

STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

TEACHING AND EVALUATION SCHEME FOR 6TH Semester (MECHATRONICS) (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 | | Theory Of Machine and Machine Design | 4 | | - | 20 | 80 | 3 | 100 |
| Th.2 | | CNC Technology | 4 | | - | 20 | 80 | 3 | 100 |
| Th.3 | | Programmable Logic Controller | 4 | | - | 20 | 80 | 3 | 100 |
| Th.4 | | Industrial Robots | 4 | | - | 20 | 80 | 3 | 100 |
| | | <i>Total</i> | 16 | | | 80 | 320 | - | 400 |
| Practical | | | | | | | | | |
| Pr.1 | | PLC Lab | - | - | 4 | 25 | 25 | 3 | 50 |
| Pr.2 | | CNC Lab | - | - | 5 | 25 | 50 | 3 | 75 |
| Pr.3 | | Robotics Lab | - | - | 4 | 25 | 25 | 3 | 50 |
| Pr.4 | | Project Work Phase-II | - | - | 5 | 50 | 100 | 3 | 150 |
| Pr.5 | | Life Skill | | | 2 | 25 | - | - | 25 |
| | | Student Centred Activities | | | 3 | | | | |
| | | <i>Total</i> | - | - | 23 | 150 | 200 | - | 350 |
| | | Grand Total | 16 | | 23 | 200 | 550 | - | 750 |

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

Minimum Pass Mark in each Theory s ubject 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.

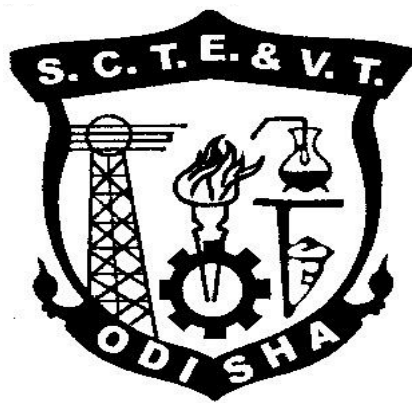
There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional: Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester

CURRICULLUM OF 6th SEMESTER

For

DIPLOMA IN MECHATRONICS ENGINEERING

(Effective FROM 2020-21 Sessions)



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

Th1 THEORY OF MACHINE & MACHINE DESIGN

| | | | |
|---|-------|---------------------------|-----------------|
| Name of the Course: Diploma in MECHATRONICS ENGINEERING | | | |
| Course code: | | Semester | 6 th |
| Total Period: | 60 | Examination | 3hrs |
| Theory periods: | 4 P/W | Teacher's Assessment: | 20 |
| Maximum marks: | 100 | End Semester Examination: | 80 |

A. RATIONAL:

This gives us the knowledge of dynamics of machine and design procedure.

B. COURSE OBJECTIVES :

To study about the function of fly wheel and Governor.

- 1 To know about the friction and its application.
- 2 To know about the balancing and vibration.
- 3 To study about the Engineering materials and properties.
- 4 To study about the design of fastening elements.
- 5 To study about the design of shafts, keys and coupling.
- 6 To study about the design of lever.
- 7 To study about the design procedure of closed coil helical spring of round rod and its materials

| C. Topic wise distribution of periods: | | |
|--|-------------------------------------|-----------|
| Sl. No. | Topics | Period |
| 1. | Fly wheel | 04 |
| 2. | Governor | 04 |
| 3. | Friction and its application | 04 |
| 4. | Balancing and vibration | 06 |
| 5. | Engineering materials | 06 |
| 6. | Design of fastening elements | 15 |
| 7. | Design of shafts, keys and coupling | 10 |
| 8. | Design of lever | 06 |
| 9. | Design of spring | 05 |
| Total: | | 60 |

D. SUBJECT CONTENT:

1.0 FLY WHEEL

- 1.1 Turning moment diagram, problems.

2.0 GOVERNOR

- 2.1 Types and its working principle, problems .

3.0 FRICTION AND ITS APPLICATION

- 3.1 Clutch, types of clutch
- 3.2 Single plate clutch, multi-plate clutch
- 3.3 Bearing definition, types—conical pivot bearing, thrust bearing and footstep bearing.

4.0 BALANCING AND VIBRATION

- 4.1 Concept, types of balancing of masses revolving in the same plane
- 4.2 Terminology of vibration, causes, analysis and remedies of vibration.

5.0 ENGINEERING MATERIALS

- 5.1 Role of engineering materials and mechanical, Physical, chemical, and thermal properties
- 5.2 Stress ,strain and its types, stress—strain diagram ,UTS, Hooke's law, Young's modulus, problems.
- 5.3 Thermo Plastics, Rubber based Teflon materials, Specialized Rubber, Ferrous and non ferrous materials.

6.0 DESIGN OF FASTENING ELEMENTS

- 6.1 Design of cotter joint
- 6.2 Design of riveted joint
- 6.3 Describe the failure of riveted joint
- 6.4 Strength and efficiency of riveted joint

7.0 DESIGN OF SHAFTS, KEYS AND COUPLING

- 7.1 Design of types of shaft
- 7.2 Design of types of key
- 7.3 Design of types of coupling

8.0 DESIGN OF LEVER

- 8.1 Definition types and functions
- 8.2 Design procedure of hand lever and foot lever.

9.0 DESIGN OF SPRING

- 9.1 Design a closed coil helical spring of round rod
- 9.2 Material used for closed coil helical spring

Syllabus to be covered up to I.A.

Chapter: 1, 2, 3 ,4 and 5

| Learning Resources: | | | |
|----------------------------|-------------------------------|------------------------|--------------------------|
| SI.No | Title of the Book | Name of Authors | Name of Publisher |
| 1 | Theory of Machine | R.S Khurmi | |
| 2 | Theory of Machine | V.P Singh. | |
| 3 | A Text Book of Machine Design | R.S Khurmi & J.K Gupta | |
| 4 | Design of Machine Elements | V.B Bhandari | |
| 5 | Machine Design | S.K Mandal. | |
| 6 | Machine Design | P C Sharma | |

Th2 CNC TECHNOLOGY

| | | | |
|---|-------|---------------------------|-----------------|
| Name of the Course: Diploma in MECHATRONICS ENGINEERING | | | |
| Course code: | | Semester | 6 th |
| Total Period: | 60 | Examination | 3hrs |
| Theory periods: | 4 P/W | Teacher's Assessment: | 20 |
| Maximum marks: | 100 | End Semester Examination: | 80 |

A. RATIONAL:

The most advanced technology used for machining of objects to various design with high accuracy by the programming.

B. GENERAL OBJECTIVE:

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

1. To have a knowledge of NC & CNC.
2. To know to principles of NC & CNC.
3. To know the knowledge of design of CNC machine structure and feedback devices axes identification.
4. To have knowledge of different types f cutting tool materials, holders, ATC.
5. To have knowledge of CNC manual programming. Job planning, cut planning.

| C. Topic wise distribution of periods: | | |
|--|---|-----------|
| Sl. No. | Topics | Period |
| 1 | Introduction to Computer Numerical; Control | 2 |
| 2 | CNC Hardware Basics | 4 |
| 3 | CNC Tooling | 2 |
| 4 | CNC Machine Tools and Control Systems | 2 |
| 5 | CNC Programming | 20 |
| 6 | Advanced Part Programming Methods | 10 |
| 7 | Turning Center Programming | 20 |
| | Total: | 60 |

D. SUBJECT CONTENT:--

1.0 INTRODUCTION TO COMPUTER NUMERICAL CONTROL

- 1.1 Introduction
- 1.2 Numerical Control.
- 1.3 Numerical Control Modes.
- 1.4 Numerical Control Elements.
- 1.5 NC Machine Tools.

2.0 CNC HARDWARE BASICS

- 2.1 Structure of CNC Machine Tools
- 2.2 Spindle Design.
- 2.3 Drives.
- 2.4 Actuation Systems.
- 2.5 Feedback Devices.

2.6 Axes—Standards.

3.0 CNC TOOLING.

3.1 Cutting Tool Materials.

3.2 Turning Tool Geometry.

3.3 Milling Tooling systems.

3.4 Tool Presetting.

3.5 Automatic Tool Changers.

3.6 Working Holding

3.7 Cutting process Parameter Selection.

4.0 CNC MACHINE TOOLS AND CONTROL SYSTEMS.

4.1 CNC Machining Centers

4.2 CNC Turning Centers.

4.3 High Speed Machine Tools.

4.4 Machine Control Unit.

4.5 Support Systems.

4.6 Touch Trigger Probes.

5.0 CNC PROGRAMMING.

5.1 Part Programming Fundamental.

5.2 Manual Part Programming.

5.3 Preparatory Functions.

5.4 Miscellaneous Functions.

5.5 Program Number.

5.6 Tool Length Compensation.

5.7 Canned Cycles.

5.8 Cutting Radius compensation.

5.9 Practice of all programs on the Computer using simulation software.

6.0 ADVANCED PART PROGRAMMING METHODS.

6.1 Polar Cp—ordinates.

6.2 Parameters.

6.3 Looping and Jumping.

6.4 Subroutines.

6.5 Mirror imaging and Scaling.

6.6 Canned Cycles.

6.7 Practice of all programs on the computer using simulation software.

6.8 CAD/ CAM and its application.

7.0 TURNING CENTER PROGRAMMING.

7.1 Comparison between Machining Centers and Turning Centers.

- 7.2 Tape Formats.
- 7.3 Axes System.
- 7.4 General Programming Functions.
- 7.5 Motion Commands.
- 7.6 Cut Planning.
- 7.7 Thread Cutting.
- 7.8 Canned Cycles.
- 7.9 Practice of all programs on the computer using simulation software.

Syllabus to be covered up to I.A.

Chapter: 1, 2, 3 ,4 and 5

| Learning Resources: | | | |
|----------------------------|--|------------------------|--------------------------|
| SI.No | Title of the Book | Name of Authors | Name of Publisher |
| 1 | Mechatronics | W.Bokon | |
| 2 | Automation Production Systems & Computer Integrated Manufacturing. | M.P.Groover | |
| 3 | Computer Numeric control of machine tools | G.E.Thyer | |
| 4 | Mechatronics | HMT (TMH) | |

Th3 PROGRAMMABLE LOGIC CONTROLLER

| | | | |
|--|-------|---------------------------|-----------------|
| Name of the Course: Diploma in MECHATRONICS ENIGINEERING | | | |
| Course code: | | Semester | 6 th |
| Total Period: | 60 | Examination | 3hrs |
| Theory periods: | 4 P/W | Teacher's Assessment: | 20 |
| Maximum marks: | 100 | End Semester Examination: | 80 |

A. RATIONAL:

The PLC is widely used in industry for critical automation work as well as have an exposure about PCS as well as SCADA.

B. GENERAL OBJECTIVE:

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

1. To get an overview of various industrial automation and its utility.
2. To understand various robotics controls such as conveyer belt, processing unit.
3. To understand different electro mechanical instruments such as traffic light, elevator
4. To understand sensors and packaging units.

C. Topic wise distribution of periods:

| Sl. No. | Topics | Period |
|---------|--|-----------|
| 1 | PLC basics | 2 |
| 2 | Basic PCL Programming | 7 |
| 3 | Basic PLC Functions | 8 |
| 4 | Intermediate functions | 6 |
| 5 | Data handing functions | 5 |
| 6 | PLC functions working with bits | 7 |
| 7 | Advanced PLC functions | 2 |
| 8 | Overview of Siemens PLCs, ABB, PLCs & Fanuc PLCs | 6 |
| 9 | Introduction to VHDL | 8 |
| 10 | SCADA System & protection. | 6 |
| 11 | DCS | 3 |
| | Total: | 60 |

D. SUBJECT CONTENT:--

1.0 PLC BASIC

- 1.1 Overall look inside PLC
- 1.2 General PLC programming procedure and I/C devices.

2.0 BASIC PROGRAMMING

- 2.1 ON/Off inputs and ON/Off outputs
- 2.2 Relation between digital gates & coil/contact logic.
- 2.3 Creating ladder diagrams for process control.
- 2.4 LAD, STL & FBD

3.0 BASIC FUNCTIONS

3.1 Registers Basic.

3.2 Timer Functions.

3.3 Counter Functions.

4.0 INTERMEDIATE FUNCTIONS

4.1 Arithmetic functions

4.2 Number comparison Functions.

4.3 Number conversion function.

5.0 DATA HANDLING FUNCTION

5.1 PLC SKIP & Master Control Relay Functions.

5.2 JMP instruction.

5.3 Data Movement instructions.

5.4 Other Function.

6.0 FUNCTION WORKING WITH BITS

6.1 Digital bit functions and their. applications.

6.2 Sequencer functions.

6.3 Robot control with PLC.

7.0 ADVANCED PLC FUNCTIONS.

7.1 Analog PLC operations and PID control.

7.2 Networking PLC and troubleshooting PLC.

8.0 OVER VIEW OF DIFFERENT TYPES OF PLC.

8.1 Siemen's PLC, ABBPLC, FANUC PLC, MISITUBI PLC's etc.

9.0 INTRODUCTION TO VHDL

9.1 VHDL introduction, Capabilities, Hardware abstraction.

9.2 Basic Terminology, Entry Declaration, Architecture

9.3 Configuration Declaration, Package Declaration Package Body.

9.4 Model Analysis, Simulation.

10.0 SCADA SYSTEM

10.1 HMI & graphic design

10.2 Protection, Arm handling, event handling, tripping Limits and sequence of events.

11.0 DISTRIBUTED CONTROL SYSTEM

11.1 History, Multithread,(X-y Plot),bar graph.

Syllabus to be covered up to I.A.

Chapter: 1, 2, 3 ,4 and 5

| Learning Resources: | | | |
|----------------------------|---|------------------------------|--------------------------|
| SI.No | Title of the Book | Name of Authors | Name of Publisher |
| 1 | Programmable Logic Controllers | John W.Webb, RonaidA.Reis | |
| 2 | Introduction to Programmable Logical Controller | Gary Dunning | |
| 3 | Programmable Logic Controllers | Frank D.petruzello | THM |
| 4 | Programmable Logic Controllers | DF Mitra&DrS.sengupta | |
| 5 | Digital Electronics | Soumitra Kumar Mandal. | |
| 6 | Manuals of (a) Siemens,(b)Fanuc,(c)Allienbradely | | |

Th4 INDUSTRIAL ROBOTS

| | | | |
|---|-------|---------------------------|-----------------|
| Name of the Course: Diploma in MECHATRONICS ENGINEERING | | | |
| Course code: | | Semester | 6 th |
| Total Period: | 60 | Examination | 3hrs |
| Theory periods: | 4 P/W | Teacher's Assessment: | 20 |
| Maximum marks: | 100 | End Semester Examination: | 80 |

A. RATIONAL:

In the age of automation robot plays important role for assembly with high accuracy as well as material handling and other automotive process

B. GENERAL OBJECTIVE:

After completion of this subject the student will be able to

1. Familiarization to industrial robot and its application.
2. To get knowledge about different types of manipulator and calculation.
3. To get knowledge about machine vision, implementation principles and issues.
4. To get knowledge about control (movement, force) of the manipulator.
5. Familiarization to the robot programming language.
6. Familiarization to the robot intelligence and task planning.

| C. Topic wise distribution of periods: | | |
|--|--|-----------|
| Sl. No. | Topics | Period |
| 1 | Introduction—Robotics | 10 |
| 2 | Robot motion & control and coordinate frames, Mapping, transforms | 12 |
| 3 | Manipulators kinematics | 6 |
| 4 | Sensor | 5 |
| 5 | Control of manipulators | 6 |
| 6 | Machine vision, implementation principles & issues and robot applications. | 6 |
| 7 | Robot programming language and systems. | 6 |
| 8 | Robot—off line programming systems | 4 |
| 9 | Robot intelligence and task planning. | 5 |
| Total: | | 60 |

D. SUBJECT CONTENT:--

1.0 INTRODUCTION—ROBOTICS

- 1.1 Background, Progressive advancement in robotics, development, Definition of robot, Law of robotics.
- 1.2 Robot anatomy—Anatomy, Links, joints and joint notation scheme, Configuration, DOF, degree of freedom required in a manipulator, joint Drive system, arm configuration, wrist configuration.

- 1.3 End effectors—definition, classification of end effectors, Grippers (Mechanical, Mech.-types, magnetic, vacuum & Adhesive), consideration in gripper selection and designing.
- 1.4 Work cell, work envelope, works volume.
- 1.5 Specification to robots and safety measure in robotics.
- 2.0 ROBOT MOTION & CONTROL AND COORDINATE FRAMES, MAPPING, TRANSFORMS.**
- 2.1 Homogenous transformations manipulator path control.
- 2.2 Coordinate frames—mapping, mapping between rotated frames. Mapping between translated frames, mapping between rotated and translated frames.
- 2.3 Description of objects in space, transformation of vectors—rotation of vectors, translation of vectors, combined rotation and translation of Vectors, composite transformation.
- 2.5 Fundamental rotation matrices—principal axes rotation, fixed angle, Representation, Euler angle representation. Equivalent angle axis Representation.
- 3.0 MANIPULATORS KINEMATICS.**
- 3.1 Introduction, definition of kinematics
- 3.2 Forward kinematics
- 3.3 Position and orientation of the end effectors of 2 DOF 2D Manipulator.
- 3.4 Position and orientation of the end effectors 3 DOF 2D manipulator.
- 3.5 Problems .
- 3.6 Revers kinematics.
- 4.0 SENSOR.**
- 4.1 Definition types, application.
- 5.0 CONTROL OF MANIPULATORS.**
- 5.1 Linear controls of manipulator—introduction, feedback and closed, Loop control ,control law partitioning, trajectory following control, Disturbance rejection, continuous vs. discrete time control, modeling And control of a single joint, architecture of an industrial robot controller.
- 5.2 Non linear control of manipulators—introduction, non linear and Time Varying systems, Multi-input, Multi-output control systems, the control Problems of manipulators, practical consideration, present industrial robot Control systems, Cartesian-based control systems, adaptive control.
- 5.3 Force control of manipulators—introduction, application of industrial robots to assembly tasks, a framework for control in partially constrained tasks, the hybrid position/force control scheme ,presents industrial robot control scheme.

6.0 MACHINE VISION, IMPLEMENTATION PRINCIPLES AND ISSUES AND ROBOT APPLICATIONS.

- 6.1 Introduction to machine vision, the sensing and digitizing function in Machine vision.
- 6.2 Image processing and analysis, training and vision system.
- 6.3 Plant survey to identify potential applications, selection of the best Applications and selection of the robot.
- 6.4 Robot applications—material handling, processions. Assembly and Inspection, capabilities of robots, obstacle avoidance.

7.0 ROBOT PROGRAMMING LANGUAGE AND SYSTEMS.

- 7.1 Introduction, method of robot programming, lead through programming Methods, a robot program as a path in space. Motion interpolation, wait Signal and delay commands, branching, capabilities and limitations of lead through methods.
- 7.2 Three levels of robot programming—characteristics of Robot level Languages, characteristics of task level languages, concluding remarks.
- 7.3 A sample application, requirements of a robot programming language.
- 7.4 An example application coded in the three RPLs, problems peculiar to Robot programming language.

8.0 Robot—off line programming systems.

- 8.1 Introduction, central issues in OLP systems.
- 8.2 Cim-Station, automating subtasks in OLP systems.

9.0 Robot intelligence and tasks planning.

- 9.1 Introduction, state space search, problem reductions, use of predicate Logic.
- 9.2 Goals of AI research, AI techniques, LISP programming, AI & Robotics, LISP in the factory, Means—Ends analysis, problem solving.
- 9.3 Robot learning, task planning basic problems in task planning, expert System and knowledge engineering.

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 | Introduction to Robotics | Jhon.J.Craig | |
| 2 | Robotics | K.S.Fu,R.CGonzalez,C.S. G Lee | |
| 3 | Industrial Robotics | MikellP.Groover,Mitchell, Weiss,Roger N. Nagle, Nicholar. | |
| 4 | Automation Production Systems and CIM | MikellP.Groover | |
| 5 | Robotics and control | R.K.Mittal,I.J.Nagrath | |
| 6 | Robotics Technology and Flexible Automation | S.R.Deb (TMH) S.DEB. | |
| 7 | Introduction to Robotics | S.K.Saha(TMh) | |
| 8 | Industrial Robotics | Ganesh S.Hegde. | |

Pr1. PLC LAB.

| | | | |
|---|-------|---------------------------|-----------------|
| Name of the Course: Diploma in MECHATRONICS ENGINEERING | | | |
| Course code: | | Semester | 6 TH |
| Total Period: | 60 | Examination | 4hrs |
| Lab periods: | 4 P/W | Sessional | 25 |
| Maximum marks: | 50 | End Semester Examination: | 25 |

RATIONALE:

The students will be able to operate in different functions in PLC and can do any activity by using control system.

| Sl.no. | Topics | Total Peroids 60 |
|--------|--|------------------|
| 1 | Basic Programming | 07 |
| 2 | Digital Programming | 08 |
| 3 | Design a Program for motor start and stop by using set and reset function. | 08 |
| 4 | Design a ladder diagram for following condition using Flip Flop. | 08 |
| 5 | Familiarization of ON – Delay Timer. | 08 |
| 6 | Familiarization of Count up – Counter. | 08 |
| 7 | Any Real time application projects. | 08 |
| 8 | Simple digital system design using VHDL. | 05 |

SUBJECT CONTENT :

1. BASIC PROGRAMMING :

- (i) Design a PLC Program for the following condition.
 - a) Switch – ON Light – Glows.
 - b) Switch – OFF Light – Puts Off.
- (ii) Design a program DOL Starter for motor.
- (iii) Design a program for toward Reverse – stop with mutual interlock.
- (iv) Design a program for forward – Reverse – Stop with direct reversal.
- (v) Design a program for start – Stop – Jog.
- (vi) Design an Alarm system.

2. DIGITAL PROGRAMMING :

- (i) Design a Program
 - a) AND OR and NOT gate.
 - b) NAND and NOR gate.

- (ii) Design a conveyor control system in which conveyor "C" is to run when any one of the 4 inputs is ON and it should stop when any one of the 4 other inputs are ON.
- (iii) Write a program that a fan "P" will run the equation is getting satisfied (11) $(12+13) (15, 16) = P$.
- (iv) Draw a program file for following expression.
 $(1 + M + N) + (Q R) R = S$.

3. DESIGN A PROGRAM FOR MOTOR START AND STOP BY USING SET AND RESET FUNCTION.

4. DESIGN A LADDER DIAGRAM FOR FOLLOWING CONDITION USING FLIP FLOP.

- (i) When switch – pressed, output light – glows.
- (ii) When switch – again pressed, output light – puts off.

5. FAMILIARIZATION OF ON – DELAY

- (i) Start a machine after 5 seconds.
- (ii) Start 3 machines consequently after 3 seconds.

6. FAMILIARIZATION OF COUNT UP – COUNTER.

- (i) When a sensor hand sensed 5 bottles the machine should ON.

7. ANY REAL TIME APPLICATION PROJECTS.

8. SIMPLE DIGITAL SYSTEM DESIGN USING VHDL.

Pr2 CNC LAB.

| | | | |
|--|-------|---------------------------|-----------------|
| Name of the Course: Diploma in MECHATRONICS ENIGINEERING | | | |
| Course code: | | Semester | 6 TH |
| Total Period: | 75 | Examination | 4hrs |
| Lab periods: | 5 P/W | Sessional | 25 |
| Maximum marks: | 75 | End Semester Examination: | 50 |

RATIONAL:

This course will help for handsome practice about advanced language and network connection for data transmission .

| Sl.No | Major Topics | Total Periods= 60 |
|-------|---|-------------------|
| 1 | CNC | 30 |
| 2 | Computer Aided Manufacturing. | 30 |
| | CNC | |
| 1 | Introduction to CNC Machine. | 01 |
| 2 | Machine specification. | 01 |
| 3 | Machine Control Panel | 01 |
| 4 | Settings of Offset | 02 |
| 5 | Editing Program | 02 |
| 6 | Single Block Dry run | 01 |
| 7 | Tool Setting DNC | 02 |
| 8 | Practice on the M/C with different exercises. | 20 |
| | COMPUTER AIDED MANUFACTURING | |
| 1 | Introduction to Master CAM | 02 |
| 2 | 2D Contour | 04 |
| 3 | Pocket | 08 |
| 4 | Frill | 02 |
| 5 | Face | 02 |
| 6 | 3D Counter | 02 |
| 7 | 3D Surface Machining | 06 |
| 8 | Generation of NC Codes | 02 |
| 9 | Communication of NC Codes to CNC M/C | 02 |

Pr3. ROBOTICS LAB.

| | | | |
|---|-------|---------------------------|-----------------|
| Name of the Course: Diploma in MECHATRONICS ENGINEERING | | | |
| Course code: | | Semester | 6 th |
| Total Period: | 60 | Examination | 4hrs |
| Lab periods: | 4 P/W | Sessional | 25 |
| Maximum marks: | 50 | End Semester Examination: | 25 |

RATIONAL:

This will be helpful to the students about the robots for automation work in the field of material handling, machine operation work etc.

| Sl.No | Major Topics | Total Periods= 60 |
|-------|-------------------------------------|-------------------|
| 1 | Robot component recognition. | 05 |
| 2 | Manipulating the robot | 05 |
| 3 | Recording the position | 04 |
| 4 | Writing and running robot programs. | 04 |
| 5 | Pick and Place tasks. | 04 |
| 6 | Inputs (Digital, Analog, Sensors) | 04 |
| 7 | Output | 04 |
| 8 | Joint & XYZ coordinate system. | 04 |
| 9 | Point to point control | 04 |
| 10 | Linear interpolation | 04 |
| 11 | Circular interpolation | 04 |
| 12 | Relative positions | 04 |
| 13 | Writing the programs using Loops | 05 |
| 14 | Writing the programs using Delay | 05 |

SUBJECT CONTENT :

1.0 ROBOT COMPONENT RECOGNITION.

- 1.1 What is robot ?
- 1.2 Robot Arm
- 1.3 Robot controller
- 1.4 End effectors
- 1.5 Identifying robot arm components
- 1.6 Robot controller components
- 1.7 Identifying robot controller components
- 1.8 Accessories
- 1.9 Input devices
- 1.10 Software
- 1.11 Activating software.

2.0 MANIPULATING THE ROBOT.

- 2.1 Joint coordinates
- 2.2 XYZ coordinates
- 2.3 Manual mode
- 2.4 Auto mode
- 2.5 Robot working limits
- 2.6 Operating the gripper
- 2.7 Changing speed
- 2.8 Homing

3.0 RECORDING THE POSITION.

- 3.1 Recording desired robot positions
- 3.2 Moving robot to the recorded positions.
- 3.3 Saving and deleting the recorded positions
- 3.4 Activating software and loading recorded positions.

4.0 WRITING AND RUNNING ROBOT PROGRAMS.

- 4.1 Activating software
- 4.2 Writing a simple program
- 4.3 Saving the program
- 4.4 Loading recorded positions
- 4.5 Running the program
- 4.6 Aborting program
- 4.7 Inserting and deleting the programs.

5.0 PICK AND PLACE TASKS.

- 5.1 Recording Pick and Place tasks.
- 5.2 Performing Pick and Place movements
- 5.3 Writing a Pick and Place program.
- 5.4 Running the program line by line.
- 5.5 Running the program continuously.

6.0 INPUTS (DIGITAL, ANALOG, SENSORS).

- 6.1 Digital inputs and outputs
- 6.2 Programming with inputs

7.0 OUTPUT

- 7.1 Digital relay outputs.
- 7.2 Writing a program to control outputs
- 7.3 Integrating inputs and outputs.

8.0 JOINT & XYS CO-ORDINATE SYSTEM.

- 8.1 Joint coordinates.
- 8.2 XYZ coordinates
- 8.3 Manipulating robot in Cartesian coordinates.
- 8.4 Manipulating robot in joint coordinates.
- 8.5 Displaying position coordinates.
- 8.6 Recording absolute XYZ positions.
- 9.0 POINT-TO-POINT CONTROL.**
- 9.1 Point-to-point control
- 9.2 Manipulating robot in Point-to-point control
- 9.3 Writing programs in Point-to-point control
- 10.0 LINEAR INTERPOLATION.**
- 10.1 Continuous path control
- 10.2 Linear interpolation
- 10.3 Manipulating robot in Linear interpolation
- 10.4 Writing programs with Linear interpolation
- 11.0 CIRCULAR INTERPOLATION.**
- 11.1 Continuous path control
- 11.2 Circular interpolation
- 11.3 Manipulating robot in Circular interpolation
- 11.4 Writing programs with circular interpolation
- 12.0 RELATIVE POSITIONS.**
- 12.1 Relative positions
- 12.2 Recording relative positions
- 12.3 Using relative position on the “Z” Axis for the pick and place application.
- 12.4 Changing the reference position.
- 13.0 WRITING THE PROGRAMS USING LOOPS.**
- 13.1 Do while Loop
- 13.2 For Next
- 13.3 Programming using Do while Loop and For Next
- 14.0 WRITING THE PROGRAMS USING DELAY.**
- 14.1 Time delay
- 14.2 Setting of speed
- 14.3 Point to point path control
- 14.4 Linear interpolation
- 14.5 Circular interpolation
- 14.6 Integration of inputs and outputs.

Pr4. PROJECT Phase - II

| | | | |
|---|------------|---------------------|-----------------|
| Name of the Course: Diploma in Mechatronics | | | |
| Course code: | | Semester | 6 th |
| Total Period: | 75 | Examination | 3 hrs |
| Lab. periods: | 5 P / week | Sessional | 50 |
| Maximum marks: | 150 | End Sem Examination | 100 |

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 engineering and practices in real life situations, so as to participate and manage a large Mechatronics engineering projects, in future. Entire Project spreads over 5th and 6th Semester. Part of the Project covered in 5th Semester was 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, 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.
- To achieve real life experience in Project design.
- To develop the skill of writing Project Report

Project Phase-I and Phase-II

The Project work duration covers 2 semesters(5th and 6th sem). The Grouping of students, selection of Project, assignment of Project Guide to the Group was done in the beginning of 5th semester under Project Phase-I. The students were allowed to study literature, any existing system and then define the Problem/objective of the Project. Preliminary work and Design of the system also have to be complete in Phase-I. Development may also begin in this phase. Project Milestones are to be set so that progress can be tracked .

In Phase-II Development, Testing, Documentation and Implementation 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-II in 6th semester there shall be one presentation by each group on whole Project work undertaken by them.

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 to such an exhibition.

The Project Report need to be prepared as per standard format and following is the indicative format. The Teacher Guide may make minor alteration keeping the sense in tact.

Organization of Project Report

1. Cover page:

It should contain the following (in order)

- (i) Title of the Project
- (ii) "Submitted in partial fulfillment of the requirements for the Diploma in <Branch Name>"
- (iii) By Name of the Student(s)
- (iv) Logo of the Institution
- (v) Branch Name/Depart Name and Institution Name with Address
- (vi) Academic Year

2. 1st Inner page

Certificate:

It should contain he following

"This is to certify that the work in this Project Report entitled <Project Title> by <Name of student(s)> has been carried out under my supervision in partial fulfillment of the requirements for the Diploma in <Branch Name>" during session <session > in <Branch /Department Name> of <Institute name> and this work is the original work of the above student(s).

Seal and signature of the Supervisor/Guide with date

3. 2nd Inner Page

Acknowledgement by the Student(s)

4. Contents.

5. Chapter wise arrangement of Reports

6. Last Chapter: Conclusion

It should contain

- (i) Conclusion
- (ii) Limitations
- (iii) Scope for further Improvement

7. References

Pr-5 LIFE SKILL

(Common to All Branches)

| | | | |
|----------------------|---------------------------|--------------------|-----------------|
| Practical | 2 Periods per week | Sessional | 25 Marks |
| Total Periods | 30 Periods | Total Marks | 25 Marks |

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

- Develop team spirit i.e. concept of working in team
- Apply problem solving skills for a given situation
- Use effective presentation techniques
- Apply task management techniques for given projects
- Enhance leadership traits
- Resolve conflict by appropriate method
- Survive self in today's competitive world
- Face interview without fear

DETAIL CONTENTS:

1. SOCIAL SKILL

Society, Social Structure, Develop Sympathy and Empathy

Swot Analysis – Concept, How to make use of SWOT

Inter personal Relation: Sources of conflict, Resolution of conflict ,
Ways to enhance interpersonal relation

2. PROBLEM SOLVING

Steps of Problem solving:

- Identify and clarify the problem,
- Information gathering related to problem,
- Evaluate the evidence,
- Consider alternative solutions and their implications,
- Choose and implement the best alternative,
- Review
- Problem solving techniques:

1) Trial and error, 2) Brain storming, 3) Lateral (Out of Box) thinking

3. PRESENTATION SKILL

Body language , Dress like the audience

Posture, Gestures, Eye contact and facial expression. STAGE FRIGHT,

Voice and language – Volume, Pitch, Inflection, Speed, Pause

Pronunciation, Articulation, Language, Practice of speech.

Use of AV aids such as Laptop with LCD projector, white board etc.

4. GROUP DISCUSSION AND INTERVIEW TECHNIQUES

Group Discussion:

Introduction to group discussion, Ways to carry out group discussion,
Parameters— Contact, body language, analytical and logical thinking,
decision making

Interview Technique :

Dress, Posture, Gestures, facial expression, Approach

Tips for handling common questions.

5. WORKING IN TEAM

Understand and work within the dynamics of a groups.

Tips to work effectively in teams,

Establish good rapport, interest with others and work effectively with them

to meet common objectives,
Tips to provide and accept feedback in a constructive and considerate way ,
Leadership in teams, Handling frustrations in group.

6. TASK MANAGEMENT

Introduction, Task identification, Task planning ,
organizing and execution, Closing the task

PRACTICAL

List of Assignment: (Any Five to be performed including Mock Interview)

a. SWOT analysis:-

Analyse yourself with respect to your strength and weaknesses, opportunities and threats.
Following points will be useful for doing SWOT.

- a) Your past experiences,
- b) Achievements,
- c) Failures,
- d) Feedback from others etc.

b. Solve the True life problem assigned by the Teacher.

3. Working in a Team

Form a group of 5-10 students and do a work for social cause e.g. tree plantation, blood donation, environment protection, camps on awareness like importance of cleanliness in slum area, social activities like giving cloths to poor etc.(One activity per group where Team work shall be exhibited)

4. Mock Interview

5. Discuss a topic in a group and prepare minutes of discussion.

6. Deliver a seminar for 5 minutes using presentation aids on the topic given by your teacher.

7. Task Management

Decide any task to be completed in a stipulated time with the help of teacher. Write a report considering various steps in task management (with Break up into sub tasks and their interdependencies and Time)

Note: -1. Please note that these are the suggested assignments on given contents/topic. These assignments are the guide lines to the subject teachers. However the subject teachers are free to design any assignment relevant to the topic.

Note: -2. The following Topics may be considered for Seminar/GD in addition to other Topics at the discretion of the Teacher.

(Comparison with developed countries, Occupational Safety, Health Hazard, Accident & Safety, First-Aid, Traffic Rules, Global Warming, Pollution, Environment, Labour Welfare Legislation, Labour Welfare Acts, Child Labour Issues, Gender Sensitisation ,Harassment of Women at Workplace)

METHODOLOGY:

The Teacher is to explain the concepts prescribed in the contents of the syllabus and then assign different Exercises under Practical to the students to perform.

Books Recommended:-

| Sl.No | Name of Authors | Title of the Book | Name of the Publisher |
|-------|---------------------|---------------------------------|-----------------------|
| 01 | E.H. Mc Grath , S.J | Basic Managerial Skills for All | PHI |
| 02 | Lowe and Phil | Creativity and problem | Kogan Page (I) P Ltd |

| | | | |
|----|--------------|-----------------------------------|------------------------------|
| | | solving | |
| 03 | Adair, J | Decision making & Problem Solving | Orient Longman |
| 04 | Bishop , Sue | Develop Your Assertiveness | Kogan Page India |
| 05 | Allen Pease | Body Language | Sudha Publications Pvt. Ltd. |