

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
TEACHING SCHEME (w. e. f. Jan ' 12)
SEMESTER- VI

SR. NO	SUB. CODE	SUBJECT	TEACHING SCHEME (HOURS)			CREDITS
			THEORY	TUTORIAL	PRACTICAL	
1	2362001	Microcontrollers	4	0	2	6
2	2362002	Project - II	0	0	12	12
3	2362004	Computer Aided Graphics	0	0	4	4
4	2362005	Fundamental of CNC Programming	2	0	2	4
5		Elective	3	0	0	3
6		Elective Practices	0	0	2	2
		TOTAL	9	0	22	31

Select ANY ONE from the following subjects

Sr. No.	Sub. Code	Elective
1	2362003	Robotics
2	2362006	Networking system & Communications
3	2362008	Digital Signal Processing
4	2361909	Advance Manufacturing System
5	2361917	Hydraulic and pneumatic Devices

Select ANY ONE from the following subjects

Sr. No.	Sub. Code	Elective Practices
1	2362010	Robotics Practice
2	2362007	Networking system & Communications Practice
3	2362009	Digital Signal Processing Practice
4	2361910	Advance Manufacturing System Practice
5	2361918	Hydraulic and pneumatic Devices Practice

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Microcontrollers
Subject Code: 2362001

Sr. No.	Subject Content	Total Hrs.
1	MICROPROCESSORS AND MICRO CONTROLLERS. 1.1 Microprocessors - general idea and block diagram 1.2 Micro controller 1.3 Block diagram of a micro controller 1.4 Introduction to micro controller 1.5 Operating principle 1.6 Comparison between microprocessor and micro controller	6
2	8051 MICRO CONTROLLER HARDWARE. 2.1 Introduction 2.2 8051 micro controller hardware 2.3 8051 block diagram 2.4 Function of each block 2.5 8051 Programming model 2.6 8051 DIP Pin assignment 2.7 8051 oscillator and clock 2.8 Ceramic resonator oscillator circuit 2.9 Program counter and data pointer 2.10 A and B CPU registers 2.11 Flags and the program status word PSW 2.12 Internal memory 2.13 Internal RAM <ul style="list-style-type: none"> • Internal RAM organization 2.14 Stack and stack pointer 2.15 Special function registers 2.16 Internal ROM 2.17 Input / output Pins Ports and circuits <ul style="list-style-type: none"> • Port 0 Pin configuration • Port 1 pin configuration • Port 2 pin configuration • Port 3 pin configuration 	12

	<p>2.18 External memory</p> <ul style="list-style-type: none"> • Connecting external memory <p>2.19 Counters and timer</p> <ul style="list-style-type: none"> • TCON and TMOD function registers • TCON (Timer control) function registers • TMOD Time mode control Function Register • Timer counter interrupts • Timer mode 1, 2 & 3 <p>2.20 Serial Data input / output</p> <p>2.21 Interrupts</p> <ul style="list-style-type: none"> • Introduction • Types of interrupts 	
3	<p>MOVING DATA</p> <p>3.1 Introduction</p> <p>3.2 Addressing Modes</p> <p>3.3 External Data Moves 3.4 Code memory Read-only Data Moves</p> <p>3.5 Push and Pop opcodes</p> <p>3.6 Data exchanges</p> <p>3.7 Example programs</p>	12
4	<p>LOGICAL ARITHMETIC OPERATIONS</p> <p>4.1 Introduction</p> <p>4.2 Byte level logical operation</p> <p>4.3 Bit level logical operation</p> <p>4.4 Rotate and swap operation</p> <p>4.5 Flags</p> <p>4.6 Incrementing and decrementing</p> <p>4.7 Additions</p> <p>4.8 Subtraction</p> <p>4.9 Multiplications and division</p> <p>4.10 Decimal arithmetic</p> <p>4.11 Example programs</p> <p>4.12 Jump and call program range</p> <p>4.13 Calls and subroutines</p> <p>4.14 Interrupts and returns</p>	10
5	<p>8051 MICRO CONTROLLER DESIGN</p> <p>5.1 Introduction</p> <p>5.2 Micro controller specifications</p>	6

	5.3 A micro controller design <ul style="list-style-type: none"> • External memory and memory space decoding • Reset and clock circuit • Expanding I/O 5.4 Timing Subroutines 5.5 Lookup table for 8051 5.6 Serial data transmission	
6	APPLICATIONS 6.1 Introduction 6.2 Interface keyboards to 8051 based micro controller 6.3 Interface LED & LCD display 6.4 Interface the micro controller system to A/D and D/A converters 6.5 8051 Data communications modes example programmes 6.6 Data acquisition systems	10
	TOTAL	56

NOTE:-Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

Sr. No.	Subject	Total Hrs.
1	8051 Oscillator circuit and timing	2
2	Timer / counter control logic	2
3	External memory circuit	2
4	Interrupts circuits	2
5	Assembly language programming	2
6	Programming the 8051 - 8051 instruction syntax	2
7	Use commands to move data	2
8	Addition programming	2
9	Subtraction programming	2
10	Multiplication and division programming	2
11	Byte and bit logical operation	2
12	Interface LED display	2
13	A to D converter	2
14	D to A converter	2
	TOTAL	28

Reference Books:

1. Microcontroller-Architecture, Programming and Application- H.A.Momaya
2. The 8051 Micro controller Architecture, Programming and Application-
Kenneth J.Ayala
3. Microprocessor and Micro controllers - B.P.Singh

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Project - II
Subject Code: 2362002

NOTE: - Following are the minimum experiences required, but the college can do more experiences if possible.

Title	Discription	Total Hrs.
1. Selection of Project	Explanations of following aspects 1) Determination of logic 2) Market survey and Feasibility using the infrastructure of the Institute. 3) Making of relevant drawing/drafting. 4) Incorporating major manufacturing processes if possible. 5) Non repetitive in nature 6) To develop the generic as well as technology related skills. 7) Having measurable and analytical and results. 8) Innovative in nature	2
2. Project model Components.	Explanation of components that may be used in project: 1) Sensor(limit switch, Proximity, ldr, etc..) 2) Use logic through programmable IC (micro controller) Or Language base. 3) Motor (DC, Stepper, AC, RC-Servo). 4) Digital gates. 5) Seven segment led or LCD as a display deviece. 6) Hydraulic and pneumatic components 7) P.L.C.	6
3.Project Preparation	1) Model making with defined logic and components. 2) Simulation/ Execution of Project 3) Fault finding/ Trouble shooting	56
4. Format of Project Report	Explanation of format of report. 1) Main Project title: 16 point, bold, Capital, Times New Roman. 2) '12' point time new roman. 3) '1.5' line spacing. 4) '12' point bold times new roman title	2
5. Documentation	Preparation of Project report and PPT file	18
	Total	84

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Computer Aided Graphics
Subject Code: 2362004

NOTE: - Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

Practical No.	Title	Total Hrs.
1	Prepare 2D production drawing(This includes tolerances, limits, sections, surface roughness, geometric accuracy and precesion symbols etc.) with AutoCAD	4
2	Prepare 2D drawingwith anyone software such as proE, Unigraphics or any one in current use.	4
3	Prepare 3D solid models of given components(At least three) using AutoCAD	6
4	Prepare 3D surface models of given components(At least two) using AutoCAD	4
5	Prepare 3D solid models of given components (at least five with basic features like extrude, revolve, cut, shell, chamfer, rib, fillet etc.) using any one parametric software available.	14
6	Prepare 3D models of given components(at least two with advance modeling features like blend, sweep, pattern) using anyone parametric software available.	8
7	Prepare 3D solid models of components of given assembly (5-7 parts having mechanism) also prepare assembly and orthographic drawings. Also simulate the assembly using any parametric modeling software with animation.	16
	TOTAL	56

References Books:

- | | |
|--|----------------------------|
| 1. CAD-CAM | By Grover And Zimmer. |
| 2. CAD-CAM-CIM | By Rao, Tiwari And Kundra. |
| 3. Computer Graphics- | By Herne Backer. |
| 4. Books/ manuals for CAD software selected. | |
| 5. ProEngineer for designers | By Prof. Sham Tickoo |

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Fundamentals of CNC Programming
Subject Code: 2362005

Sr. No.	Subject Content	Total Hrs.
1	FUNDAMENTALS OF PROCESS PLANING: 1.1 Definition, need & various information required for process plan 1.2 Structure of process plan 1.3 Various factors influencing the process plan 1.4 Technological sequence of operations in process planning 1.5 To prepare process plan for different 4 to 5 components having minimum 7 to 8 types of operations.	5
2	INTRODUCTION TO CNC SYSTEMS: 2.1 Definition of NC Program and CNC system. 2.2 Definition and application of DNC system. 2.3 Configuration of the CNC system & its various elements 2.4 Schematic diagram of a CNC machine tool. 2.5 Closed loop and open loop control system. 2.6 Machine control unit and its various modes of operations. 2.7 Various elements of CNC machines and its major functions (such as ball screw, drives, guideways, encoders/decoders, ATC, APC) 2.8 Various compensations for machine accuracies and cutting. 2.9 Study of specifications of a CNC system.	8
3	CNC TOOLINGS: 3.1 Introduction to tooling system in CNC machines 3.2 Various modular carbide tipped tools and tool holders used for CNC turning Centre as per ISO standards. 3.3 Various tooling and tool holders used for CNC machining centre as per ISO standards. 3.4 Tool setting, tool presetting and qualified tools Various tool materials and its cutting parameters for different work piece materials.	2
4	CNC PART PROGRAMMING: 4.1 Three types of CNC control systems. 4.2 Absolute and incremental dimensions methods 4.3 Introduction of part programming. 4.4 Procedure associated with part programming system. 4.5 CNC co ordinate system.	13

4.6 Axes and motion nomenclature 4.7 Structure and format of a part programme 4.8 Word address format. 4.9 Preparatory functions(G code). 4.10 Miscellaneous functions (M codes). 4.11 Circular interpolation using polar co-ordinates and by specifying the radius. 4.12 Various tool compensation. 4.13 Subroutines (Macros). 4.14 Canned cycles. 4.15 Mirror image. 4.16 Thread cutting cycles. 4.17 Constant cutting speed and constant speed programming. 4.18 Programming examples for turning centres. 4.19 Programming examples for machining centres	TOTAL	28
--	--------------	-----------

NOTE: - Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:	Hrs.
1. Prepare conventional process plan for given components	2
2. Study and demonstration of CNC controller's features.	2
3. Demonstration of tool setting, tool handling and tool management system on a CNC machine.	2
4. To understand various modes of operations in CNC machines	2
5. Preparation of CNC part programmers and job for	18
(i) 3 jobs on CNC turning centre.	
(ii) 1 job on CNC turning centre with subroutines/cycle.	
(iii) 1 job on CNC machining centre for 2D contouring, drilling, tapping and slot milling.	
6. Prepare report on industrial visit	
7. Study of various elements of CNC machine	2

Total	28

Reference Books:

1. Mechatronics	HMT.
2. CNC part programming	Pabla
3. CNC machines	Kief
4. CNC machines	Narang & Seharavat
5. Computer aided manufacturing	Kundra , Rao , Tiwari.
6. Production technology	HMT
7. Industrial engineering	O.P Khanna.

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Robotics (Elective)
Subject Code: 2362003

Sr. No.	Subject Content	Total Hrs.
1	INTRODUCTION <ul style="list-style-type: none"> • Robot-definition, need, brief history, social justification • Robot terminology, basic concepts, and key features • Advantages and limitations of robots. 	4
2	ELEMENTS OF ROBOT <ul style="list-style-type: none"> • Basic structure. • Classification of robotic systems <ul style="list-style-type: none"> ➤ According to types of system ➤ According to types of control loop ➤ According to structure of manipulator (Cartesian, cylindrical, spherical, articulated) • Degree of freedom, concept measuring and importance. • Elements: types and functions. • End effectors: types, sketches, working and applications • Drives: types and applications. • Sensing devices : <ul style="list-style-type: none"> ➤ Optical sensors ➤ Proximity sensors ➤ LVDT ➤ Thermocouple, RTD, Thermister ➤ Force sensing – strain gauge, piezoelectric ➤ Acoustic sensing • Control systems : Open loop and close loop with applications and its elements • Robot configurations : (1) stand above (2) in line (3) cycle independent, advantages, limitations and applications. • Selection criteria for robot • Robot machine vision 	11
3	ROBOTIC CONTROLS <ul style="list-style-type: none"> • Purpose • Levels of controls : <ul style="list-style-type: none"> ➤ Device controller ➤ Work cell controller 	14

	<ul style="list-style-type: none"> ➤ Area controller ➤ Plant host • Servo and non servo control systems – Types, basic principles and block diagram • Types, working (with diagrams), and applications of various controls. Types includes following <ul style="list-style-type: none"> ➤ Computed torque technique ➤ New minimum time control ➤ Variable structure control ➤ Non linear decoupled feedback control ➤ Resolved motion control ➤ Adaptive control • Types, electrical hardware, programming languages used, advantages, limitations and specific examples of control systems. Types includes the following <ul style="list-style-type: none"> ➤ Robot as work cell controller ➤ Programmable logic controller ➤ Work cell control with local area networking ➤ Multiple network levels 	
4	INTRODUCTION TO ROBOT PROGRAMMING <ul style="list-style-type: none"> • Need and functions of programming • Methods of robot programming <ul style="list-style-type: none"> ➤ Manual Teaching ➤ Lead through ➤ Programming languages. ➤ Programming with graphics. • Types, features and applications of various programming languages. • Simulation for robot movements 	6
5	ROBOTICS APPLICATIONS, MAINTENANCE & SAFETY <ul style="list-style-type: none"> • Applications of robots (including special types) • Robot maintenance: Need and types. • Common troubles and remedies in robot operation. • General safety norms, aspects and precautions in robot handling 	7
	TOTAL	42

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Robotics Practice (Elective Practice)
Subject Code: 2362010

NOTE: - Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

Practical No.	Title	Total Hrs.
1	Study, demonstrations and critically analyse the robot features, specifications, elements, configurations. (At least two)	4
2	Demonstration of different types of end effectors	2
3	Study and prepare report for any one type of special purpose robot.	2
4	Seminar/group discussion/case study/industrial visit for Subject Content and recent developments in the field of robotics.	4
5	Simulation various robot actions (motions, operations etc.) for different tasks on robotic software	2
6	Critical study of control and control methods (including vision system)	4
7	Practice/ Programming on robot for 4 tasks	10
	TOTAL	28

Reference Books:

- | | | |
|-------------------------------------|----------------------------------|-------|
| 1. Robotics for Engineers | Yoram Koren | MGH |
| 2. Robot applications design manual | Jon Hoshizaki, Emily Bopp | |
| 3. CAD/CAM/CIM | P Radhakrishnan, S. subramaniyam | Wiley |
| 4. Robotics | K S fu | |
| | R Gonzalez | |
| | C S G Lee | |
| 5. Robotic Engineering | Richard k lafter | |
| 6. Robotic application India | Dr. Amitabh Bhattarcharya | |

7. Robot Reliability and safety
8. CAD/CAM
9. Industrial Robotics

B.S.Dhillon

M.P.Grover & Zimmer

M.P. Grovers and Others

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Networking System & Communications (Elective)
Subject Code: 2362006

Sr. No.	Subject Content	Total Hrs.
1	NETWORKING OVERVIEW 1.1 DEFINITION AND ADVANTAGES 1.2 NETWORK HARDWARE 1.3 NETWORK SOFTWARE 1.4 O.S.I. MODEL AND ITS SEVEN LAYERS 1.5 TYPES OF NETWORK: LAN, WAN, MAN, INTRANET, INTERNET	4
2	COMPONENTS OF LAN 2.1 TRANSMISSION MEDIA 2.1.1 TWISTER PAIR CABLE 2.1.2 COAXIAL CABLE 2.1.3 FIBER OPTIC CABLE 2.1.4 WIRELESS MEDIA 2.2 SERVERS 2.3 WORK STATIONS 2.4 CONNECTORS 2.5 NETWORK INTERFACE CARD-NIC 2.6 LAB, REPEATELY BRIDGE, ROUTERS, GATEWAY SWITCHES.	6
3	PROTOCOL AND ADAPTER 3.1 DEFINITION OF PROTOCOL 3.2 IPX/SPX 3.3 TCP/IP 3.4 FTP 3.5 NCP 3.6 ODI 3.7 TOKENING 3.8 TOP 3.9 MAP	6
4	ARCHITECTURE AND TOPOLOGIES 4.1 PEER TO PEER 4.2 CLIENT SERVER 4.3 BUS, STAR, RING, MESH, FREE	4

5	SERVER & WORK STATION 5.1 ADMINISTRATION AND ITS COMMANDS	4
6	INTERNET 6.1 DEFINITION 6.2 FEATURES AND SERVICES 6.2.1 E-MAIL 6.2.2 FILE TRANSFER 6.2.3 REMOTE LOGIN 6.2.4 WWW 6.3 TYPES OF CONNECTION 6.3.1 PC DIAL UP 6.3.2 LAN DIAL UP 6.3.3 DEDICATED LEASED LINE	6
7	INTRODUCTION TO COMMUNICATION 7.1 WHAT IS COMMUNICATION? 7.1.1 USE OF COMMUNICATION 7.1.2 THE STRUCTURE AND TYPES OF COMMUNICATION 7.1.3 DATA COMMUNICATION 7.2 COMMUNICATION CHANNEL CHARACTERISTICS 7.2.1 COMMUNICATION CHANNEL 7.2.2 ELECTROMAGNETIC WAVES 7.2.3 FREQUENCY AND WAVE LENGTH 7.2.4 ELECTROMAGNETIC SPECTRUM 7.2.5 BAND WIDTH	6
8	COMMUNICATION SYSTEM REQUIREMENT 8.1 DATA COMMUNICATION SYSTEM ISSUE 8.2 CODE AND FORMATS 8.3 SYNCHRONOUS & ASYNCHRONOUS SYSTEM 8.4 DATA RATES, SERIAL AND PARALLEL COMMUNICATION 8.5 NETWORK INTERFACE CARD-NIC 8.6 AB, REPEATEDLY BRIDGE, ROUTERS, GATEWAY SWITCHES.	6
TOTAL		42

Reference Books:

- | | | |
|--|---------------|-------|
| 1. Introduction to Networking | - Nance | - PHI |
| 2. Local Area Network | - Tanenbaum | |
| 3. Study-Guide-Networking Essentials | - BPB | |
| 4. The Complete Reference
Netware 4.11 Internet | - Gaskin | - BPB |
| 5. The Complete Reference
Netware 4.1 | - TOM SHELDON | - TMH |

- | | | | |
|---|---|---------------------|-------|
| 6. The Complete Reference
Netware 5. | - | | - TMH |
| 7. Data Communication | - | William L. Schweber | - MGH |
| 8. Data & Computer Communication | | William Stallings | - PHI |

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Networking System & Communication Practice
(Elective Practice)

Subject Code: 2362007

NOTE:- Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

SR NO.	EXPERIMENTS	Hrs.
1	INSTALL AND TEST VARIOUS NETWORK CONNECTORS, CABLES INSTALL AND TEST VARIOUS NETWORK CARDS	4
2	PREPARE COMPUTER SYSTEM FOR NETWORK	2
3	PREPARE WORK STATION FOR REMOTE BOOTING	2
4	INSTALL AND TEST ACTIVE AND PASSIVE HUB	4
5	INSTALL INTERNET DIAL UP CONNECTION AND ITS SOFTWARE	2
6	USE OF INTERNET • SURFING	2
7	• E-MAIL	6
8	STUDY OF ROUTER, REPEATER AND BRIDGE	2
9	APPLICATION OF MODEM AND DATA TRANSFER	2
10	STUDY OF ISDN	2
	TOTAL	28

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Digital Signal Processing (Elective)
Subject Code: 2362008

Sr. No.	Subject Content	Total Hrs.
1	DISCRETE TIME SYSTEM 1.1 Introduction 1.2 Discrete – time signals 1.3 Discrete – time systems 1.3.1 Linearity 1.3.2 Time invariance 1.3.3 Causality 1.3.4 Impulse response and convolution sums 1.3.5 Stability 1.4 Difference equations and time-domain response 1.5 Sampling of continuous – time signals 1.5.1 Basic Principle 1.5.2 Sampling Theorem	8
2	THE z – TRANSFORM 2.1 Introduction 2.2 Definition of the z – transform 2.3 Inverse z – transform 2.3.1 Residue theorem 2.3.2 Partial – fraction expansions 2.3.3 Polynomial division 2.3.4 Series expansion 2.4 Properties of the z – transform 2.4.1 Linearity 2.4.2 Time – reversal 2.4.3 Time – shift theorem 2.4.4 Multiplication by an exponential 2.4.5 Complex differentiation 2.4.6 Complex Conjugation 2.4.7 Real and Imaginary sequences 2.4.8 Initial value theorem 2.4.9 Convolution theorem 2.4.10 Product of two sequences 2.4.11 Parseval's theorem 2.4.12 Table of the basic z – transforms	8

3	FOURIER TRANSFORM 3.1 Introduction 3.2 Fourier Transform 3.3 Properties of the Fourier Transform 3.3.1 Linearity 3.3.2 Time – reversal 3.3.3 Time – shift theorem 3.3.4 Multiplication by an exponential 3.3.5 Complex differentiation 3.3.6 Complex Conjugation 3.3.7 Real and Imaginary sequences 3.3.8 Symmetric and anti symmetric sequences 3.3.9 Convolution theorem 3.3.10 Product of two sequences 3.3.11 Parseval's theorem	4
4	DISCRETE TRANSFORM (DFT) 4.1 Introduction 4.2 Discrete Fourier Transform (DFT) 4.3 Properties of the DFT 4.3.1 Linearity 4.3.2 Time – reversal 4.3.3 Time – shift theorem 4.3.4 Modulation theorem 4.3.5 Circular convolution in time 4.3.6 Correlation 4.3.7 Real and Imaginary sequences 4.3.8 Symmetric and anti symmetric sequences 4.3.9 Parseval's theorem 4.3.10 Relationship between the DFT and z – transform	6
5	FAST FOURIER TRANSFORM (FFT) 5.1 Introduction 5.2 Types of FFT algorithms 5.2.1 Radix – 2 algorithm with decimation in time 5.2.2 Decimation in frequency 5.2.3 Radix – 4 algorithm 5.2.4 Algorithm for arbitrary values of N 5.2.5 Alternative techniques for determining the DFT 5.3 Signal representations	6
6	FIR DIGITAL FILTERS 6.1 Introduction 6.2 Ideal characteristics of standard filters 6.2.1 Low pass, High pass, band pass, and band stop filters 6.2.2 Differentiators 6.2.3 Hilbert transform 6.3 FIR filter approximation by frequency sampling	5

7	IIR DIGITAL FILTERS 7.1 Introduction 7.2 Analog filter approximations 7.2.1 Analog filter specification 7.2.2 Butter worth approximation 7.2.3 Chebshev approximation 7.2.4 Elliptic approximation 7.3 Time domain approximation	5
	TOTAL	42

Reference Books:

1. Digital Signal Processing -Diniz, da Silva and Netto
- Cambridge University
2. Discrete Time Signal Processing -Oppenheim and Schafer -PHI
3. Digital Signal Processing -John Proakis and Manolakis
4. Introduction to DSP -J R Johnson

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Digital Signal Processing Practice (Elective Practice)
Subject Code: 2362009

NOTE:- Following are the minimum experiences required, but the college can do more experiences if possible.

Laboratory Experiences:

Perform specific experiments with MATLAB

1. To study discrete – time systems
2. To study sampling theorem
3. Computation based on Residue theorem
4. Computation based on Polynomial division
5. To study the properties of the z – transform
6. To study the properties of the Fourier transform
7. To study the properties of the DFT
8. To study the types of FFT algorithms
9. To study the characteristics of low pass and high pass FIR filter
10. To study Hilbert Transforms
11. To study Butter worth IIR Filter approximation
12. To study Chebshev IIR Filter approximation

Reference Books:

- | | |
|------------------------------------|-----------------------------|
| 1. Digital Signal Processing | -Diniz, da Silva and Netto |
| | - Cambridge University |
| 2. Discrete Time Signal Processing | -Oppenheim and Schafer |
| | -PHI |
| 3. Digital Signal Processing | -John Proakis and Manolakis |
| 4. Introduction to DSP | -J R Johnson |

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Advance Manufacturing System (Elective)
Subject Code: 2361909

Sr. No.	Subject Content	Total Hrs.
1	INTRODUCTION TO ADVANCE MANUFACTURING SYSTEM(AMS). 1.1 Know the objectives of learning this subject. 1.2 Need, Scope & importance of AMS in industries. 1.3 Need of attitude, knowledge & skill required for application of AMS. 1.4 Recall evolution of transformation & manufacturing systems. 1.5 Concept, components, working and features of Computer Numerical Control (CNC) machine.	3
2	GROUP TECHNOLOGY (GT). 2.1 GT - concept, definition, need, scope, & benefits. 2.2 GT- codification systems , types, importance, part families, part classification and coding systems, examples/case study. 2.3 GT Layout -concept, need, importance, comparison with conventional layout with examples/case study, benefits. 2.4 Computer Aided Process Planning (CAPP) – conventional process planning & examples, CAPP- concept, types, features, methods and importance.	8
3	CELLULER MANUFACTURING. 3.1 Concept and definition, application and benefits. 3.2 Part family and cell formation. 3.3 Composite component and key machine concepts. 3.4 Cell layout and design. 3.5 Job and tool movement within cell. 3.6 Types of cell: manual and automatic cell, assembly cell, comparison of cell and Flexible Manufacturing Cell (FMC).	4
4	JUST IN TIME (JIT). 4.1 JIT concept, meaning, definition, need and reasons to include this concept in AMS. 4.2 Unnecessary elements in conventional manufacturing system with reference to JIT with suitable engineering	3

	<p>examples/ case study.</p> <p>4.3 JIT implementation requirement.</p>	
5	<p>FLEXIBLE MANUFACTURING SYSTEM (FMS).</p> <p>5.1 Flexible Manufacturing Unit (FMU), turn-mill centres, multiple centres, advanced machining centres, etc.</p> <p>5.2 Transfer line- concept, meaning, features & examples.</p> <p>5.3 Flexible Manufacturing System (FMS) -concept, meaning & benefits, major elements and their role.</p> <p>5.4 FMS : layout concept, system, tool handling system, material handling principle and system.</p> <p>5.5 Automated Guided Vehicles (AGV) in FMS- concept, definition, types, functions.</p> <p>5.6 Signal flow diagram, line balancing, Automated Storage and Retrieval System (AS/RS), case examples of FMS for specific components/group of components.</p>	9
6	<p>ROBOTICS.</p> <p>6.1 Introduction</p> <p>6.2 Robots-concept, definition, economic justification, benefits.</p> <p>6.3 Robots-types, classification, various terminology, specification criterion.</p> <p>6.4 Axes nomenclature, elements, control, for each type of robots.</p> <p>6.5 Sensors- types, classifications, working and applications.</p>	6
7	<p>INTEGRATION OF COMPUTER AIDED DESIGN (CAD) WITH COMPUTER AIDED MANUFACTURING (CAM).</p> <p>7.1 Concept, meaning, importance and benefits.</p> <p>7.2 Activities involved in integration of CAD with CAM.</p> <p>7.3 Features and applications of software packages having CAD/CAM integration.</p> <p>7.4 Interfacing: types, standards, features & applications.</p>	3
8	<p>COMPUTER INTEGRATED MANUFACTURING (CIM).</p> <p>8.1 Concept, definition, areas covered and benefits.</p> <p>8.2 CIM: need, block diagram & explanations, importance & features of each terms involved.</p> <p>8.3 Computer Aided Inspection- concept, benefit, types, working and examples, Coordinate Measuring Machine (CMM) - its working and applications.</p> <p>8.4 Protocols in CIM- their features, functions and applications.</p>	3
9	<p>CONCURRENT ENGINEERING (CE).</p> <p>9.1 Introduction</p> <p>9.2 Concept, meaning, terminology, definitions and objective in CE</p>	3

	9.3 Parallel processing & CE team. 9.4 Schemes, their definition and exemplification for CE.	
	Total	42

Reference Books:

1. CAD/CAM/CIM P.Radha krishnan & S.subra narayan
(New Age Intentional)
2. Computer Integrated Manufacturing S.K.Vajpayee
(PHI Publication)
3. Computer Integrated Design & Manufacturing Bedworth, Wolfe and Anderson (McGraw Hill Internationa publication)
4. Automation, Production and Computer integrated Manufacturing Mikell P. Groover, (PHI publication)
5. Mechatronics HMT
6. Mechatronics Bradleg and Offers (Chapman and Hall publication)
7. Introduction to Robotics Arthur J. Critchlow (Mc Millan publication)
8. Robotics for engineers Yorom Koran (Mc G.H. Publication)
9. Practical Robotics Willium C. Burns Jr. & Janet Evans worthington (PHI publication)
10. Computer aided manufacturing Rao, Tiwari & Kundra (TMGH Publication)
11. Computer automated Manufacturing John H. Powers Jr. (Mc GH Publication)
12. CAD/CAM/FOF, Vol I,II, & III Juneja, Pujara & Sagar TMGH)
13. Production and operations management Chase/Aquilano (Irwin publication)

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Advance Manufacturing System Practice (Elective Practice)
Subject Code: 2361910

NOTE: - Following are the minimum experiences required, but the college can do more experiences if possible.

LABORATORY EXPERIENCES :			
Experience Type	Experience Number	Description of Laboratory Experience	Total Hrs.
Preparatory	1	1. Appreciate main objectives of learning this subject: a. Strengthen the fundamentals of machining processes and computers. b. Familiarise with advance manufacturing systems. c. Appreciate the need of higher mental ability and skill level to work with advance systems. 2. Recall and strengthen know-how for various machining processes and industrial management functions.	2
Study and demonstration	2	Various sensors and their applications.	2
	3	Flexible manufacturing system with protocols.	2
	4	Various robotics applications.	2
Performance	5	Develop GT codes in suitable part coding system for approximately 12 to 15 components. Ask each student to bring at least one component (having more than 5-6 operations) and also ask him/her to draw it and make the process plan including details of tools required.. Then the data will be interchanged by batch students. Also prepare feature matrix for all components. (Note : Collection of parts and making drawing and process plan as home assignment.)	4
	6	a) Learn fundamentals of any one database	4

		software operation. b) Prepare database for experience number 5 and analyse this database for formation of various groups.	
	7	a) Prepare block diagram/structure for any group developed in exercise no.6 for use in Computer Aided Process Planning (CAPP). b) Estimate the time for each operation of each component of group. c) Assuming data on quantity of each component of group, calculate total time for each process.	4
	8	Develop conceptual FMS model for any one group formed in experience number 6. Also explain steps & procedure for model. This exercise should be held in a group of 3-4 students & group should represent seminar for the model developed. Develop at least three models in a batch.	4
Download and seminar presentation, (Copy downloaded content and seminar of whole batch In one /one set of CD/DVD)	9	a) Prepare and present seminar individually in your batch. (Seminar topic has to be given by teacher). b) Download individually visual aids, movies, content and other related content for the given case/situation. (Case/situation has to be given by teacher-preferably from emerging/ recent trends).Present and discuss the same in your batch.	4
Industrial visits	10	Visit at least two related industries.	-
Assignments (Home Assignment)	11	Solve the given tutorials and assignments. One assignment must be on preparation of chart / diagram / poster / graph / drawing / etc on half imperial size of drawing sheet.(For subject AMS).	-
		Total	28

Reference Books:

- | | |
|---|--|
| 1. CAD/CAM/CIM | P.Radha krishnan & S.subra narayan
(New Age Intentional) |
| 2. Computer Integrated Manufacturing | S.K.Vajpayee
(PHI Publication) |
| 3. Computer Integrated Design & Manufacturing | Bedworth, Wolfe and Anderson (McGraw Hill International publication) |
| 4. Automation, Production and Computer integrated Manufacturing | Mikell P. Groover, (PHI publication) |

- | | | |
|-----|--------------------------------------|--|
| 5. | Mechatronics | HMT |
| 6. | Mechatronics | Bradleg and Offers (Chapman and Hall publication) |
| 7. | Introduction to Robotics | Arthur J. Critchlow (Mc Millan publication) |
| 8. | Robotics for engineers | Yorom Koran (Mc G.H. Publication) |
| 9. | Practical Robotics | William C. Burns Jr. & Janet Evans worthington (PHI publication) |
| 10. | Computer aided manufacturing | Rao, Tiwari & Kundra (TMGH Publication) |
| 11. | Computer automated Manufacturing | John H. Powers Jr. (Mc GH Publication) |
| 12. | CAD/CAM/FOF, | Vol I,II, & III Juneja, Pujara & Sagar (TMGH) |
| 13. | Production and operations management | Chase/Aquilano (Irwin publication) |

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Hydraulic and Pneumatic Devices. (Elective)
Subject Code: 2361917

Sr. No.	Subject Content	Total Hrs.
1	<p>CONTROL SYSTEMS.</p> <p>1.1 Know the objectives of learning this subject.</p> <p>1.2 Need, Scope & importance of Hydraulic and Pneumatic Devices (HPD).</p> <p>1.3 Need of attitude, knowledge & skill required for application of HPD.</p> <p>1.4 Control system-concept, definition , need, important terminology used.</p> <p>1.5 Open loop and close loop control systems-block diagrams, differences and applications.</p> <p>1.6 Servo control system-concept and application.</p>	3
2	<p>FUNDAMENTALS OF HYRAULICS.</p> <p>2.1 Hydrostatic and hydrodynamic-concept and definitions.</p> <p>2.2 Laws governing fluid flows-Pascal's law, continuity equation and Bernoulli's theorem.</p> <p>2.3 Flow through pipes-types, pressure drop in pipes.</p> <p>2.4 Working fluids used in hydraulic systems-types, properties, designation, standards and selection criteria.</p> <p>2.5 Hydraulic systems-concept, application areas, advantages and limitations.</p>	3
3	<p>HYDRAULIC ELEMENTS.</p> <p>3.1 Hydraulic pipes-types, materials, designations and standards, properties, pressure ratings and selection criteria.</p> <p>3.2 Piping layout – concept, guiding rules/norms/traditions.</p> <p>3.3 Hydraulic pump- types, construction, working, mounting methods, applications and selection criteria.</p> <p>3.4 Control valves – types, designations, standards, working, mounting methods, applications and selection criteria.</p> <p>3.5 Actuators- types, designations, standards, working, mounting methods, applications, synchronization and selection criteria.</p> <p>3.6 Other elements, fittings and accessories-types (such as strainers, filters, distributors, manifold, accumulator, coolers, heat exchangers, hoses, connectors, oil reservoir, oil purifier, oil level and pressure indicators, seals, etc.), designations, standards, working, mounting methods,</p>	5

	applications and selection criteria.	
4	<p>HYDRAULIC CIRCUIT.</p> <p>4.1 Concept, meaning and ISO symbols used.</p> <p>4.2 Basic hydraulic circuits-types, circuit diagrams, working and applications.</p> <p>4.3 Logic circuits-types, symbols and truth tables.</p> <p>4.4 Guiding rules/norms/steps/methods for designing hydraulic circuit.</p> <p>Simple circuit design(at least two design based on given problems/situation and based on selection and arrangement of elements)- circuit diagram, list of elements with specifications, working, metering in and metering out control circuits.</p>	6
5	<p>HYDRAULIC DEVICES, INSTALLATION AND MAINTENANCE.</p> <p>5.1 Hydraulic devices-types(automotive hydraulic brake , material handling trolley/forklift, power pack, hydraulic jack, automotive power steering), working diagram, hydraulic circuit, working, major elements and their specifications, controls, performance variables/criteria, applications, general guidelines for operation.</p> <p>5.2 Installation of hydraulic devices (covered in 5.1 above)-need, pre-preparation, connection methods for hydraulic circuit, procedure and testing.</p> <p>5.3 Common troubles ,its causes and preventive/post remedial actions for hydraulic devices covered in 5.1 above.</p> <p>5.4 Need for preventive maintenance and maintenance schedule for hydraulic devices, general guidelines for maintenance.</p> <p>5.5 Critical spares and their need/importance for their stock for hydraulic devices.</p> <p>5.6 Instruments/methods for common fault finding.</p>	5
6	<p>FUNDAMENTALS OF PNEUMATICS.</p> <p>6.1 Compressible fluid flow-properties, applicable laws(Boyel's, Charles', Lussac's combined) , mass flow rate.</p> <p>6.2 Compressible fluids-types, properties and applications.</p> <p>6.3 Pneumatic systems-advantages and limitations.</p>	2
7	<p>PNEUMATIC ELEMENTS.</p> <p>7.1 Pipe-materials, types, standards and designations, properties, applications.</p> <p>7.2 Piping layout-concept, loop systems, guiding rules/norms/traditions, pressure drop.</p> <p>7.3 Air compressor-types and selection criteria.</p> <p>7.4 Air receiver-specification, working, capacity control.</p> <p>7.5 Driers-types, working and selection criteria.</p> <p>7.6 Pneumatic cylinders-types, cushion assemblies, types of mounts, construction materials, lubrication, installation and maintenance.</p> <p>7.7 Air motors-types and working.</p> <p>7.8 Pneumatic valves-types, standards and designations, working, mounting</p>	5

	<p>methods, applications and selection criteria.</p> <p>7.9 Other fittings/elements and accessories-types and sub-types(such as filters, pressure regulator, lubricator, mufflers), working, standards and designations applications and selection criteria.</p>	
8	<p>PNEUMATIC CIRCUIT.</p> <p>10.1 Concept, meaning and ISO symbols used.</p> <p>8.2 Guiding rules/norms/steps/methods for designing pneumatic circuit.</p> <p>8.3 Basic pneumatic circuits- types, circuit diagrams, working and applications.</p> <p>8.4 Simple circuit design(at least two design based on given problems/situation and based on selection and arrangement of elements)- circuit diagram, list of elements with specifications and working.</p>	6
9	<p>PNEUMATIC DEVICES, INSTALLATION AND MAINTENANCE.</p> <p>9.1 Pneumatic devices-types,(pneumatic brake, air suspension system of automotive, pneumatic drill) working diagram, hydraulic circuit, working, major elements and their specifications, controls, performance variables/criteria, applications, general guidelines for operation.</p> <p>9.2 Safety and cleanliness for pneumatic devices.</p> <p>9.3 Installation of pneumatic devices mentioned at 9.1 above,- need, pre-preparation connection method for pneumatic circuit.</p> <p>9.4 Common troubles ,its causes and preventive/post remedial actions for pneumatic devices covered in 9.1 above.</p> <p>9.5 Need for preventive maintenance and maintenance schedule for pneumatic devices, general guidelines for maintenance.</p> <p>9.6 Critical spares and their need/importance for their stock for pneumatic devices.</p> <p>9.7 Instruments/methods for common fault finding.</p>	5
10	<p>HYDROPNEUMATICS.</p> <p>10.1 Introduction, elements, working and applications.</p> <p>10.2 Types of feed.</p> <p>10.3 Introduction to integration of hydraulic/pneumatic circuit with microprocessor/microcontroller/programmable logic controller (PLC).</p>	2
	Total	42

Reference Books:

- | | |
|--|--|
| 1. Mechatronics | W.Bolten (Pearsons) |
| 2. Hydraulic and Fluid mechanics and Hydraulic machineries | Abdula Sharrif and others (Dhanapatrai publications) |
| 3. Fluid power design handbook | Frank Yeaple |
| 4. Hydraulic & Hydraulic machineries | TTTI, Madras. |
| 5. Process control | Peter Harriott(TMGH) |

6. Automatic process control

Donald P. Eckman(Wiely

7. Hydraulic machines including fluidics

Eastern)

Dr.Jagdishlal(metropolitine
book co., NewDelhi.

8. Industrial pneumatic control

Z.J.Lansky(Marcel Dekker, Inc.

GUJARAT TECHNOLOGICAL UNIVERSITY
DIPLOMA IN MECHATRONICS ENGINEERING
SEMESTER- VI

Subject Name: Hydraulic and Pneumatic Devices Practice
(Elective Practice)

Subject Code: 2361918

NOTE: - Following are the minimum experiences required, but the college can do more experiences if possible.

LABORATORY EXPERIENCES :			
Experience Type	Experience Number	Description of Laboratory Experience	Total Hrs.
Preparatory	01	3. Appreciate main objectives of learning this subject: a. Read/interpret given hydraulic/pneumatic circuit. b. Operate , maintain and assemble simple hydraulic and pneumatic devices/elements. c. Identify and rectify simple and common troubles of hydraulic and pneumatic devices. 4. Strengthen know how for fundamental fluid mechanics units and systems.	2
Study and demonstration	02	Major hydraulic elements and at least three devices.	2
	03	Major pneumatic elements and at least three devices.	2
	04	Computer based hydraulic and pneumatic system circuit designs.	2
Performance	05	Test various logic circuits for hydraulics and pneumatics.	2
	06	Design, assemble and operate hydraulic system, based on given simple system requirement (Design mainly include selection and arrangement of elements).	4
	07	Design, assemble and operate pneumatic system, based on given simple system requirement (Design	4

		mainly include selection and arrangement of elements)	
	08	Take any two hydraulic devices/elements (eg. Power pack, cylinder, hydraulic jack, hydraulic brake), make system diagram, dismantle and assemble them.	6
	09	Take any two pneumatic devices/elements (eg. Pneumatic brake, cylinder, air suspension, pneumatic drill), make system diagram, dismantle and assemble them.	
Download and seminar presentation, (Copy downloaded content and seminar of whole batch In one /one set of CD/DVD)	10	c) Prepare and present seminar individually in your batch. (Seminar topic has to be given by teacher). d) Download individually visual aids, movies, content and other related content for the given case/situation. (Case/situation has to be given by teacher)Present and discuss the same in your batch.	4
Industrial visit	11	Visit at least two related industries.	-
Assignments (Home Assignment)	12	Solve the given tutorials and assignments. One assignment must be on preparation of chart / diagram / poster / graph / drawing / etc on half imperial size of drawing sheet.(For subject Mechatronics).	-
		Total	28

Reference Books:

- | | |
|--|--|
| 1. Mechatronics | W.Bolten (Pearsons) |
| 2. Hydraulic and Fluid mechanics and machineries | Abdula Sharrif and others Hydraulic (Dhanapatrai publications) |
| 3. Fluid power design handbook | Frank Yeaple |
| 4. Hydraulic & Hydraulic machineries | TTTI, Madras. |
| 5. Process control | Peter Harriott(TMGH) |
| 6. Automatic process control | Donald P. Eckman(Wiely Eastern) |
| 7. Hydraulic machines including fluidics | Dr.Jagdishlal(metropolitine i. book co., NewDelhi. |
| 8. Industrial pneumatic control | Z.J.Lansky(Marcel Dekker, Inc. |