MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI

TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES

COURSE NAME : DIPLOMA IN INDUSTRIAL ELECTRONICS

COURSE CODE : IE

DURATION OF COURSE : 6 SEMESTERS for IE and 8 SEMESTERS for IU **WITH EFFECT FROM 2012-13**

SEMESTER : SIXTH **DURATION : 16 WEEKS**

PATTERN : FULL TIME-SEMESTER **SCHEME : G**

SR. NO.	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			EXAMINATION SCHEME									SW (17600)
							PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)		
				TH	TU	PR		Max	Min	Max	Min	Max	Min	Max	Min	
1	Management $	MAN	17601	03	--	--	1&½	50#*	20	--	--	--	--	--	--	50
2	Industrial Drives	IDR	17667	04	--	02	03	100	40	25#	10	--	--	--	--	
3	Industrial Automation	IAU	17664	03	--	04	03	100	40	25#	10	--	--	25@	10	
4	Embedded Systems β	ESY	17658	03	--	02	03	100	40	50#	20	--	--	25@	10	
5	**Elective (Any One)**															
	Very Large Scale Integration	VLS	17659	03	--	02	03	100	40	--	--	--	--	25@	10	
	Mechatronics	MEC	17660	03	--	02	03	100	40	--	--	--	--	25@	10	
6	Simulation Software β	SSO	17807	--	--	02	--	--	--	--	--	--	--	25@	10	
7	Industrial Project β	IPR	17808	--	--	04	--	--	--	--	--	50#	20	50@	20	
			TOTAL	**16**	**--**	**16**	**--**	**450**	**--**	**100**	**--**	**50**	**--**	**150**	**--**	**50**

Student Contact Hours Per Week: **32 Hrs.**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.

Total Marks **: 800**

@- Internal Assessment, # - External Assessment, [ ] No Theory Examination, $ - Common to all branches, #* - Online Theory Examination,

β - Common to ET / EJ / EN / EX / IS / IC / DE / EV / IU / ED / EI / MU

Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work.

- Conduct two class tests each of 25 marks for each theory subject. Sum of the total test marks of all subjects is to be converted out of 50 marks as sessional work (SW).
- Progressive evaluation is to be done by subject teacher as per the prevailing curriculum implementation and assessment norms.
- Code number for TH, PR, OR and TW are to be given as suffix 1, 4, 8, 9 respectively to the subject code.

Course Name : All Branches of Diploma in Engineering / Technology

Course Code : EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/CO/CM/IF/ CW/EE/EP/EU/CH/CT/PS/CD/ED/EI/CV/FE/IU/MH/MI/TX/TC/FG

Semester : Sixth for EJ/EN/ET/EX/EV/IC/IE/IS/MU/DE/ME/PG/PT/AE/CE/CS/CR/ CO/CM/IF/CW/EE/EP/EUCH/CT/PS/TX/TC/FG and Seventh for MH/MI/CD/ED/EI/ CV/FE/IU

Subject Title : Management

Subject Code : 17601

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	--	1&½	50#*	--	--	--	50

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head of tests Sessional Work (SW).**
-

Rationale:

Management concepts are universal and it is a multidisciplinary subject. They are equally applicable to different types industries like Manufacturing, Service and Trade as well as different kind of business activities like industry, army, school, hospital, retail shops etc. Also, at the end of diploma course polytechnic students are expected to enter in to the Industrial Environment. This environment is altogether different and new to the students. A proper introduction and understanding of management fundamentals is therefore essential for all these students.

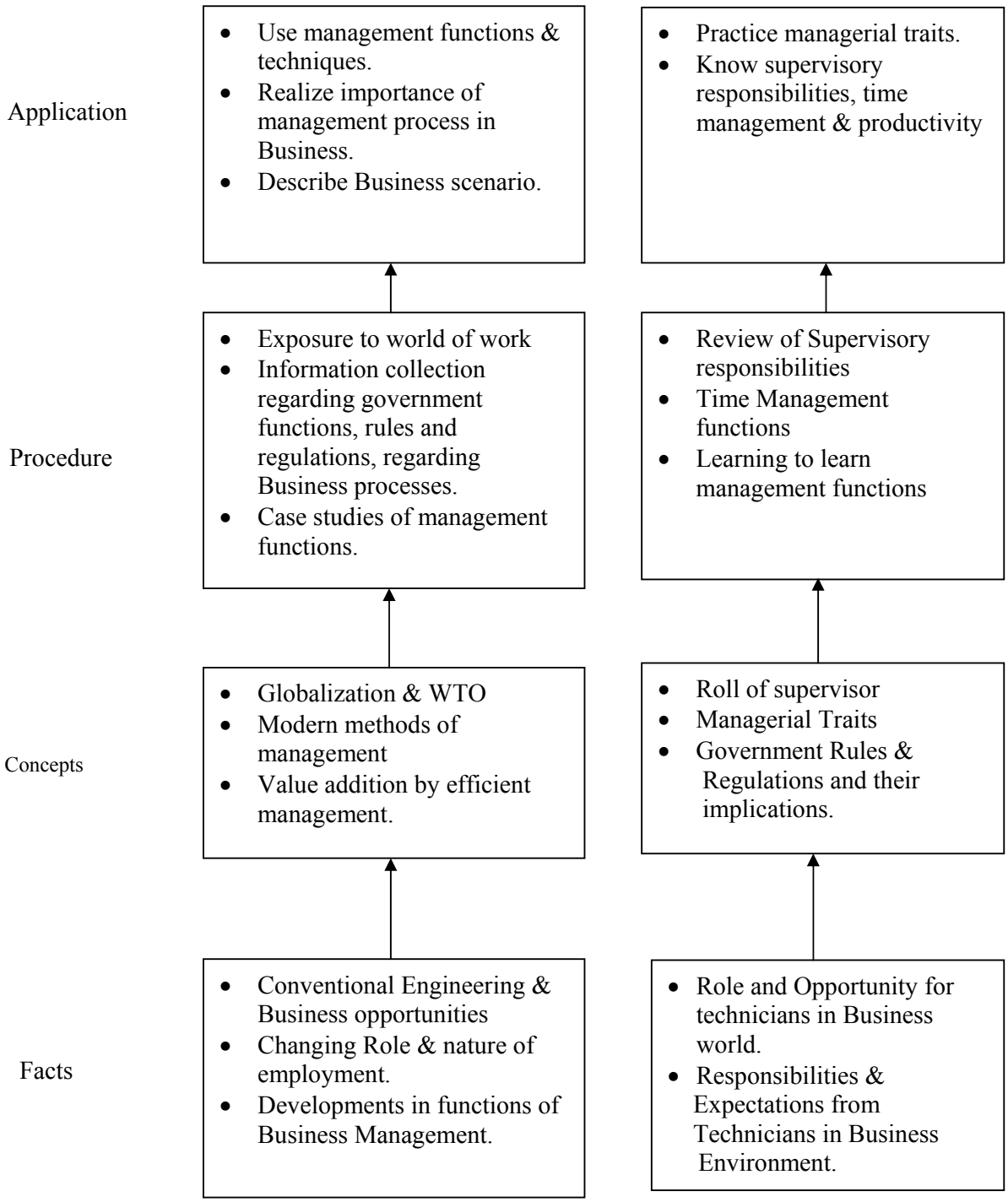
Contents of the this subject will enable the students to address various issues related to human resource, finance, materials, legislations etc. by use of basic principles of management. This will ensure that students will play their role effectively to enhance the quality of business output in total.

Objective:

The students will able to:

1. Get familiarized with environment related to business processes.
2. Know the management aspects of the organisations.
3. Understand Role & Responsibilities of a Diploma engineer.
4. Understand importance of quality improvement techniques.
5. Appreciate need and importance of safety in industries.
6. Understand process of Industrial finance and its management.
7. Know the latest trends in industrial management.

Learning Structure:



Contents: Theory

Topic and Contents	Hours	Marks
Topic 1: Overview of Business **Specific Objectives** ➢ State various business types and sectors ➢ Describe importance of globalisation 1.1. Types of Business • Service • Manufacturing • Trade 1.2. Industrial sectors Introduction to • Engineering industry • Process industry • Textile industry • Chemical industry • Agro industry • IT industry • Banking, Insurance, Retail, Hospitality, Health Care 1.3 Globalization • Introduction • Advantages & disadvantages with respect to India	02	04
Topic 2: Management Process **Specific Objectives** ➢ State various management principles ➢ Describe different management functions 2.1 What is Management? • Evolution • Various definitions of management • Concept of management • Levels of management • Administration & management • Scientific management by F.W.Taylor 2.2 Principles of Management (14 principles of Henry Fayol) 2.3 Functions of Management • Planning • Organizing • Directing • Controlling • Decision Making	08	08
Topic 3: Organisational Management **Specific Objectives** ➢ Compare different forms of organisation , ownership for a specific business ➢ Describe types of departmentation 3.1 Organization : • Definition	08	08

• Steps in organization 3.2 Types of organization • Line • Line & staff • Functional • Project 3.3 Departmentation • By product • By process • By function 3.4 Principles of Organisation • Authority & Responsibility • Span of Control • Effective Delegation • Balance ,stability and flexibility • Communication 3.5 Forms of ownership • Proprietorship • Partnership • Joint stock • Co-operative Society • Govt. Sector		
Topic 4: Industrial Safety and Legislative Acts **Specific Objectives** ➢ Describe types of accidents & safety measures ➢ State provisions of industrial acts. 4.1 Safety Management • Causes of accidents • Types of Industrial Accidents • Preventive measures • Safety procedures 4.2 Industrial Legislation - Necessity of Acts Important Definitions & Main Provisions of following acts: • Indian Factory Act • Workman Compensation Act • Minimum Wages Act	08	06
Topic 5: Financial Management (No Numerical) **Specific Objectives** ➢ Explain functions of financial management ➢ State the sources of finance & types of budgets. ➢ Describe concepts of direct & indirect taxes. 5.1 Financial Management- Objectives & Functions 5.2 Capital Generation & Management • Types of Capitals - Fixed & Working • Sources of raising Capital - Features of Short term, Medium Term & Long Term Sources 5.3 Budgets and accounts • Types of Budgets	08	08

• Fixed & Variable Budget - Concept • Production Budget - Sample format • Labour Budget - Sample format • Profit & Loss Account & Balance Sheet - Meaning, sample format, meaning of different terms involved. 5.4 Meaning & Examples of - • Excise Tax • Service Tax • Income Tax • Value Added Tax • Custom Duty •		
Topic 6: Materials Management (No Numerical) **Specific Objectives** ➢ Describe concept of inventory, ABC analysis & EOQ. ➢ Describe purchase functions & procedures ➢ State features of ERP & MRP 6.1 Inventory Concept, its classification, functions of inventory 6.2 ABC Analysis - Necessity & Steps 6.3 Economic Order Quantity Concept, graphical representation, determination of EOQ 6.4 Standard steps in Purchasing 6.5 Modern Techniques of Material Management • Material Resource Planning (MRP) - Functions of MRP, Input to MRP, Benefits of MRP • Enterprise Resource Planning (ERP) - Concept, list of modules, advantages & disadvantages of ERP	08	08
Topic 7: Quality Management **Specific Objectives** ➢ State Principles of Quality Management ➢ Describe Modern Technique & Systems of Quality Management 7.1 Meaning of Quality Quality Management System - Activities, Benefits Quality Control - Objectives, Functions, Advantages Quality Circle - Concept, Characteristics & Objectives Quality Assurance - Concept, Quality Assurance System 7.2 Meaning of Total Quality and TQM Components of TQM - Concept, Elements of TQM, Benefits 7.3 Modern Technique & Systems of Quality Management like Kaizen,5'S',6 Sigma 7.4 ISO 9001:2000 - Benefits, Main clauses.	06	08
Total	**48**	**50**

Learning Resources:
Books:

Sr. No	Author	Name of Book	Publisher
01	Dr. O.P. Khanna	Industrial Engineering & Management	Dhanpat Rai & Sons New Delhi
02	Banga & Sharma	Industrial Engineering & Management	Khanna Publication
03	Dr. S.C. Saksena	Business Administration & Management	Sahitya Bhavan Agra
04	W.H. Newman E. Kirby Warren Andrew R. McGill	The process of Management	Prentice- Hall

E Source:

nptel.iitm.ac.in
http://iete-elan.ac.in/subjects/amIndustrialMgmt.htm

Course Name : Diploma in Industrial Electronics

Course Code : IE/IU

Semester : Sixth for IE and Seventh for IU

Subject Title : Industrial Drives

Subject Code : 17667

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
04	--	02	03	100	25#	--	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

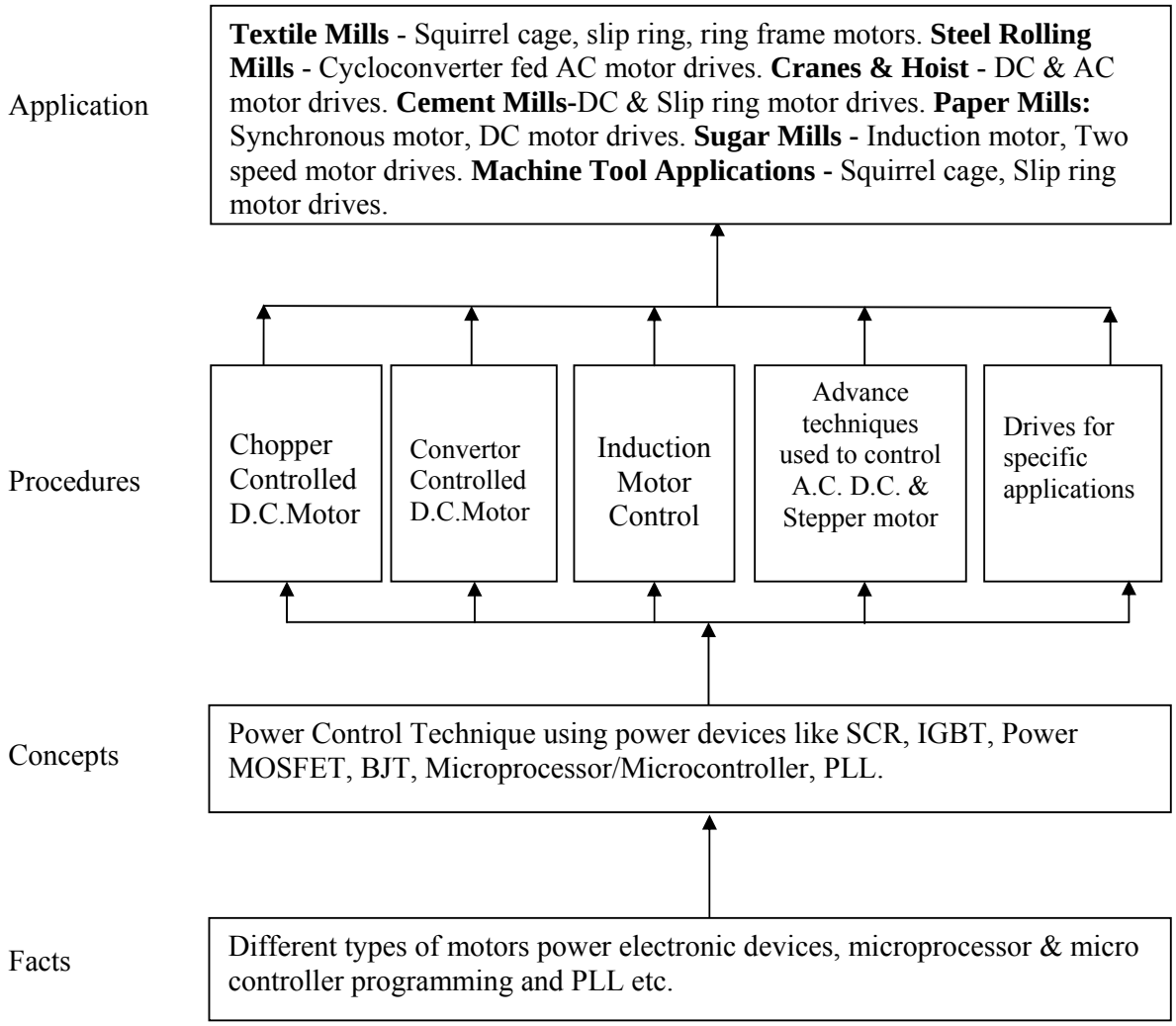
This Subject is introduced in curriculum to enable students to understand the role of industrial drives in modern industries. Development of industrial drives is based on Industrial Electronics devices and circuits. Industrial drives using Microcontroller, PLC and CNC are invariably used in modern manufacturing processes. Use of industrial drives improves performance, efficiency, quality of product and also provides better safety.

General Objectives:

The students will be able to

1) Understand applications of various drives
2) Understand different control techniques in different types of drives.
3) Understand the performance of drives through output waveforms.
4) Understand techniques of operation, maintenance and control the drives for specific applications.

Learning Structure:



Contents Theory:

Topic and Contents	Hrs.	Marks
Topic 1) Fundamentals of Drives **Specific objectives:** ➢ **Identify appropriate Drive** ➢ **Select appropriate prime mover** ➢ **Classify different drives** ➢ **Identify suitable starting and Braking method** **Contents:** • Review of AC, DC motors(No marks) • Need of drives • Block Diagram of Basic Elements of drives ,advantages of electric motor as prime mover • Classification / Types of drives • Need of adjustable speed drives. • Four quadrant operation of drive • Comparison of AC and DC drives. • Selection criteria of drives and specifications • Definition of Stability , Condition of stability, stable, unstable and neutral state of stability of drives (No mathematical analysis) • State Starting and braking methods, advantages of electrical braking.	10	16
Topic 2) Chopper Controlled DC Drives **Specific objectives:** ➢ **Realize the working of chopper controlled drives** **Contents:** • Construction, Working, Types, Characteristics of DC Shunt & Series Motor • DC Chopper using power MOSFET • Classification of chopper controlled drives (I, II , IV Quadrants) • Basic Circuit &Working of single, two, four quadrant chopper drives with waveforms. • Working of multiphase chopper drives with waveform and its advantages	06	12

Topic 3) SCR Controlled DC Drives **Specific objectives:** ➢ **Realize operation of converter controlled drives** ➢ **Identify converter controlled drives** **Contents:** • Classification of SCR controlled drives. • Basic Circuit diagram, working with waveforms, equation of average armature voltage and application of drives: a) Single phase 1) Half wave converter 2) Semi converter 3) Full Wave converter 4) Dual converter b) Three Phase 1) Half wave converter 2) Semi converter 3) Full Wave Converter 4) Dual Converter • Comparison between single phase and three phase drives. • Advantages of converter controlled drives. (No derivation, simple numericals using formulae, no waveforms for three phase drives) • Importance of phase failure protection in three phase drives.	14	16
Topic 4) AC Drives **Specific objectives:** ➢ **Draw & realize operation of AC drives** ➢ **Realize the technique of Maintenance and operate drives.** **Contents:** • Review of AC motors • Advantages of converter fed induction motor • Relation between speed, frequency & number of poles(Simple numerical) • Different methods of speed control of IM • Block diagram & working of a) Stator voltage control b) Rotor voltage control c) Frequency control d) stator voltage / frequency control d) Rotor resistance control • Block diagram & working of closed loop control of synchronous motors • Block diagram & working of V/f control using square wave inverter • Block diagram & working of PWM control of induction motor. • Block diagram & working of rotor resistance control using chopper. • Comparison between stator voltage control, constant V/f control & rotor resistance control.	16	20
Topic 5) Advance Techniques of Motor Control **Specific objectives:** ➢ **Realize the operation of Microprocessor/microcontroller controlled drives.** ➢ **Identify the suitable advance technique** **Contents:** • Advantages of microcontroller/ microprocessor based control for drives • Functions of microcontroller/ microprocessor in speed control of drives • Block diagram & working of Phase locked loop control of DC	10	20

motor • Block diagram & working of Microcomputer control of DC motor drive • Block diagram & working of Microcontroller / microprocessor control • of Synchronous Motor drives • Ratings & specifications of stepper motor • Block diagram & working of stepper motor drives employing microcontroller (No programming)		
Topic 6) Drives for Specific Applications **Specific objectives:** ➢ **Identify suitable drives for a specific application** ➢ **Identify suitable drives at different stages** **Contents:** Sequence of stages & drives required at each stage for following applications. • Textile Mills • Steel Rolling mills • Elevators • Paper Mills • Sugar Mills • Machine Tool Applications	08	16
TOTAL	**64**	**100**

Practical:
Skills to be developed:
Intellectual Skills:

1. Select prime mover, power devices, converters.
2. Select methods to control drives.
3. Select microcontroller software.
4. Identify faults.

Motor Skills:

1. Measure speed, torque other parameters
2. Repair and commissioning of drivers.
3. Develop plant layout.
4. Use of software.
5. Testing of Drives

List of Practicals

1. Speed control of DC Motor using armature voltage control method.
2. Speed control of DC Motor using field current control method.
3. Measure the output voltage of chopper for resistive load by varying the frequency and /or duty cycle of chopper.
4. Effect on speed of given D.C. series motor by varying armature voltage using step down chopper.
5. Effect on speed of given D.C. separately excited motor by varying voltage using step down chopper.
6. Variation in armature voltage of given separately exited motor by changing the firing angle of SCR using single Phase semi converter & measure the speed.

7. Variation in armature voltage of given separately exited motor by changing the firing angle of SCR using single phase full converter & measure the speed.
8. Verification of V/f control using frequency controlled AC drive.
9. Plot graph of speed v/s stator voltage by using programmable frequency control.
10. Speed control of synchronous motor drives using microcontroller.
11. Demonstration of High power SCR & Heat sink. List their specifications & rating.

List of Assignments

1. Collect information about the specifications of the various drives and compare them.

Learning Resources:

Books:

Sr. No.	Title	Author	Publisher
01	Electric drives	Vedam Subrahmanyan	TATA McGraw Hill
02	Power Electronics - Circuits, Devices, and Applications	Muhammad H Rashid	Pearson
03	Electrical Technology Volume - II, A.C,D.C.Machines	B.L.Theraja A.L.Theraja	S.Chand & Company
04	Industrial Electronics & Control	S.K.Bhattacharya & S. Chaterjee.	TATA McGraw Hill

Course Name : Diploma in Instrumentation / Instrumentation Control / Industrial Electronics

Course Code : IS/IC/IE/IU

Semester : Sixth for IS/IC/IE and Seventh for IU

Subject Title : Industrial Automation

Subject Code : 17664

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	04	03	100	25#	--	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

The subject is classified under applied technology group. It teaches the students Programmable Logic Controller (PLC) system used in automation industries for application such as pick and place, welding, spray painting, cutting, drilling, transportation of the objects etc.

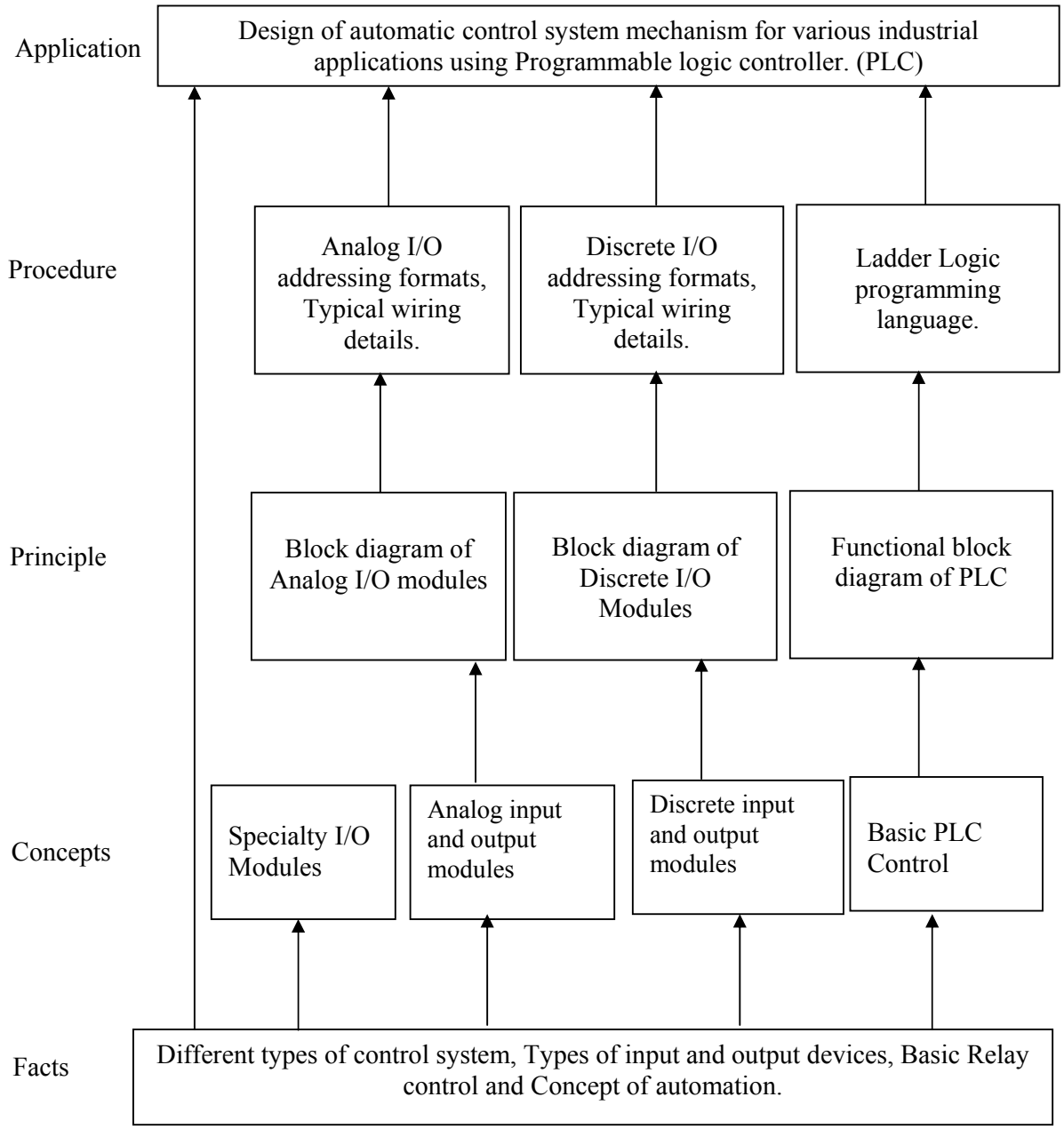
This subject will explore what a PLC is , operation, usage, Instructions, hardware selection and configuration, applications, introductory programming examples and exercises and some troubleshooting hints of PLC system.

General Objectives:

The student will be able to:

1. Know the new advanced system used in industrial as well as at domestic level.
2. Identify and understand different parts of PLC and different languages used in PLC.
3. Select PLC hardware configuration for given application.
4. Prepare a Ladder logic Program for a given applications.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
Topic 1: Introduction to Automation Specific Objectives: ➢ Understand the need of automation in industries ➢ Understand different automation tools. Contents: 1.1 **Automation** – Definition, Need, Benefits, Different tools for automation [4]	02	04
Topics 2: PLC Fundamentals ➢ Know about basics of PLC. ➢ Understand functions diff. parts of PLC. ➢ Understand working of diff. specialty modules. 2.1 Evolution of PLC in automation, difference between relay control and PLC Control. [02] 2.2 **Block diagram and description of different parts**: [10] • **CPU** - Function, scanning cycle, speed of execution. • **Power supply**- function, Block diagram. • **Memory** – function & organisation of ROM & RAM • **Input modules**- function, diff. input devices used with PLC(only name & their uses) • **Output modules**- function, diff. output devices used with PLC(only name & their uses) • Fixed and Moduler PLCs & their types. 2.3 [04] • **Specialty I/O modules**: communication module, high speed encoder, RTD input module, stepper motor control module, thermocouple module. • Redundancy in PLC modules.	08	16

Topics 3: PLC Hardware ➢ Understand the details of diff. I/O modules of PLC. ➢ Understand their wiring connections. ➢ Select a proper type of module for specific application. **3.1** [**10**] • **Discrete input modules:** ➢ **AC input modules**- block diagram, description, typical wiring details, specifications. ➢ **DC input modules**- block diagram, description, typical wiring details, sinking and sourcing concept & specifications. • **Analog input modules**- block diagram, description, typical interfacing of input devices & specifications. **3.2** [**12**] • **Discrete output modules:** ➢ **AC output modules**- block diagram, description, typical wiring, and specifications. ➢ **DC output modules**- block diagram, description, typical wiring details, sinking and sourcing connections & specifications. ➢ Relay and Isolated o/p modules.(only description) • **Analog output modules**- block diagram, description, typical wiring details & specifications. • I/O module selection criterion.	10	22
Topics 4: PLC Instruction Set ➢ Get familiar with the instruction set of PLC system. ➢ Understand the I/O addressing of PLC. **4.1** [**4**] • I/O addressing of PLC. • **Relay type instructions** - NO, NC, One shot, Latch, and Unlatch. **4.2** **[8]** • **Timer instructions** - On delay timer, off delay timer, Retentive timer, and Timer reset. • **Counter instructions** - up counter, down counter, high speed counter, counter reset. **4.3** **[4]** • **Comparison instructions** – Equal, Not equal, Greater, Greater than equal, Less, Less than equal. • **Data handling instructions** – Move, Masked Move, and Limit test. • **Logical instructions** – AND, OR, EX-OR, NOT. **4.4** [**6**] • **Miscellaneous instructions** – Sequencer instructions, scale with parameter, subroutine and PID instructions.	10	22
Topic 5: PLC Programming and Applications ➢ Understand different programming languages of PLC ➢ Develop programming skills using simple programming examples. ➢ Prepare ladder program for different industrial applications. **5.1** **[4]** • Different PLC programming languages (only introduction) - FBD, Instruction list, structured text, sequential function chart, and ladder	12	24

logic. **5.2** [**8**] • Simple programming examples using ladder programming language based on relay, timer, counter, logical, comparison, Data handling and miscellaneous instruction. **5.3** [**12]** • Application development based on description such as- 1. Motor sequence control. 2. Traffic light control. 3. Elevator control. 4. Tank level control. 5. Reactor control. 6. Conveyor system. 7. Stepper motor control. (Any specific application can be considered in each above area to develop a ladder program) • Speed Control of AC/ DC Motor using Programmable Drives		
Topics 6: Installation and Troubleshooting ➢ To understand installation details of PLC system. ➢ To troubleshoot the PLC system for different faults. **6.1** **[6]** • PLC installation- enclosures, rack, master control relay, grounding, noise suppression, maintenance guidelines. **6.2** **[6]** • PLC troubleshooting- input and output troubleshooting using module LED status, troubleshooting of ladder program.	06	12
Total	**48**	**100**

Practical:
Skills to be developed:

Intellectual Skills:
1. To understand PLC structure.
2. To interpret the results from observations and calculations.
3. Logical thinking
4. Software development
5. Programming using ladder language

Motor Skills:
1. Proper handling of instruments.
2. Measuring physical quantities accurately.
3. Observational Skills

List of Practical:
1. Verify functions of logic gates by using PLC.
2. Ladder program for Start stop logic using two inputs.
3. Ladder program for push to start and push to stop. (Use single Push Button)
4. Ladder program for blinking of LED's.
5. Write and verify ladder program for sequential ON-Off control of Lamps.
6. Write and verify ladder program for sequential control of DC motors.
7. Write and verify ladder program for stepper motor.

8. Use of Timers for Traffic Control.
9. Use of counters for pulse counting using limit switch/ proximity sensor.
10. Interfacing of thermocouple/RTD as an analog sensor with PLC.
11. Design of temperature On-Off control loop using PLC.
12. Use of PID control for Temperature control loop.
13. Use of sequencer instructions for stepper motor control.
14. Development of ladder program for washing system.
15. Development of ladder program for automated parking system.
16. Design of PLC based application using conveyor system.
17. Design of PLC based application using Elevator system.
18. Development of ladder program for security Gate to record entry and exit of employee and visitors
19. Speed Control of AC/DC Motor using Programmable drives

List of Laboratory equipment:

- Programmable Logic controllers from standard vendors.
- IEC 1131-3 compatible programming software.
- Limit switches, proximity switches, push buttons, Relays, Lamps.
- Single phase motor, 24V-DC motor, solenoid Valve, Fan, Heater.
- Setup for actual working processes (No simulation)
  a) Temperature control loop b) conveyor system

List of Assignments:

- Simple and Application programming examples from Chapter 5.

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
1	Gary Dunning	Intro. To Programmable logic control	Cenage Learning
2	F.D. Petruzella	Programmable logic controllers (Third edition)	Tata- McGraw-Hill
3	NIIT	Programmable Logic control principles and applications.	PHI learning pvt.ltd.
4	John Hackworth and Federic Hackworth	Programmable logic controllers	Pearson education
5	Jon Stenerson	Industrial automation and process control	Prentice Hall
6	V. R. Jadhav	Programmable logic controllers	Khanna Publishers

Websites:

www.learningpit.com - for download of trial version of PLC simulation software.
www.plctutor.com - for PLC tutorials.

Course Name : Electronics Engineering Group

Course Code : ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU/IU/ED/EI

Semester : Sixth for ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU and Seventh for IU/ED/EI

Subject Title : Embedded System

Subject Code : 17658

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	**50#**	--	25@	150

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

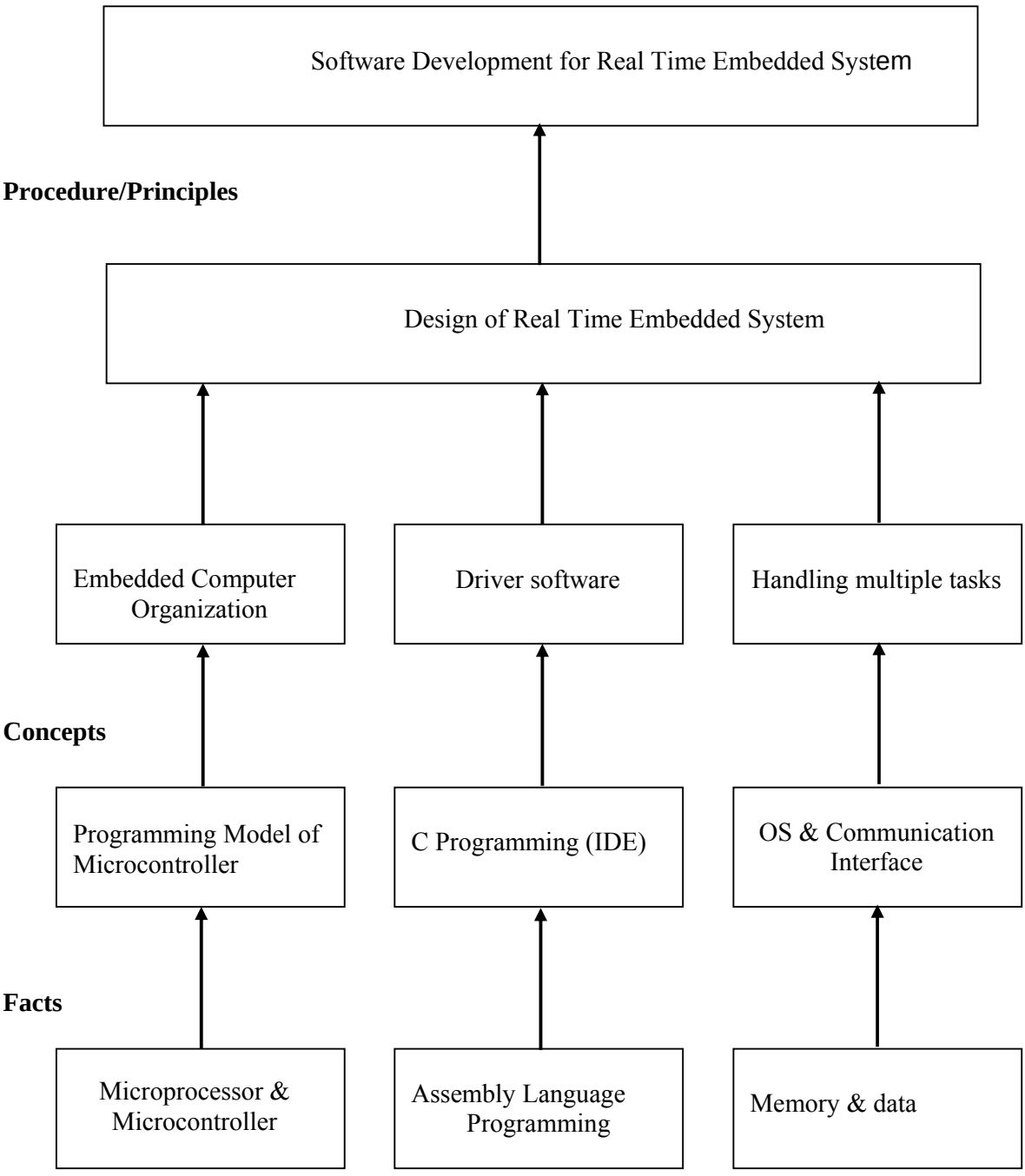
In the age of computer we are surrounded by the Embedded System - at home, office, colleges, canteen, toys, cell phones, transit, aerospace technology, military application. Out of millions of processor manufactured every year, nearly 95% processors are used in Embedded System. The Embedded Systems design is with or without OS. Most of them are Real Time Embedded Systems.

Due to such tremendous growth of Embedded Systems in recent years, one needs to be familiar with its design aspects, characteristics. Also the knowledge and programming of Real Time Embedded System is must. This subject is the advanced part of the subject Microcontroller.

General Objectives:

1. Differentiate and decide the architectures of processors for application.
2. Define communication media.
3. Design and development of small Embedded Systems.
4. Development of software.
5. Understand architecture of RTOS.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
Topic 1: Architecture of Microprocessor and Microcontroller **Specific Objectives:** ➢ Study of Architecture of microcontroller 89C51. ➢ Distinguish Microprocessor and Microcontroller architectures. **Contents:** 1.1 Architecture of Microcontroller 89C51 GPR, SFR • Address, Data & Control bus generation. • Memory structure (Data and Program memory) • IO Ports, Interrupts, • Timer/Counter, Serial Communication 1.2 Block diagram and description of architectures of Processors: • Von Neumann • Harvard • RISC • CISC • DSP • Multi Core Processor	08	08
Topic 2: Programming Microcontroller 89C51 with 'C' ➢ Use Integrated Development Tools ➢ Develop Program logic with 'C'. **Contents:** 2.1 Software Development Tools: Operation and selection (08 Marks) • Integrated Development Environment (IDE): Cross-Complier, Emulator and Flash/OTP Programmer. • In-Circuit Emulator (ICE), debugger, JTAG port • Embedded C: Assembly Language V/S Embedded C. • Programming Microcontroller 89C51 with C. • 'C' Compiler for Microcontroller 89C51: SPJ Systems, Keil • Program downloading tools: ISP/IAP 2.2 Programming with 'C': (16 Marks) • Input/output operation. • Bit/Byte operations. • Arithmetic and Logical operations on data. • Time delay routines. • Timer/Counter operations. • Generation of patterns on port lines. • Serial Communication. • Use of Assembly Instruction in 'C' program.	12	24
Topic 3: Communication Protocols ➢ Use of communication modes and protocols. **Contents:** • Need of communication interface in embedded system. • Serial V/S Parallel Communication, Synchronous V/S Asynchronous Communication • RS232: DB9-pin functions, MAX 232, MAX 233, Microcontroller 8051 connection with RS232 and RS485 • Communication protocols	06	16

• Serial Communication Protocol: I2C, CAN, USB, Serial Peripheral Interface **(**SPI), Synchronous Serial Protocol (SSP). • Parallel Communication Protocol: PCI, PCI-X • Wireless Communication Protocol: IrDA, Bluetooth, Zigbee, IEEE802.11		
Topic 4: I/O Interfacing ➢ Interface different devices to Microcontroller 89C51. ➢ Develop logic of program to work with different devices. **Contents:** **Interfacing:** • Interfacing Keys, LEDs and relay and its programming with 'C'. • Interfacing matrix keyboard and its programming with 'C'. • Interfacing LCD and its programming with 'C'. • Interfacing ADC and its programming with 'C'. • Interfacing DAC and its programming with 'C' for generation of different patterns. • Interfacing Stepper Motor and its programming with 'C'. • Interfacing DC Motor and its programming with 'C'.	10	24
Topic 5: Embedded System Design ➢ Classify and specify characteristics of embedded system. **Contents:** • Embedded System: Introduction, block diagram, applications, advantages and disadvantages. • Classification of Embedded System: Small scale, medium scale, sophisticated, stand-alone, reactive/real time (soft and hard real time), Networked, Mobile, Single functioned, Tightly constrained, • Design Metrics/Specifications/Characteristics of Embedded System: Processor power, memory, operating system, Reliability, performance, power consumption, NRE cost, unit cost, size, flexibility, time-to-prototype, time-to-market, maintainability, correctness and safety.	06	12
Topic 6: Real Time Operating System ➢ Define, understand and classify operating system. ➢ Define, describe and applications of real time operating system. **Contents:** **Operating System:** • Operating System, functions of operating system. • Architecture of Real Time Operating System (RTOS). • Scheduling architecture. • Multitasking. • Share data problem. • Semaphore. • Dead lock. • Inter-task Communication.	06	16
Total	**48**	**100**

Intellectual Skills:

1) Use IDE for Microcontroller programming with 'C'.
2) Develop Logic of program.
3) Write 'C' Program.

Motor Skills:

1) Use of IDE for Microcontroller programming.
2) Interface Microcontroller Evaluation boards & peripherals.

List of Practical:

1. Develop and execute C language program to input and output operation via ports of 8051.
2. Develop and execute C language program for arithmetic and logical operations.
3. Develop and execute C language program to blink a LED connected on port pin. Use assembly language instructions to generate delay.
4. Develop and execute C language program to generate square wave on port of 8051.
5. Develop and execute C language program to read the status of key and turn ON/OFF a LED connected to port pins of 8051.
6. Develop and execute C language program to ON/OFF a bulb through a relay connected to port pin of 8051.
7. Interface 16 x 2 LCD to 8051. Develop and execute C language program to display string on it.
8. Interface a 4 x 4 matrix keyboard and 16 x 2 LCD to 8051. Develop and execute C language program to read and display key code on LCD.
9. Interface 8 bit ADC and 16 x 2 LCD to 8051. Develop and execute C language program to read and display data of ADC on LCD.
10. Interface a 8 bit DAC to 8051. Develop and execute C language program to generate square, ramp and triangular waveforms.
11. Interface stepper motor to 8051. Develop and execute C language program to rotate stepper motor with different speed in clockwise and counter clockwise direction.

Learning Resources:

1. Books:

Sr. No.	Author	Title	Publisher
1	Frank Vahid & Tony Givargis	Embedded System Design A Unified Hardware/Software Introduction	Wiley
2	Raj Kamal	Embedded System Architecture, Programming and Design	Tata McGraw Hill
3	Dr K.V.K.K. Prasad	Embedded/Real-Time Systems: Concept, Design & Programming	Dreamtech Press
4	Jean J Labrosse	Micro C/OS-II The Real Time Kernel	CPM Books
5	Mazidi, Mazidi & McKinlay	The 8051 Microcontroller and Embedded System Using Assembly and C	Prentice Hall
6	Ajay V. Deshmukh	Microcontrollers (Theory and Applications)	Tata McGraw Hill

2. Websites:

1) http://developer.apple.com/documentation/mac/devices-313.html
2) http://en.wikipedia.org/wiki/Integrated_development_environment.
3) http://en.wikipedia.org/wiki/communication_protocol.
4) http://en.wikipedia.org/wiki/RS-232.
5) http://en.wikipedia.org/wiki/Embedded_system.
6) http://en.wikipedia.org/wiki/Real_time_operating_system.

Course Name : Electronics Engineering Group

Course Code : EJ/ET/EX/EN/EV/ED/EI/IE

Semester : Sixth Semester for EJ/ET/EX/EN/EV/IE and Seventh for ED/EI

Subject Title : Very Large Scale Integration (Elective)

Subject Code : 17659

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

Very-Large-Scale Integration (**VLSI**) is the process of creating integrated circuits by combining thousands of transistors into a single chip. VLSI began in the 1970s when complex semiconductor and communication technologies were being developed. The microprocessor is a VLSI device. VLSI design is effective in providing potential engineers with exposure to both front-end and back-end processes. **Very-Large-Scale Integration is** an emerging technology trend in the industry. VLSI design and verification is done using the RTL Coding and verification tools.

VLSI design tools eventually included not only design entry and simulation but eventually cell-based routing, ROM compilers, and a state machine compiler. The tools were an integrated design solution for IC design and not just point tools, or more general purpose system tools.

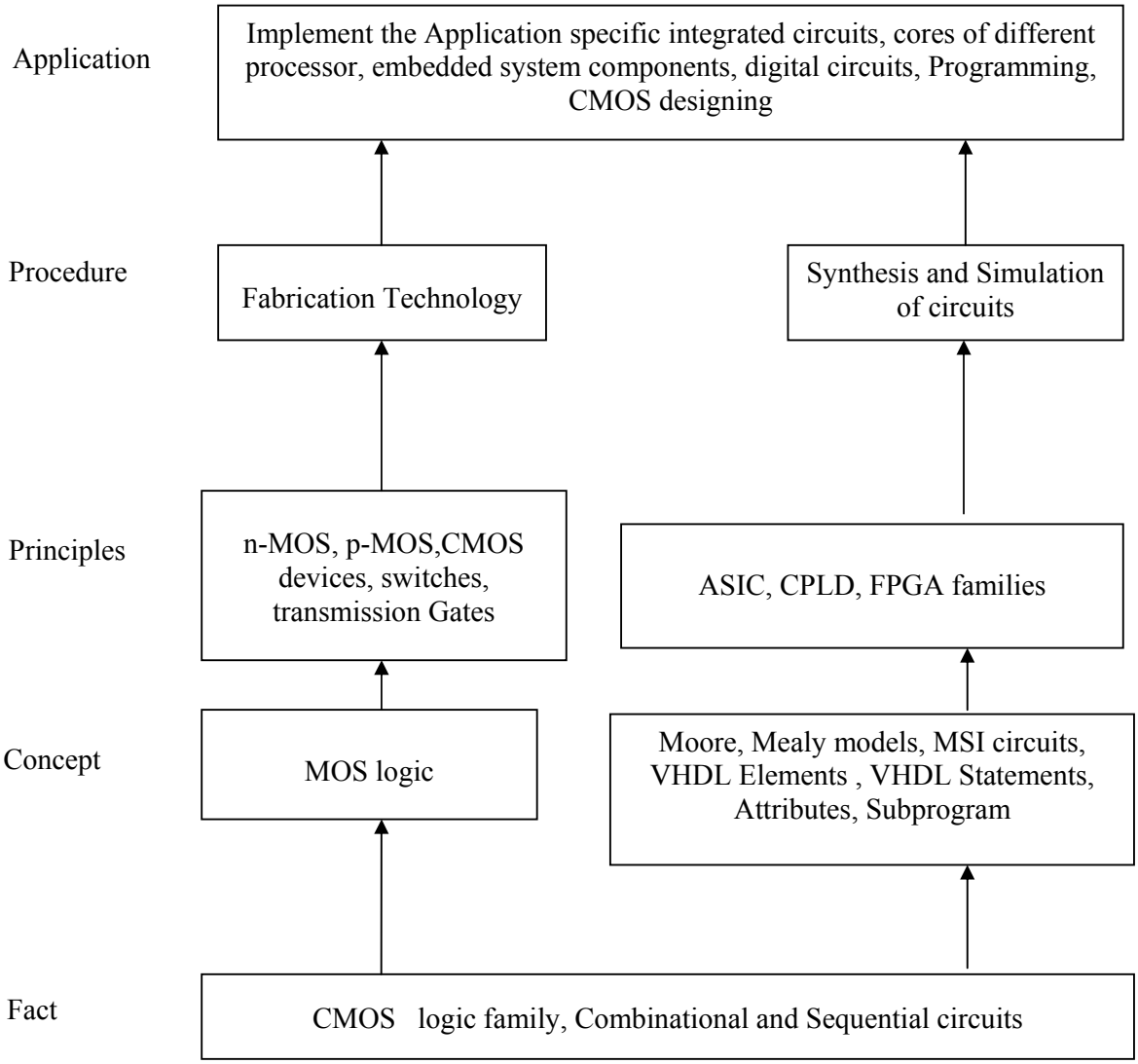
The VLSI is intended for the students having prerequisite of principles of analog and digital electronics. Students can use this knowledge in the digital design field to implement combinational and sequential logic circuit, ASIC, cores of various processors using HDL. They also design CMOS Logics at foundry levels. Students can utilize the basics of VLSI design tools as programmer, designers in IT, embedded systems in industrial sector.

General Objectives:

The student will be able to

1. Develop the state diagram, state table and built Moore and Mealy models.
2. Implement logical equations using CMOS technology.
3. Develop program to implement combinational and sequential logic circuit using VHDL and synthesize and optimum coding style.
4. Act as industry logic designers for imparting standard ICs, ASIC libraries**.**

Learning Structure:



Theory:

Name of the Topic	Hours	Marks
Topic 1: Introduction to Advanced Digital Design **Specific Objectives:** ➢ Develop the state diagram, state table ➢ Develop model of Moore and Mealy machine **Contents :** 1. Review of Sequential Logic : Asynchronous and Synchronous, Metastability, Noise margins, Power Fan-out, Skew (Definitions only) 2. Moore and Mealy Models, state machine notation, examples on Moore and mealy: counter, sequence detector only	04	14
Topic 2: Introduction to CMOS Technology ➢ Implement CMOS logic and logical equations. ➢ Comprehend CMOS processing Technology **Contents :** • Comparison of BJT and CMOS parameters • Design of Basic gates using CMOS: Inverter, NOR, NAND, MOS transistor switches, transmission gates. • Drawing of complex logic using CMOS (building of logic gate as per the Boolean equation of three variable) • Estimation of layout resistance and capacitance, switching characteristics, • Fabrication process: Overview of wafer processing, Oxidation, epitaxy, deposition, Ion–Implementation and diffusion, silicon gate process. • Basics of NMOS, PMOS and CMOS: nwell, pwell, twin tub process.	12	20
Topic 3: Introduction to VHDL ➢ Comprehend Hardware description language , its components and programming syntax **Contents :** • Introduction to HDL: History of VHDL, Pro's and Con's of VHDL • VHDL Flow elements of VHDL(Entity, Architecture, configuration, package, library only definitions) • Data Types, operators, operations • Signal, constant and variables(syntax and use)	08	14
Topic 4: VHDL Programming ➢ Develop program to implement combinational and sequential logic circuit using VHDL. **Contents :** • Concurrent constructs (when, with, process) • Sequential Constructs (process, if, case, loop, assert, wait) • Simple VHDL program to implement Flip Flop, Counter, shift register, MUX, DEMUX, ENCODER, DECODER, MOORE, MEALY machines • Test bench and its applications	08	16
Topic 5: HDL Simulation and Synthesis ➢ Comprehend VHDL simulation and synthesis. **Contents :** • Event scheduling, sensitivity list, zero modeling, simulation cycle,	12	20

comparison of software and hardware description language, • delta delay, Types of simulator event based and cycle based • HDL Design flow for synthesis • Efficient Coding Styles, Optimizing arithmetic expression, sharing of complex operator		
Topic 6: Introduction to ASIC, FPGA, PLD ➢ Comprehend ASIC, FPGA and PLDs. **Contents :** • ASIC design flow • CPLD -Xilinx and Atmel series architecture, Details of internal block diagram • Introduction to FPGA like Xilinx (FPGA), SPARTAN 3 series and Atmel	04	16
Total	**48**	**100**

Practical:

Intellectual Skills:

1. Use the different VLSI design Software tools for programming, simulation and synthesis.
2. Learn different Programmable logic devices (CPLD, FPGA, etc) and selection for target implementation

Motor Skills:

1. Write and test and debug the VHDL programming
2. Make the different connections for programming PLDs as a target device
3. Simulate and implement different programming modules on PLDs

List of Practical:

1. Write VHDL program for any two basic gates.
2. Write VHDL program for full adder / subtractor & Synthesize using FPGA
3. Write VHDL program for 8:1 multiplexer & Synthesize using FPGA
4. Write VHDL program for 2:4 Decoder & Synthesize using FPGA
5. Write VHDL program for 8:3 Encoder & Synthesize using FPGA
6. Write VHDL program for synchronous counter & Synthesize using FPGA
7. Write VHDL program for binary to gray code converter & synthesize using FPGA
8. Interfacing of DAC and ADC using FPGA
9. Interfacing Stepper motor controller using FPGA
10. Implement four Bit ALU or sequence generator.

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
1	Gaganpreet Kaur	VHDL Basics to programming	Pearson
2	John M. Yarbrough	Digital Logic: Application and design	Thomson
3	William I. Fletcher	An Engineering approach to digital design	Prentice-Hall of India
4	Neil H. E. Weste Kamran Eshraghian	Principals Of CMOS VLSI Design: A Systems Perspective	Pearson Education
5	Douglas Perry	VHDL Programming by example	Tata McGraw-Hill
6	Sarkar & Sarkar	VLSI design and EDA tools	Scitech Publication India Ltd

Web Sites:

www.xilinx.com
www.altera.com

Course Name : Electronics Engineering Group

Course Code : ET/EJ/EN/EX/IE/IU

Semester : Sixth for ET/EJ/EN/EX/IE and Seventh for IU

Subject Title : Mechatronics (Elective)

Subject Code : 17660

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	--	02	03	100	--	--	25@	125

NOTE:

- **Two tests each of 25 marks to be conducted as per the schedule given by MSBTE.**
- **Total of tests marks for all theory subjects are to be converted out of 50 and to be entered in mark sheet under the head Sessional Work (SW).**

Rationale:

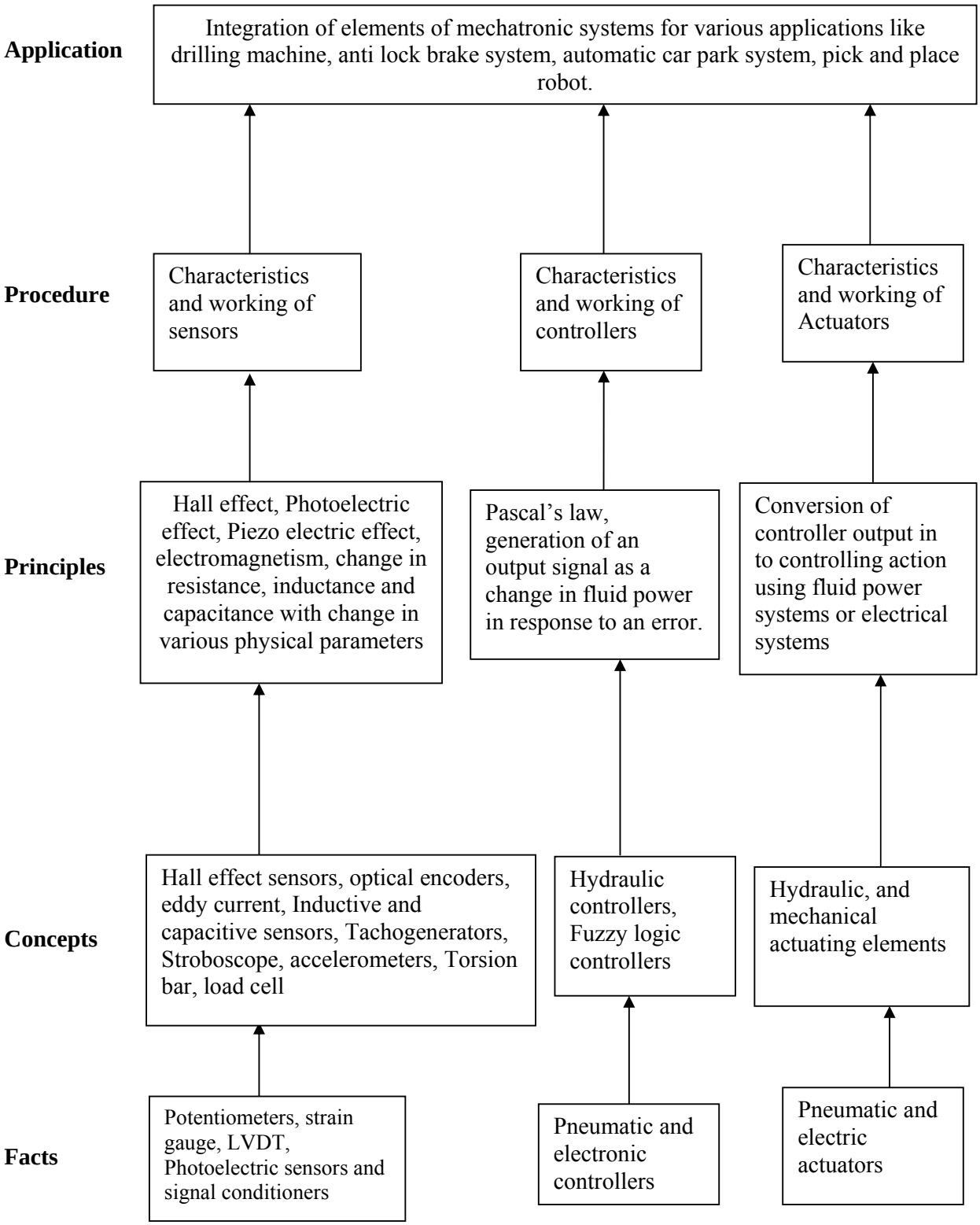
Mechatronics is a rapidly developing interdisciplinary field of engineering, which comprises of development of various computer integrated electro mechanical systems. It is an integration of mechanical engineering, electronic engineering, computer technology and control and instrumentation engineering. This integration facilitates the production of complex engineering systems with a high level of performance, reliability and value at a low price. Due to these aspects, industrial sector is rapidly adopting such integrated systems in manufacturing processes. To adopt such systems, industries are in need of the engineers with knowledge of this integration. Hence it is essential for the students to have knowledge of this multidisciplinary field. Students will be able to select sensors and actuators, develop control algorithms and use or develop advanced functional materials for the design of mechanical systems such as anti-lock brakes, engine control units, disk drives, cameras, service and surgical robots and artificial hearts.

General Objectives:

The student will be able to:

1. Understand the elements of Mechatronics systems.
2. Understand the significance of sensors & transducers in Mechatronics.
3. Understand the different types of controllers used in Mechatronics.
4. Understand the fundamentals of Robotics & micro electro mechanical systems.
5. Develop the skills to integrate the Mechatronics system with the help of case studies.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
Topic 1: Elements of Mechatronic System Specific Objectives: ➢ Explain the importance of mechatronics systems ➢ Draw the block diagram and identify the elements of mechatronics systems. Contents: Importance of mechatronics in various fields of engineering, Evolution of mechatronis**,** Block diagram of mechatronic systems and identification of elements **(**Sensors, signal conditioners, controllers, Actuators), Advantages and disadvantages of mechatronic systems	04	08
Topics 2: Sensors and Transducers in Mechatronics Systems Specific Objectives: ➢ Differentiate between transducers and sensors. ➢ Classify the transducers. ➢ Explain the sensors used for displacement, proximity, velocity, acceleration, and force and torque measurement. ➢ Appreciate the importance of signal conditioner. ➢ Review of transducers and sensors, classification and selection parameters for transducers, Review of displacement sensors: Potentiometer, Resistance strain gauge and LVDT (**no marks**) **Contents:** 2.1 **Proximity and position Sensors: [6]** Photo electric sensors, hall effect sensors, optical encoder, eddy current proximity sensor, Inductive sensor, Capacitive sensor **(**construction, principle of operation and application) 2.2 **Velocity, Motion, Acceleration, Force and Torque Sensors (construction, principle of operation and application) [10]** • **Velocity Sensors**: Electromagnetic transducers, Tacho generators. • **Motion Sensors:** Stroboscope , Pyroelectric Sensors • **Acceleration sensors:** Strain gauge accelerometer, Piezo electric accelerometer, LVDT accelerometer. • **Torque sensors :** Torque measurement using strain gauge, torque measurement using torsion bar (optical method, capacitive method, proximity sensor method, stroboscope method) **2.3 Signal conditioners : [4]** Need of Isolators, Filters, amplifiers and data converters in mechatronic systems	10	20

Topic 3: Controllers in Mechatronic Systems Specific Objectives: ➢ Explain the principles of controllers ➢ Differentiate between Electronic, Pneumatic and Hydraulic controllers ➢ Explain the application of PLC,CNC and microcontrollers in Mechatronics Contents: 3.1 **[08]** • **Electronic and Pneumatic controllers:** Characteristics and implementation of P,PI,PD,PID, • **Hydraulic controllers:** advantages, disadvantages and implementation of proportional type 3.2 **Digital Logic Control:** **[12]** • Block diagram of Fuzzy logic controllers , function of each block, application of fuzzy logic control in fully automatic washing machine (Only block diagram) • Review of PLC architecture and ladder logic programming, application of PLC for control of process tank and conveyor motor, advantages of PLC • General configuration of CNC system , advantages of CNC, part programming of CNC machines, G codes and M codes, Small application programs • Review of architecture of Micro controller, application of microcontroller for stepper motor control, DC motor speed control, advantages of Micro controller	10	20
Topic 4: Actuating Elements Specific Objectives: ➢ Differentiate between pneumatic and hydraulic systems ➢ Explain Pneumatic, Hydraulic and electro-pneumatic actuators ➢ Explain various mechanical actuating systems Contents: 4.1 **Hydraulic systems, pneumatic systems and actuators:** **[08]** • **Hydraulic systems**: Physical components of hydraulic systems: Hydraulic pumps, filters and pressure regulation • **Pneumatic systems:** Air compressors, filters and regulators, Air treatment • **Actuators :**Principle of operation of Linear actuators (single acting cylinder, double acting cylinder) Rotary actuators(rotating vane, gear type) and direction Control valves (Poppet valve, spool valve) 4.2 **Electric actuators**: **[04**] Stepper motor, DC motor, Solenoid valves, Relays **(**Principle of operation and application 4.3 **Mechanical Actuating Systems** **[08]** Cams, Gear, Belt , Rack and Pinion and Bearings (Principle of operation, types, and application)	10	20

Topic 5: Robotics and Micro Electro Mechanical Systems (MEMS) Specific Objectives: ➢ Draw the block diagram and identify basic elements of a robot ➢ Classify robots based on work space ➢ Draw and identify the basic elements of micro electro mechanical systems Contents: **Robotics: [08]** 5.1 Block diagram and function of each component (Sensors, drive system, control system, end effectors), Construction and degrees of freedom of Cylindrical, Spherical and Cartesian Robots, Applications of Robot 5.2 **MEMS : [08]** Block diagram and Identify the Basic Blocks of MEMS (Micro sensors, Micro actuators, signal conditioners)**,** construction of MEMS Accelerometer, MEMS accelerometer as airbag sensors for car safety.	08	16
Topic 6: Integration of Mechatronic Systems Specific Objectives: ➢ Explain the application areas of mechatronics ➢ Integrate and interface various components of mechatronic systems Contents: **Block diagram, working and operation of following systems** • CNC based Drilling machine • Microcontroller based Antilock Brake system • PLC based Automatic car park barrier systems • Microcontroller/PLC based Pick and place robot	06	16
TOTAL	**48**	**100**

Practical:
Skills to be developed:

Intellectual Skills:

1. Proper selection of measuring instruments on the basis of range, least count, precision and accuracy required for measurement.
2. Read and interpret the graph.
3. Use these results for parallel problem

Motor Skills:

1. Proper handling of instruments.
2. Measuring physical quantities accurately.
3. Observe the phenomenon and to list the observations in proper tabular form.
4. Adopt proper procedure while performing the experiment.

List of Practicals:

1. Measurement of torque using torsion bar.
2. Measurement of speed using stroboscope.
3. Characteristics of linear, equal percentage and quick opening control valve.
4. Write and verify ladder program for ON-Off control of Lamp.
5. Write and verify ladder program for control of conveyor belt motor.

6. Write and verify ladder program for control of process tank.
7. Demonstration of CNC lathe operation.
8. Temperature controller with PID controller.
9. Stepper motor control using microcontroller.
10. Study of single acting and double acting cylinder.

List of Assignments:

1. Identify and write a report on different types of robots used in various industries.
2. Write a report on any three applications of MEMS in auto motive field.

List of Equipments:

1. PID Controller for Temperature control.
2. Micro controller kits and stepper motor interface card.
3. Single acting and double acting cylinder.
4. 8 DI / DO programmable logic controller.
5. CNC lathe machine

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
01	K. P. Ramachandran, G. K. Vijayaraghavan, M. S. Balasundaram	Mechatronics - Integrated Mechanical electronic systems	Wiley-India
02	M. D. Singh J. G. Joshi	Mechatronics	PHI Learning Private Limited
03	W. Bolton	Mechatronics	Pearson
04	Nitaigour Premchand Mahalik	Mechatronics Principles, Concepts and Applications	Tata McGraw Hill
05	Appuu Kuttan K.K	Introduction to Mechatronics	Oxford
06	A.Smaili, F. Mrad	Mechatronics Integrated technologies for Intelligent Machines	Oxford

Websites:

www.sc.leadix.com/mechatronics
www.cncsimulator.com
www.users.bergen.org/idefalco/CNC
www.plctutor.com

Course Name : Electronics Engineering Group

Course Code : ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU/IU/ED/EI

Semester : Sixth for ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU and Seventh for IU/ED/EI

Subject Title : Simulation Software

Subject Code : 17807

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	02	--	--	--	--	25@	25

Rationale:

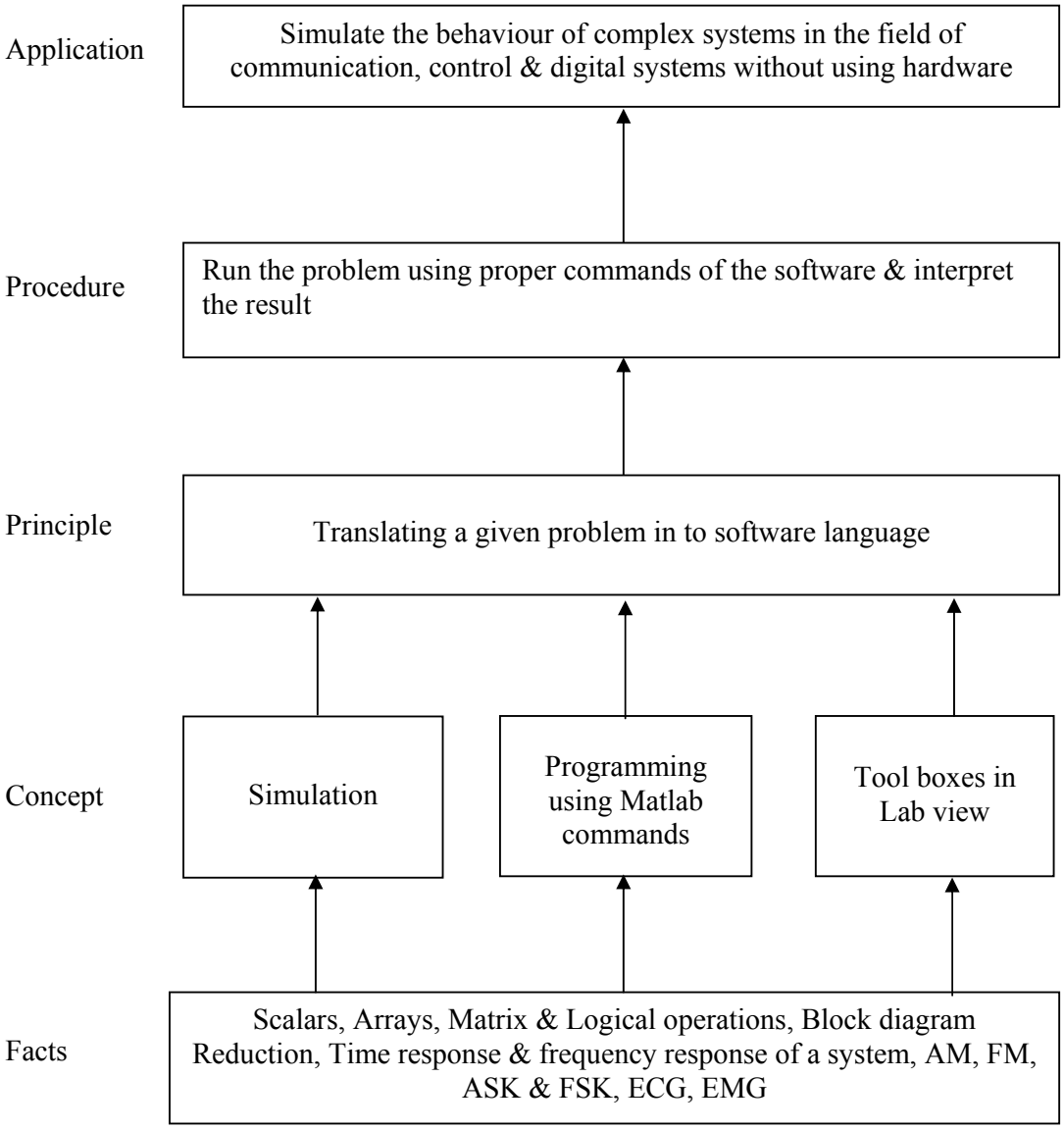
Recent development in technology has put a lot of emphasis on awareness of analytical tools available in the market. The ready to use library functions available in different simulation software enable the user to design circuits without knowing the complex mathematical details. Under this subject students will be taught softwares like Labview & MATLAB which are commonly used by electronics engineers, worldwide.

General Objectives:

Students will be able to:

1. Learn the use of various library functions available in the software.
2. Construct given circuit diagram using these library functions.
3. Study the working of the circuit for various inputs.

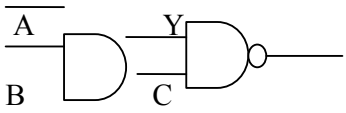
Learning Structure:



List of Experiments

1. Verify simple mathematical operations of all elements in row/column vector. Using MATLAB
    a. Sum
    b. Mean
    c. Length
    d. Max
    e. Min
    f. Prod
    g. Sign
    h. Round
    i. Sort
    j. Fix
2. Use commands to
    a. convert centigrade to Fahrenheit
    b. Given the radius of circle. Find the circumference & its area

3. Calculate the output for all the eight conditions of A,B,C



4. Use of commands to
    a. Find the determinant, inverse & transpose of the given 2X2 matrix
    b. Evaluate the following expression

$$Y = 1 + \frac{x^2}{2} + \frac{x^3}{3} + \frac{x^4}{4} + \frac{x^5}{5}$$

5. Calculate the natural frequency of oscillators for the given RLC circuit. Assume L=0.01mH, R=100Ω & C varying from 0.1 to 0.5 in steps of 0.1 μF using following equation

$$F = \sqrt{\frac{1}{LC} - \frac{R^2}{4C^2}}$$

6. A series R-L-C circuit connected across 100V peak, 50 Hz supply, consists of R=10Ω, L=0.2H, C=100μF. Write a MATLAB script to determine the resonant frequency & current at resonance

[hint: $f = \frac{1}{2\pi\sqrt{LC}}$; $I = \frac{V}{R}$; Vrms= $\frac{V_{pp}}{\sqrt{2}}$]

7. Connect three sine wave sources of given amplitude and frequency but with a phase shift of 0, 2π/3,and - 2π/3 to a 3X1 multiplexer and observe the waveforms on scope. Also, de multiplex these waveforms and observe on the scope.

8. Create a VI that produces a sine wave with a specified frequency and displays the data on a Waveform chart until stopped by the user.

9. Simulation of amplitude and frequency modulation

10. Design a low pass filter with R= 1 K Ω and C = 0.1 μF and calculate the cut off frequency.

Course Specific Simulation Programs (using either Matlab / Labview / Open source free downloadable software)

For Instrumentation Course

1. Observe step & impulse response of first & second order system & calculate time response parameters- t_d, t_r, t_p, M_p, t_s, e_{ss}
2. Characteristics equation of a system is given by $S^5+2S^4+4S^3+8S^2+3^S+1$ Check their stability with routh Hurwitz criterion
3. Observe the characteristics of linear, equal percentage and quick opening control valves

For Electronics and Industrial Electronics Course

1. Simulation of R-L-C series circuit
2. Single phase half wave phase controlled converter
3. Observe step & impulse response of first & second order system

For Medical Electronics Course

1. Calculate Body Mass Index, given the height and weight
2. Given the Heart Rate and display whether the person is having trachicardia and bradicardia
3. Design a scope for patient monitoring with at least four different parameters and observe the waveform by changing these parameters.

For EJ/ET/EX/EV Courses

1. Simulation of Sampling theorem
2. Simulation of Amplitude shift keying
3. Simulation of TDM

Course Name : Electronics Engineering Group

Course Code : ET/EN/EJ/IE/IS/IC/DE/EV/MU/IU/ED/EI

Semester : Sixth for ET/EN/EX/EJ/IE/IS/IC/DE/EV/MU and Seventh for IU/ED/EI

Subject Title : Industrial Project

Subject Code : 17808

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	04	--	--	--	50#	50@	100

Rationale:

Diploma holder need to be capable of doing self-Study throughout their life as the technology is developing with fast rate. Student will be able to find out various sources of technical information and develop self-study techniques to prepare a project and write a project report.

This subject is intended to teach students to understand facts, concepts and techniques of electrical equipments, its repairs, fault finding and testing, estimation of cost and procurement of material, fabrication and manufacturing of various items used in electrical field. This will help the students to acquire skills and attitudes so as to discharge the function of supervisor in industry and can start his own small-scale enterprise.

Objectives:

The students will be able to,

1. Work in Groups, Plan the work, and Coordinate the work.
2. Develop leadership qualities.
3. Analyse the different types of Case studies.
4. Develop Innovative ideas.
5. Develop basic technical Skills by hands on experience.
6. Write project report.
7. Develop skills to use latest technology in Electronics field.

Contents:

During fifth semester students will collect information, analyse the information and select the project. They will also prepare the List of the components required, PCB design, Testing

Procedure, Design of the Cabinet or Box or Board as the case may be. They will also prepare a synopsis of the project.

So at sixth semester they have to execute the project. A tentative Schedule is proposed below:

Proposed Schedule:	Weeks
Procuring components, component testing and circuit testing	02
PCB making and onboard testing	06
Trouble shooting and cabinet making	04
Documentation	04

References: Books/Magazines:

Name of the Magazines

1. Industrial Automation
2. Electronics for You
3. Electronics Projects
4. Computer World
5. Chip
6. Any Journal Related to Electronics/Computer/Information Technology

Website:

Using any search engine, such as http://www.google.co.in/ the relevant information can be searched on the Internet.