MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI
TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES

COURSE NAME : ELECTRONICS ENGINEERING GROUP

COURSE CODE : EJ/ET/EX/EN/ED/EI

DURATION OF COURSE : 6 SEMESTERS for ET/EN/EX/EJ and 8 SEMESTERS for ED/EI   **WITH EFFECT FROM 2012-13**

SEMESTER : SIXTH   **DURATION : 16 WEEKS**

FULL TIME / PART TIME : FULL TIME   **SCHEME : G**

SR. NO	SUBJECT TITLE	Abbreviation	SUB CODE	TEACHING SCHEME			PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)		SW (17600)
				TH	TU	PR		Max	Min	Max	Min	Max	Min	Max	Min	
1	Management $	MAN	17601	03	--	--	03	100	40	--	--	--	--	--	--	
2	Advanced Communication Systems	ACS	17656	04	--	02	03	100	40	25#	10	--	--	25@	10	
3	Mobile Communication	MCO	17657	03	--	02	03	100	40	--	--	--	--	25@	10	
4	Embedded System β	ESY	17658	03	--	02	03	100	40	50#	20	--	--	25@	10	
5	**Elective (Any One)**															50
	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	PRO	17808	--	--	04	--	--	--	--	--	50#	20	50@	20	
			Total	**16**	**--**	**14**	**--**	**500**	**--**	**75**	**--**	**50**	**--**	**175**	**--**	**50**

Student Contact Hours Per Week: **30 Hrs.**

THEORY AND PRACTICAL PERIODS OF 60 MINUTES EACH.

Total Marks **: 850**

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

β - Common to IE / IS / IC / DE / EV / IU / 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

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/EU/CH/CT/PS/TX/TC 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	--	--	03	100	--	--	--	100

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:

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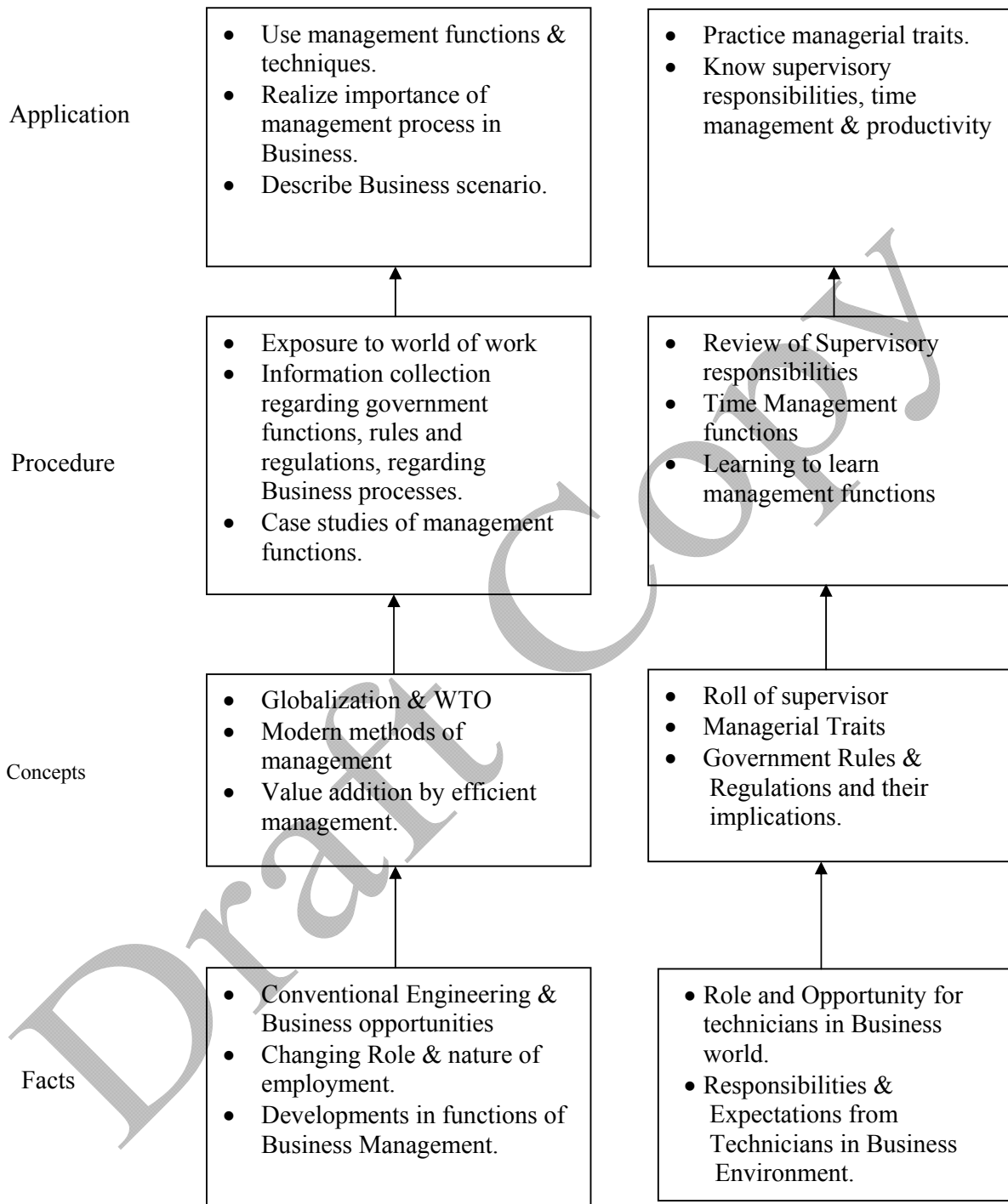
Contents of the this subject will enable the students to address various issues related to human resource, finance, materials, legislations etc. by use of basic principles of management. This will ensure that students will play their role effectively to enhance the quality of business output in total.

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:

Application	• Use management functions & techniques. • Realize importance of management process in Business. • Describe Business scenario.	• Practice managerial traits. • Know supervisory responsibilities, time management & productivity
Procedure	• Exposure to world of work • Information collection regarding government functions, rules and regulations, regarding Business processes. • Case studies of management functions.	• Review of Supervisory responsibilities • Time Management functions • Learning to learn management functions
Concepts	• Globalization & WTO • Modern methods of management • Value addition by efficient management.	• Roll of supervisor • Managerial Traits • Government Rules & Regulations and their implications.
Facts	• Conventional Engineering & Business opportunities • Changing Role & nature of employment. • Developments in functions of Business Management.	• Role and Opportunity for technicians in Business world. • Responsibilities & Expectations from Technicians in Business Environment.

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	06
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	16
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	16

• 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	14

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	16

• 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	16

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	16

Total	**48**	**100**

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 : **Electronics Engineering Group**

Course Code : **EJ/ET/EN/EX/DE/ED/EI**

Semester : **Sixth for ET/EN/EX/EJ/DE and Seventh for ED/EI**

Subject Title : **Advanced Communication System**

Subject Code : **17656**

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:

Initially communication technology focused on simple transmission links, but then quickly moved to increasingly sophisticated networks. Nowadays modern high capacity, high speed telecom networks based on microwave principles, optical fiber technology, satellite communication and radar systems became integral part of industry, society and other organizations.

Advance communication system is an application of devices and basic communication techniques. It is useful to understand principles, working, use of microwave devices and systems. Knowledge of optical fiber technology is helpful in understanding of optical communication system, maintenance of optical links and related components.

Study of satellite and radar communication system is important for understanding operation, maintenance and monitoring of these systems.
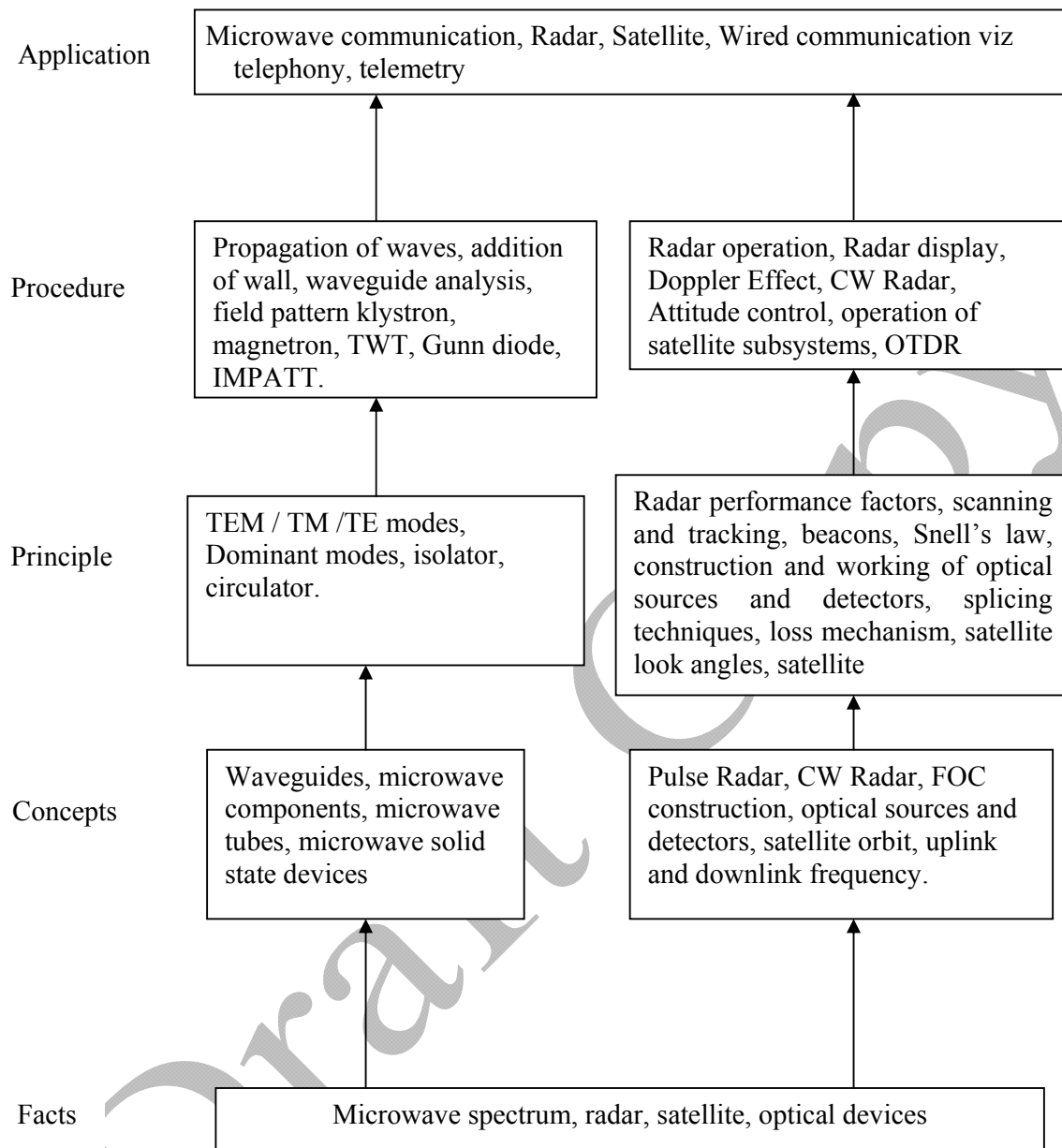
This subject is also useful as a basis to acquire in depth knowledge of advance communication systems and for analysis of these systems.

General Objectives:

Students will be able to:

1. Understand concepts and applications of microwave and optical spectrum.
2. Understand construction and working of microwave components and devices.
3. Understand basic principle & operation of radar systems.
4. Understand the construction, working and uses of optical communication system components
5. Know the concept, working and application of satellite communication system.

Learning Structure:

Application
Microwave communication, Radar, Satellite, Wired communication viz telephony, telemetry

Procedure
Propagation of waves, addition of wall, waveguide analysis, field pattern klystron, magnetron, TWT, Gunn diode, IMPATT.	Radar operation, Radar display, Doppler Effect, CW Radar, Attitude control, operation of satellite subsystems, OTDR

Principle
TEM / TM /TE modes, Dominant modes, isolator, circulator.	Radar performance factors, scanning and tracking, beacons, Snell's law, construction and working of optical sources and detectors, splicing techniques, loss mechanism, satellite look angles, satellite

Concepts
Waveguides, microwave components, microwave tubes, microwave solid state devices	Pulse Radar, CW Radar, FOC construction, optical sources and detectors, satellite orbit, uplink and downlink frequency.

Facts
Microwave spectrum, radar, satellite, optical devices

Theory:

Topic and Contents	Hours	Marks

Topic 1: Wave Guide and Components:
Specific Objectives:
Students will be able to
➢ Identify band designation with range in microwave spectrum.
➢ Compare waveguide with two wire transmission line.
➢ Plot the field pattern for dominant mode (Lower) of rectangular waveguide.
Contents:
1.1 Introduction to basics of microwave transmission.   [08]
  • Microwave spectrum and band designations.
  • Comparison of wave guide with transmission line.
  • Rectangular waveguides: Propagation of waves through rectangular wave guide, Reflection of waves from a conducting plane- Basic behaviour, dominant mode at the conducting surface, dominant mode of operation, plane waves at conducting surface, parallel and normal wavelength, phase velocity. The parallel plane waveguide, cut off wavelength, cut off frequency, group and phase velocity.(Simple numericals)
  • Rectangular waveguide modes: $TE_{m,o}$ modes, $TE_{m,n}$ modes, $TM_{m,n}$ modes, field patterns of $TE_{1,0}$, $TE_{2,0}$, $TE_{1,1}$ modes.
 	
1.2 Circular waveguide-   [04]
  • Analysis of behavior
  • field patterns for dominant mode,
  • Advantages and applications of circular waveguide.
 	
1.3 Waveguide components   [08]
  • Flanges, Rotating coupling, Bends & corners, Taper & Twist.
  • Multiple Junctions - E plane, H- plane and Hybrid junction.
  • Cavity resonators - operation, types and applications
  • Auxiliary components- Directional coupler, Isolator and circulators, Detector mounts, switches - Duplexer.
	12	20

Topics 2: Microwave Devices:
Specific Objectives:
➢ Sketch the constructional details and the working of klystron , TWT & magnetron
➢ Sketch and explain the construction of semi conductor microwave devices.
 	
Contents:
2.1   Microwave vacuum tube devices.   [12]
    Construction, working, specifications and applications of
  • Two cavity Klystron amplifier,
  • Reflex Klystron,
  • Magnetron
  • TWT
2.2   Microwave semiconductor devices.   [08]
    Construction, working and applications of
	12	20

• Gunn diode, . • IMPATT diode • PIN diode. • Tunnel diode		
Topics 3: Radar Systems: **Specific Objectives:** ➢ Interpret the radar range equation ➢ Explain operation of pulse radar, MTI and CW radar system ➢ Interpret the position of target by observing displays ➢ Explain the operation of A-scope, PPI, ATD displays Contents: • Basic block diagram of radar system. • Radar performance factors: Radar range equation, factors influencing max. Range, effect of noise. • Basic pulse Radar system: Block diagram & description. • Antenna scanning & Tracking (Definition, types and principle) of Antenna scanning: Horizontal, vertical, helical and spiral. • Antenna tracking: Sequential, conical and monopusl • Display Methods: A-Scope, PPI, Automatic target detection • Block diagram, operation and application of pulsed radar system and MTI and CW Doppler radar. • Radar Becons • Antannas used in RADAR:	12	16
Topics 4: Satellite Communication System: **Specific Objectives:** ➢ Draw block diagram of various subsystems of satellite ➢ Explain the operation of satellite earth station Contents: 4.1 Introduction to satellite communication system [08] • Importance of satellite communication system. • Concept of orbit & its types • Communication link : uplink & downlink frequency, • look angle altitude, elevation angle, Azimth angle footprint & station keeping • Block diagram and function of satellite earth station 4.2 Subsystems of satellite :Block diagram and Principle [08] • Power subsystem • Communication channel subsystem • Attitude control subsystem • Thermal control subsystem • Telemetry tracking and command subsystem • Main & auxiliary propulsion subsystem • Antenna subsystem	10	16
Topics 5: Theory of optics & fundamentals of optical fiber **Specific Objectives:** ➢ Draw constructional sketch of fiber optic cable ➢ Classify optical fibers **Contents:** • Optical spectrum: Band name and its range. • Definition & concept of reflection, refraction dispersion, diffraction	06	12

	,absorption & scattering with help of light theory		
•	Definition of critical angle, Snell's law, numerical aperture, acceptance angle, acceptance cone.		
•	Advantages & disadvantages of Fiber Optic communication		
•	Block diagram of Fiber Optic communication system		

Topics 6: Optical Communication System
Specific Objectives:
➢ Explain construction & working of LED, Laser and avalanche photo diode.
➢ Explain splicing techniques
➢ Know causes of losses in fiber optic system and minimize them.
Contents:
6.1 Types of fiber optics cable and its losses   [08]
     • Optical fiber types & characteristics.
     • Losses in optical fiber: Absorption loss, Scattering loss, Dispersion loss, Radiation loss, Coupling loss.
6.2 Optical sources and detectors   [04]
     • Optical sources: Edge emitter and Surface emitter LED, Laser construction & working principle, Comparison of different sources.
     • Photo Detector: Review of PIN photo diode, avalanche photo diode-construction & working principle.
6.3 Splicers and connectors :   [04]
     • Splicing techniques- Properties of splicing, fusion splice, V-groove splice and elastic tube splice.
        Fusion splice and V-groove splice
     • Fiber connector-properties of connector, ferrule connector
6.4 Attenuation measurements: OTDR block diagram, working principle, and OTDR trace
		12	16

	Total	**64**	**100**

Practical:
Skills to be developed:

Intellectual Skills:

1. Interpret the characteristics.

2. Identify and select the microwave devices.

3. Calculate different parameters.

Motor Skills:

1. Measure different quantities related to waveguides and microwave devices.

2. Verify characteristics of microwave devices, fiber optic sources and detectors.

List of Practical:

1. Write specifications of Microwave Test Bench and five major Microwave components.

2. Verify the characteristics of Reflex Klystron.

3. Verify characteristics of microwave tees E-plane, H-plane and E-H plane.

4. Verify characteristics of the isolator.

5. Verify characteristics of circular.

6. Verify properties of Multi-Hole Directional Coupler.

7. Calculate the Numerical Aperture(NA) of given optical fiber by using Trigonometric method (visual method)

8. Measure the bend loss and attenuation in given FOC

9. Plot (i) V-I characteristics of LED (ii) Characteristics of the output light intensity against forward current of LED

10. V-I characteristics of photo-diode (Detector) at different luminance.

Assignments:

1. Radar- Block diagram and operation of pulsed radar system.

2. Satellite communication- Block diagram and operation of satellite Earth Station.

3. Visit to Earth station/ Radio station/ TV relay station/ Airport/ BSNL.

Learning Resources:
Books:

Sr. No.	Author	Title	Publisher
01	John F Kennedy	Electronic Communication system	Tata McGraw Hill
02	Willium Schewber	Electronic Communication system	PHI publication
03	Wayne Tomasi	Advanced Electronic Communication system	PHI / Pearson publication
04	Gerd Keiser	Optical Fiber Communication	Tata McGraw Hill

Course Name : Electronics Engineering Group

Course Code : EJ/ET/EN/EX/DE/ED/EI

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

Subject Title : Mobile Communication

Subject Code : 17657

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:

The 21st century has brought the rapid growth of cell phones, LAN and wireless appliances. Wireless communication is driving the whole world towards greater integrity. RF spectrum in higher bands is available for mobile communications. Mobility awareness in civilized societies, global standardization of wireless devices and products are leading towards huge growth.
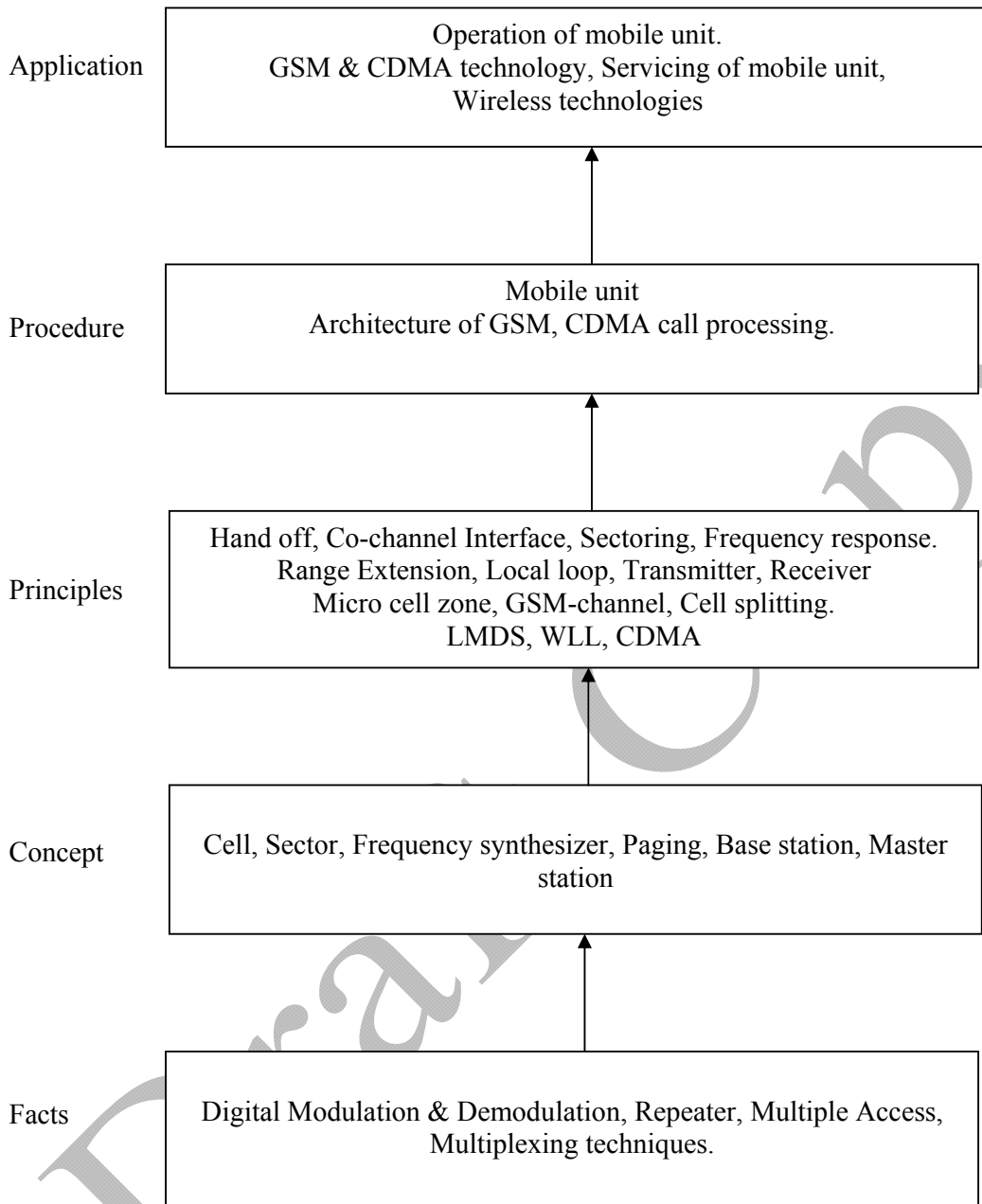
Students will know the fundamentals of mobile communication, basics of cellular system and different services provided by the cellular system. This subject gives the knowledge of cellular system architecture, components and its application along with its standards .It is the application of wireless digital communication.

General Objectives:

The student will be able to:

1. Describe cellular concept such as frequency reuse, hand off available in various mobile standards.
2. Understand GSM system, CDMA (IS-95), SS7 architecture and call processing in these system.
3. Understand 3G Mobile Communication system.

Learning Structure:

Application	Operation of mobile unit. GSM & CDMA technology, Servicing of mobile unit, Wireless technologies

↑

Procedure	Mobile unit Architecture of GSM, CDMA call processing.

↑

Principles	Hand off, Co-channel Interface, Sectoring, Frequency response. Range Extension, Local loop, Transmitter, Receiver Micro cell zone, GSM-channel, Cell splitting. LMDS, WLL, CDMA

↑

Concept	Cell, Sector, Frequency synthesizer, Paging, Base station, Master station

↑

Facts	Digital Modulation & Demodulation, Repeater, Multiple Access, Multiplexing techniques.

Theory:

Topic and Contents	Hours	Marks

Topic 1: Introduction to Wireless Communication System
Specific Objectives:
➢ State a need and application of mobile communication.
➢ State technological evolution in radio communication
➢ State basic features of AMPS, N AMPS, IS 95, GSM standards along with Global geographical utility.
➢ Explain principle of Working of Paging system, cordless telephone system, cellular telephone system and call processing.
➢ Explain operation of mobile unit.
Contents:
1.1   [10]
  • Evolution of mobile radio communications (2G,2.5G and 3G wireless system)
  • Mobile radio system around the world (AMPS, IS 95,GSM, N - AMPS)
  • Applications of wireless communication systems
    i. Paging System.
    ii. Cordless telephone system.
    iii. Cellular telephone system. Call processing in cellular telephone system.
1.2 Mobile Unit   [10]
  • Block diagram and operation of mobile Unit.
  • Block Diagram and operation of frequency synthesizer, transmitter, Receiver, Logic Unit and Control unit. Essential features of hand set.
  • Definition of mobile base station, Mobile control station.
	08	20

Topic 2: The Cellular Concept
Specific Objectives:
➢ Explain Cell Structure and its importance.
➢ State need and process of Frequency reuse, Handoff and its types.
➢ State types of interference and methods of increasing channel capacity.
➢ State how to improve coverage and capacity in cellular system.
Contents:
2.1 Introduction to cellular system.   [10]
  • Frequency reuse concept.
  • Multiple Access Technologies for Cellular systems.
  • Cellular system operation and Planning Principles.
  • System Architecture
  • Location updating and call setup.
  • Hand off strategies and Power control.
2.2 Interference and system capacity.   [10]
  • Co channel interference & system capacity.
  • Channel planning for wireless system.
  • Adjacent channel Interference.
  • Improving coverage and capacity in cellular system.
  • Cell splitting.
  • Sectoring.
  • Repeater for range extension.
	10	20

• Micro cell zone concept.			
Topic 3: Digital Cellular Mobile Systems. **Specific Objective:** ➢ Explain GSM system architecture, features, services and channel types. ➢ Explain CDMA System architecture, radio aspects and features. ➢ Define and explain Signal Traffic, services and performance of Signal System in SS7. Contents: 3.1 G.S.M : Concept of GSM, the European TDMA Digital Cellular standard. [10] • GSM Standardization and service aspects • GSM Architecture. • GSM Radio Aspects. • Security Aspects. • GSM Protocol Model • Typical flow sequence in GSM 3.2 IS 95:Concept of IS 95, the North American CDMA Digital Cellular standard. [08] • Introduction • Service Aspects • Network reference Model and Security aspects. • Radio aspects • Key features of IS 95 CDMA systems 3.3 Signal system no.7 (SS7) : Concept of SS7 [06] • NSP of SS7 • Signaling Traffic in SS7 • SS7 services and performance.	16	24	
Topic 4: Modern Wireless Communication System **Specific Objective:** ➢ List out features of 2.5 G GSM Standards HSCSD, GPRS and IS-136, EDGE and IS 95B. ➢ State features of IMT 2000 Radio spectrum, vision and Evolution. Contents: 4.1 Evolution for 2.5 G TDMA standards [12] • HSCSD for 2.5 G GSM • GPRS for 2.5 G GSM and IS-136 • EDGE for 2.5vg GSM and IS-136 • IS-95B for 2.5 G CDMA. 4.2 IMT 2000 [04] • IMT 2000 Vision and Evolution Aspects. • Radio Spectrum for IMT -2000	06	16	
Topic 5: Modern wireless Networks **Specific Objective:** ➢ State features of 3G wireless networks- UMTS, 3G CDMA 2000, G-TD-SCDMA ➢ Explain WLL and LMDS technology ➢ State features of Bluetooth and Personal Area networks ➢ State Conceptual features of 4G and 4.5G. ➢ Explain 4G architecture and its capability	08	20	

➢ Define and state importance of Blockage, voice channel blockage, Voice quality and word error rate.			
Contents:			
5.1 Third Generation (3G) Wireless Networks. [10]			
• 3G W-CDMA (UMTS) (Universal mobile Telecommunication system.)			
• 3G CDMA 2000			
• 3G- TD-SCDMA (synchronous)			
• Wireless local loop and LMDS (local multipoint distribution)			
5.2 Wireless Local Area Networks [10]			
• Features of Bluetooth and Personal Area Networks(PANS)			
• Concept of Ad voc mobile communication for 4G and 4.5G.			
• 4G wireless architecture and capabilities, characteristics,			
• MANET applications.			
• Concept of Blockage, voice-channel Blockage, call drops, voice quality, word error rate.			
(no need of detail mathematical calculation and/or derivation)			
	Total	**48**	**100**

Practical:
Skills to be developed:

Intellectual Skills:
   1. Identification of different components and their use.
   2. Interpret various generation technologies.

Motor Skills:
   1. Follow standard testing procedure
   2. Accurate measurement of waveforms and write results.
   3. Report writing.

List of Practical:
   1. Perform installation of mobile phone, registration, activation and authentication of mobile handset
   2. Observe Input / Output signal of different sections of mobile phone unit.
   3. Read the content of SIM card.
   4. Perform testing procedure of different sections of mobile phone.
   5. Find out different add- on accessories for cell phones (battery, charger, hands free data cable, memory card) and their interfacing with Handset.
   6. Identify different sections and   component of mobile unit such as (Ringer section, dialer section, receiver section etc.)
   7. Troubleshooting and testing of mobile handset. Such as Speaker problem, Ringer problem, Mike problem, Vibrator problem, SIM card problem, charging problem, display problem ,Dialing/keypad problem , Dead handset , Network problem, water dipped handset
   8. Check network availability manual and auto selection of network using AT commands in mobile.
   9. Observe the process of Call connection and Call release of Mobile system.

List of Assignments: (Any Three)

1. Industrial visit to mobile company BTS BSC MSC – GSM (Airtel, idea, Vodafone) to know duties and responsibilities of O & M engineer, Microwave and GSM antenna tower maintenance.
2. Industrial visit to CDMA mobile station BTS BSC MSC (TATA Indicom, Reliance)
3. Prepare report on features, services and technology provided by different companies.
4. Find out the electrical specifications of different handsets provided by different companies. Prepare report on GSM technology, its network, GSM capability & data Services, handoff, frequency reuse, cell splitting.
5. Study and prepare report on cell site, distance coverage, antennas used. Role of RF engineer.
6. Listing out message center number and their use.

Learning Resources:
1. Reference Books:

Sr. No.	Author	Title	Publisher
1	T.S. Rappaport	Wireless Communication Principles & Practice	Pearson Education
2	William Lee	Mobile Cellular Tele communication	Tata McGraw Hill
3	C K Toh	Ad Voc Mobile wireless Networks	Pearson Education
4	Raj Pandya	Mobile and Personal communication system and services	IEEE Press, PHI
5	Steffano Basagni Marco, Silvia, Ivan	Mobile AD HOC Network	Wiley India Pvt. Ltd.

2. CDs, PPTs Etc.:
http://nifrash.weebly.com/uploads/3/5/0/9/3509162/gsm_introduction.ppt
http://www.gadgetcage.com/4g-mobile-communications-presentation-powerpoint-download/4305/

3. IS, BIS and International Codes:
   IS 15040:2010   Radio Disturbance Characteristics for Protection of
   CISPR 25:2008   receivers Used on Board Vehicles, Boats and Internal
                              Combustion Engines – Limits and Methods of Measurement

4. Websites:
- http://en.wikipedia.org/wiki/W-CDMA_%28UMTS%29 for WCDMA
- http://www.itu.int/ITU- R/index.asp?category=information&rlink=imt-advanced&lang=en for IMTS
- http://www.mobiledia.com/glossary/33.html
- http://www.youtube.com/watch?v=whYljse4Abc

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@	175

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.
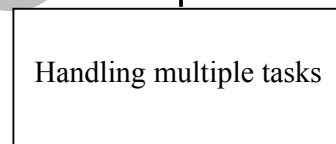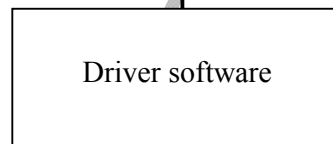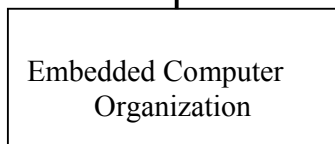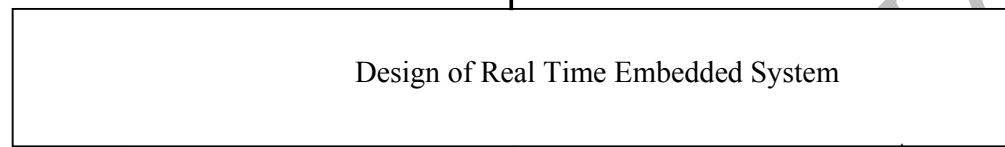
General Objectives:

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.
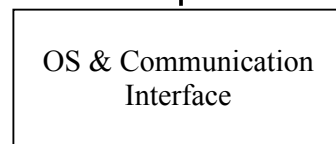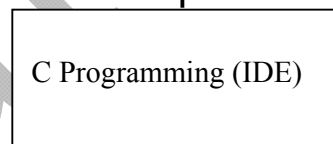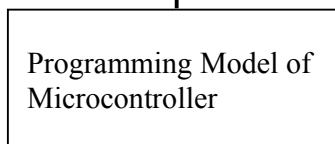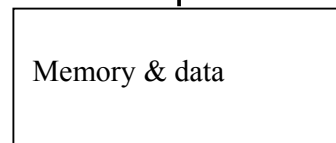5. Understand architecture of RTOS.

Learning Structure:

Application

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│      Software Development for Real Time Embedded System      │
│                                                             │
└─────────────────────────────────────────────────────────────┘
                               ▲
```

Procedure/Principles

```
┌─────────────────────────────────────────────────────────────┐
│                                                             │
│            Design of Real Time Embedded System               │
│                                                             │
└─────────────────────────────────────────────────────────────┘
          ▲                    ▲                    ▲

┌──────────────────┐  ┌──────────────────┐  ┌──────────────────┐
│ Embedded Computer│  │  Driver software │  │ Handling multiple│
│   Organization   │  │                  │  │      tasks       │
└──────────────────┘  └──────────────────┘  └──────────────────┘
          ▲                    ▲                    ▲
```

Concepts

```
┌──────────────────┐  ┌──────────────────┐  ┌──────────────────┐
│ Programming Model│  │ C Programming    │  │ OS & Communication│
│ of Microcontroller│ │     (IDE)        │  │     Interface     │
└──────────────────┘  └──────────────────┘  └──────────────────┘
          ▲                    ▲                    ▲
```

Facts

```
┌──────────────────┐  ┌──────────────────┐  ┌──────────────────┐
│ Microprocessor & │  │ Assembly Language│  │  Memory & data   │
│  Microcontroller │  │   Programming    │  │                  │
└──────────────────┘  └──────────────────┘  └──────────────────┘
```

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:

Write and execute 'C' Programs:

1) Input and output operation via ports.
2) Arithmetic and logic operations on data.
3) Use of assembly language instruction in 'C' program.
4) Generation of pulse/square wave on port line/s.
5) Reading key status and LED ON/OFF.
6) Operating Relay to activate connected devices to relay.
7) Reading matrix keyboard.
8) Read ADC and display it on LCD.
9) Generating different patterns with DAC
10) Running Stepper motor with different speed (CW/CCW).

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 McGrawHill

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.
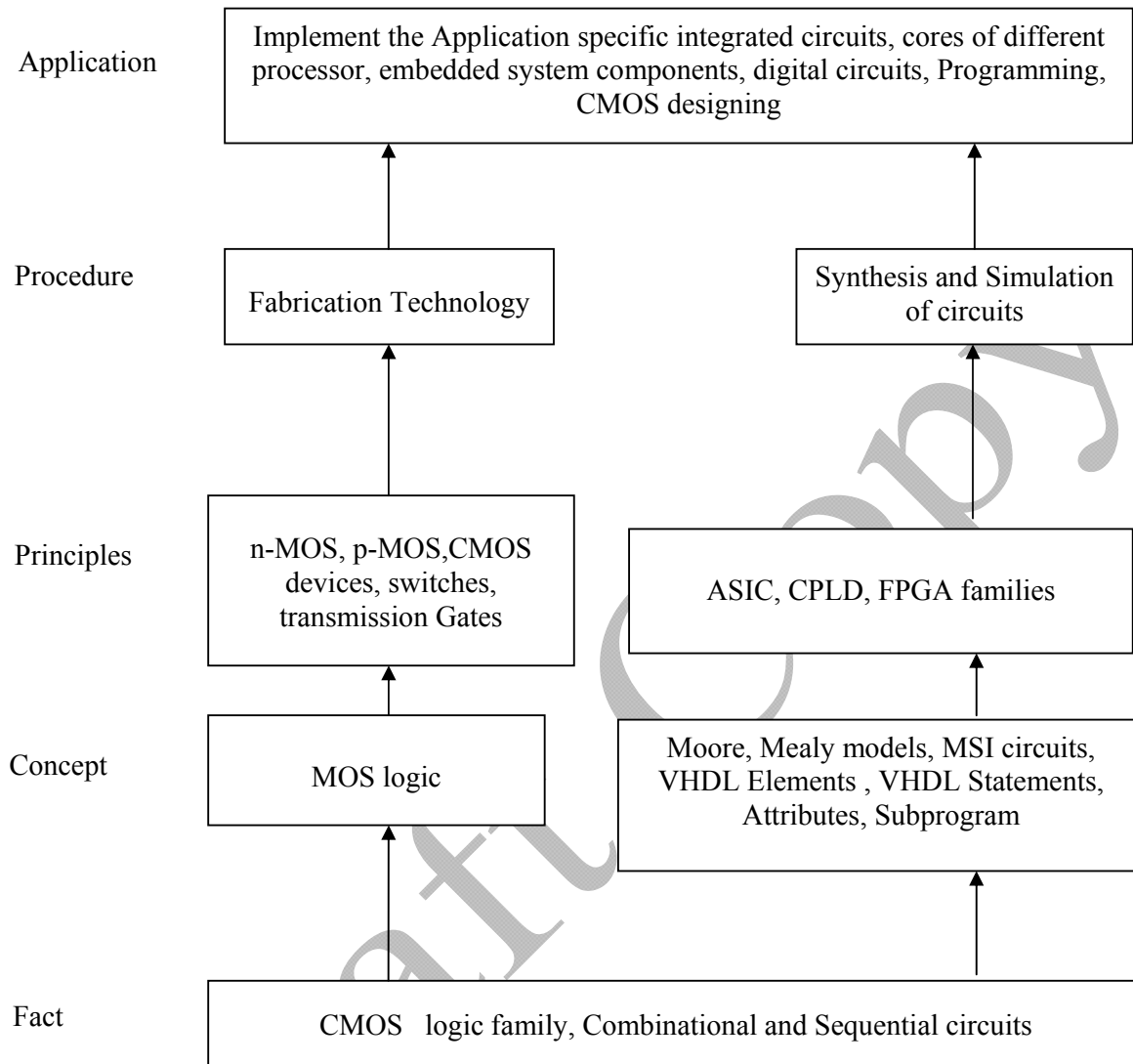
The VLSI is intended for the students having prerequisite of principles of analog and digital electronics. Students can use this knowledge in the digital design field to implement combinational and sequential logic circuit, ASIC, cores of various processors using HDL. They also design CMOS Logics at 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:

Application	Implement the Application specific integrated circuits, cores of different processor, embedded system components, digital circuits, Programming, CMOS designing
	↑ ↑
Procedure	Fabrication Technology — Synthesis and Simulation of circuits
	↑ ↑
Principles	n-MOS, p-MOS,CMOS devices, switches, transmission Gates — ASIC, CPLD, FPGA families
	↑ ↑
Concept	MOS logic — Moore, Mealy models, MSI circuits, VHDL Elements , VHDL Statements, Attributes, Subprogram
	↑ ↑
Fact	CMOS logic family, Combinational and Sequential circuits

Theory:

Topic and Contains	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).**
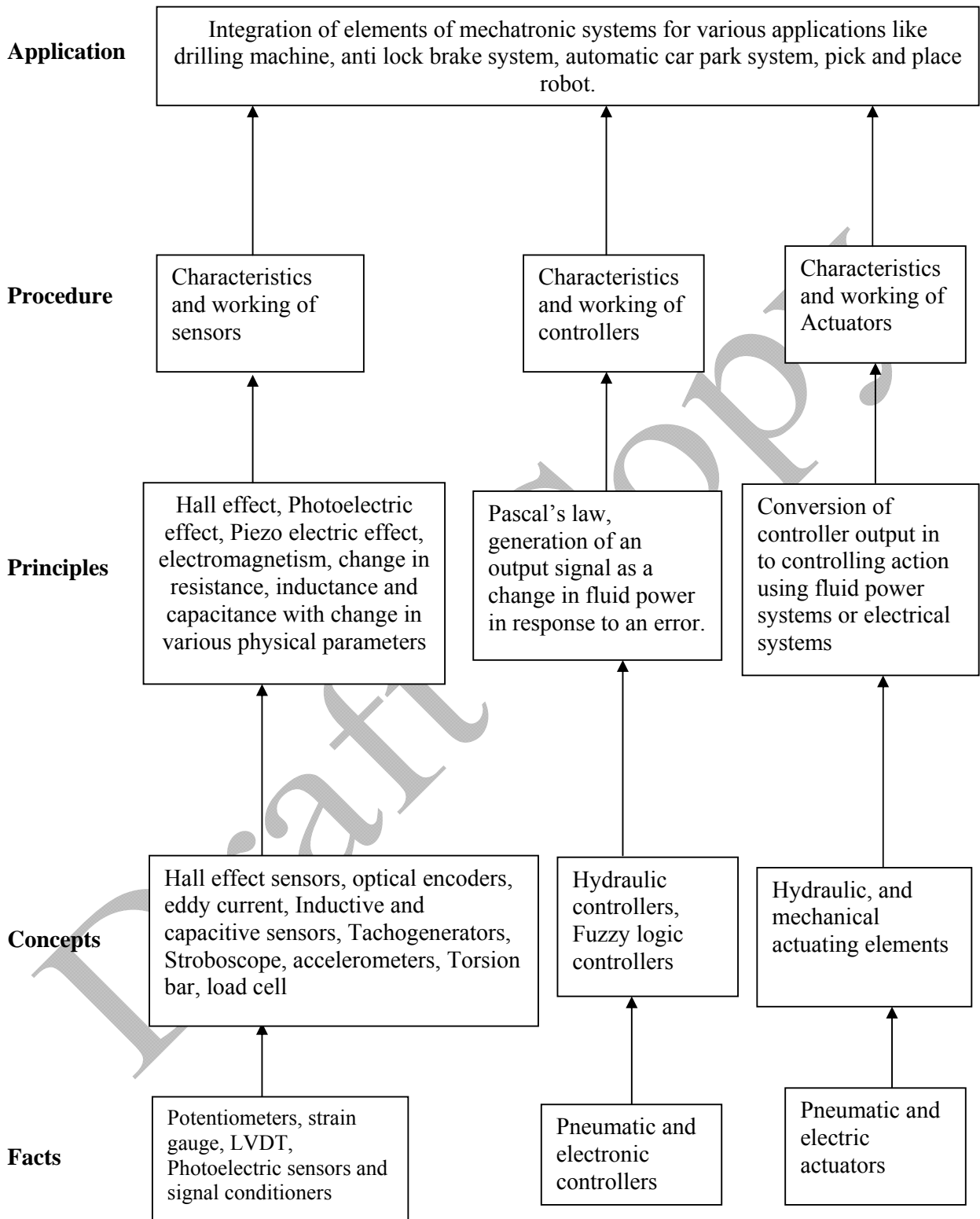
Rationale:

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:

Application	Integration of elements of mechatronic systems for various applications like drilling machine, anti lock brake system, automatic car park system, pick and place robot.

↑ ↑ ↑

Procedure	Characteristics and working of sensors	Characteristics and working of controllers	Characteristics and working of Actuators

↑ ↑ ↑

Principles	Hall effect, Photoelectric effect, Piezo electric effect, electromagnetism, change in resistance, inductance and capacitance with change in various physical parameters	Pascal's law, generation of an output signal as a change in fluid power in response to an error.	Conversion of controller output in to controlling action using fluid power systems or electrical systems

↑ ↑ ↑

Concepts	Hall effect sensors, optical encoders, eddy current, Inductive and capacitive sensors, Tachogenerators, Stroboscope, accelerometers, Torsion bar, load cell	Hydraulic controllers, Fuzzy logic controllers	Hydraulic, and mechanical actuating elements

↑ ↑ ↑

Facts	Potentiometers, strain gauge, LVDT, Photoelectric sensors and signal conditioners	Pneumatic and electronic controllers	Pneumatic and electric actuators

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:**   **[06]**
    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 :**   **[04]**
    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:
6.1 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:

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

Motor Skills:

    ▪ Proper handling of instruments.
    ▪ Measuring physical quantities accurately.
    ▪ Observe the phenomenon and to list the observations in proper tabular form.
    ▪ 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:

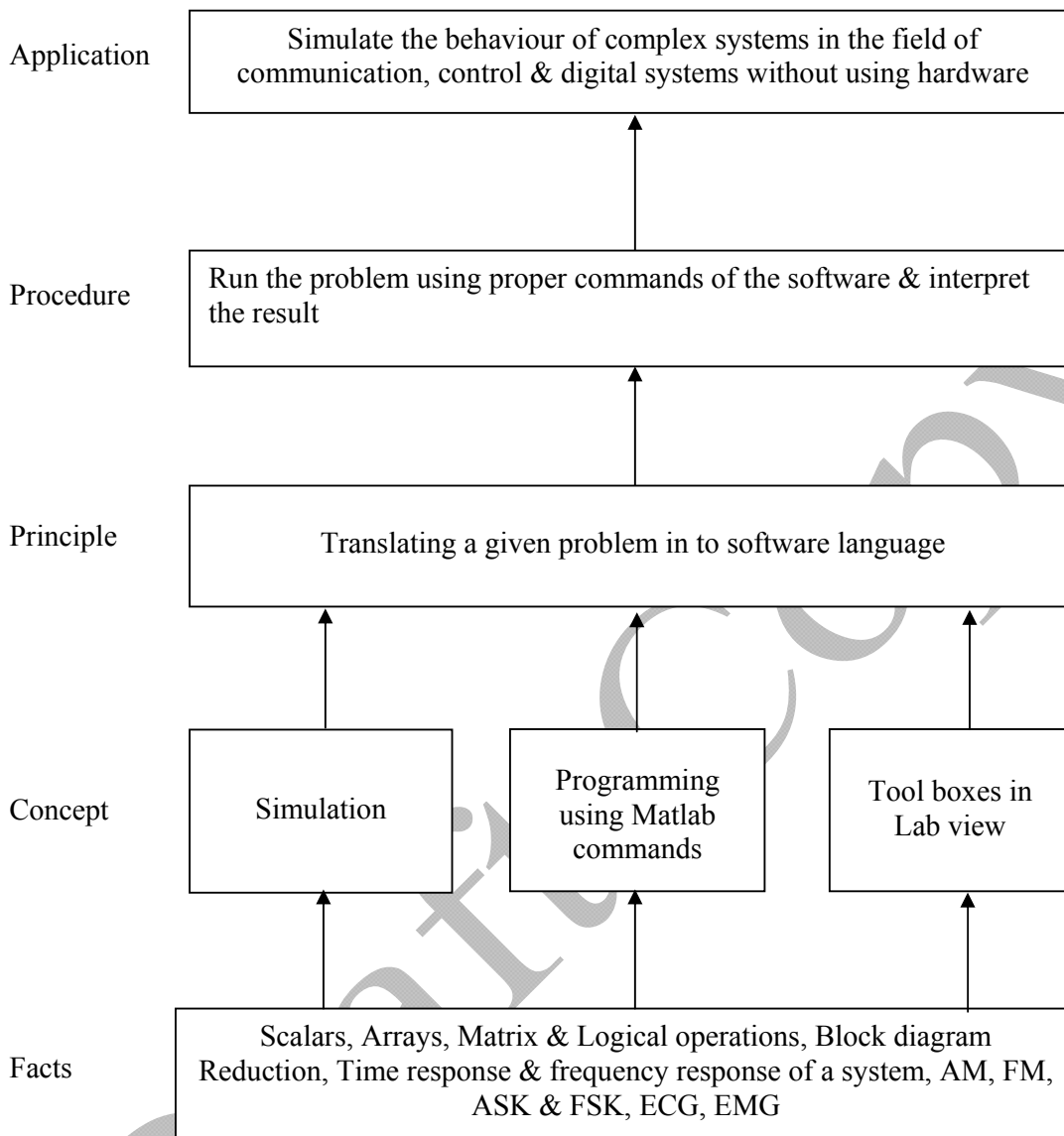| Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
--	--	02	--	--	--	--	25@	25

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:

Application	Simulate the behaviour of complex systems in the field of communication, control & digital systems without using hardware

↑

Procedure	Run the problem using proper commands of the software & interpret the result

↑

Principle	Translating a given problem in to software language

↑   ↑   ↑

Concept	Simulation	Programming using Matlab commands	Tool boxes in Lab view

↑   ↑   ↑

Facts	Scalars, Arrays, Matrix & Logical operations, Block diagram Reduction, Time response & frequency response of a system, AM, FM, ASK & FSK, ECG, EMG

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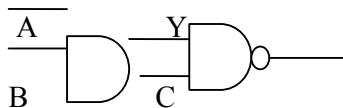
4. Use of commands to
   a. Find the determinant, inverse & transpose of the given 2X2 matrix
   b. Evaluate the following expression

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

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

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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.