of digital trainer kit	02
2	Familiarization of Logic gate ICs	02
3	Verification of Boolean Rules	04
4	Implementing and verifying Karnauhg's Map	04
5	Implementing Combinational circuits	02
6	Half Adder and full Adder circuits	04
7	Comparators, Decoders, Encoders, MUX and DeMUX	06
8	Latches and Flip Flops	04
9	Timer IC 555 and Mono stable ICs74121,7412302	02
10	Multi vibrator circuits	02
11	Counters using logic gates	06
12	Counters using ICs	08
13	Registers using Flip Flops	06
14	Registers using ICs	04
15	DAC 0808	02
16	ADC 0808	02

SUBJECT CONTENT :

1.   Familiarization of Digital Trainer Kit.

2.   Familiarization of Logic gate IC's.

2.1   NAND gate (IC 7402).

2.2   NOR gate (IC 7402)
2.3   INVERTER or NOT gate (IC 7404)

2.4   AND gate (IC 7408)

2.5   OR gate (IC 7432)

2.6   Ex – OR gate (IC 7486).

3.0   Implementing and verifying Boolean Rules.

4.0   Implementing and verifying Karnaugh's Map.

5.0   Implementing Combinational circuits.

5.1   Realizing Universal property of NAND gate.

5.2   Realizing Universal property of NOR gate.

6.0   Construct and realize Half Adder and Full Adder circuit using minimum no. of gates.

7.0   Familiarization of comparator (97485), Decorder (74138), Encoder (74147), MUX (74151) and DeMUX (7413).

8.0   Familiarization of Latches and Flip Flops (SR Latch, D Latch, JK Flip-Flop).

8.1   IC 7474 (Dual D-Flip Flop).

8.2   IC 7474 (Dual J.K. Flip Flop).

8.3   IC 74373.

8.4   IC 74374.

9.0   Familiarization of Timer ICs IC 555 & IC 74121, IC 74123.

10.0   Construction of multi-vibrator circuits (Monostable and Astable).

11.0   Design and construction of Counters (Asynchronous & Synchronous Mod 16 & BCD, Presettable).

12.0   Familiarization of Counter ICs (7490, 7493, 74163, 74193).

13.0   Design and construction of Register circuits (SISO, SIPO, PIPO, PISO, RING & JOHNSON Counter).

14.0   Familiarization of Register ICs (74164, 74165, 74194).

15.0   Familiarization of DAC 0808.

16.0   Familiarization of ADC 0808.

17.0   Verify the characteristics of Logic Families fan-in, fan-out, $V_{IL}max$, $V_{IH}min$, $V_{OL}min$, $V_{OL}min$, $V_{OH}max$.

Equipments list

SL.NO	Equipments	Specification	Quantity
	ETC LAB-II		
01	IC 741 Trainer	Using IC 741	06
02	Op-Amp Trainer for filter	HP, LP, BP	06
03	Multivibrator Trainer	Using IC 555	06
04	IC Regulator Trainer for 7805,7905,LN 371		06
	COMPUTER Network Lab		
05	Crimping tool, Cable tester, RJ 45 connectors, RJ-11, BNC Coaxial Cable, UTP, STP, OFC cable Screw Driver Kit Switch/Hub- 3 Nos. Router – 1No.		
	AUTOCAD LAB		
06	Computer with Advanced AutoCAD Software		30
	DIGITAL ETC LAB		
07	DSE Converter	Using IC 0808	06
08	ADC Converter		06
09	Different types of Digital ICS Bread Board		10