 MAHARASHTRA STATE BOARD OF TECHNICAL EDUCATION, MUMBAI TEACHING AND EXAMINATION SCHEME FOR POST S.S.C. DIPLOMA COURSES																	
COURSE NAME : DIPLOMA IN MEDICAL ELECTRONICS																	
COURSE CODE : MU																	
DURATION OF COURSE : 6 SEMESTERS										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)
				TH	TU	PR	PAPER HRS.	TH (1)		PR (4)		OR (8)		TW (9)			
								Max	Min	Max	Min	Max	Min	Max	Min		
1	Management \$	MAN	17601	03	--	--	03	100	40	--	--	--	--	--	--		
2	Therapeutic Equipment	TEQ	17671	03	--	02	03	100	40	--	--	--	--	25@	10	50	
3	Intensive Care Equipment	ICE	17672	03	01	02	03	100	40	--	--	25#	10	25@	10		
4	Medical Imaging Equipment	MIE	17673	03	--	02	03	100	40	--	--	--	--	25@	10		
5	Embedded Systems β	ESY	17658	03	--	02	03	100	40	50#	20	--	--	25@	10		
6	Simulation Software β	SSO	17807	--	--	02	--	--	--	--	--	--	--	25@	10		
7	Industrial Project β	IPR	17808	--	--	04	--	--	--	--	--	50#	20	50@	20		
TOTAL				15	01	14	--	500	--	50	--	75	--	175	--		50
<p>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 ET / EJ / EN / EX / IE / IS / IC / DE / EV / IU / ED / EI Abbreviations: TH-Theory, TU- Tutorial, PR-Practical, OR-Oral, TW- Term Work, SW- Sessional Work.</p> <ul style="list-style-type: none"> ➤ 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/
EE/EP/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/EE/EP/CH/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	--	--	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.

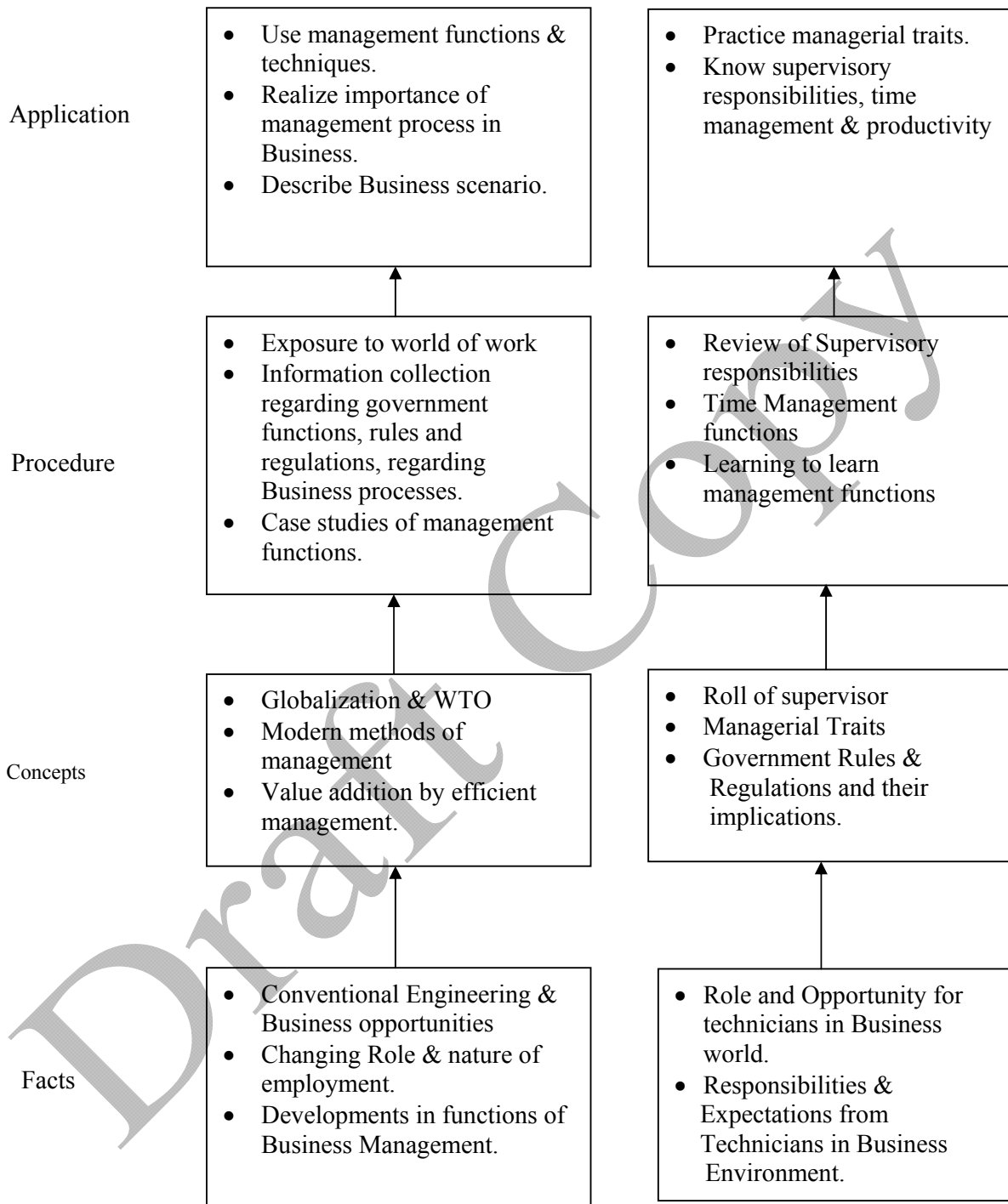
Contents of the this subject will enable the students to address various issues related to human resource, finance, materials, legislations etc. by use of basic principles of management. This will ensure that students will play their role effectively to enhance the quality of business output in total.

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:



Contents: Theory

Topic and Contents	Hours	Marks
<p>Topic 1: Overview of Business</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ State various business types and sectors ➤ Describe importance of globalisation <p>1.1. Types of Business</p> <ul style="list-style-type: none"> • Service • Manufacturing • Trade <p>1.2. Industrial sectors Introduction to</p> <ul style="list-style-type: none"> • Engineering industry • Process industry • Textile industry • Chemical industry • Agro industry • IT industry • Banking, Insurance, Retail, Hospitality, Health Care <p>1.3 Globalization</p> <ul style="list-style-type: none"> • Introduction • Advantages & disadvantages with respect to India 	02	06
<p>Topic 2: Management Process</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ State various management principles ➤ Describe different management functions <p>2.1 What is Management?</p> <ul style="list-style-type: none"> • Evolution • Various definitions of management • Concept of management • Levels of management • Administration & management • Scientific management by F.W.Taylor <p>2.2 Principles of Management (14 principles of Henry Fayol)</p> <p>2.3 Functions of Management</p> <ul style="list-style-type: none"> • Planning • Organizing • Directing • Controlling • Decision Making 	08	16
<p>Topic 3: Organisational Management</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ Compare different forms of organisation , ownership for a specific business ➤ Describe types of departmentation <p>3.1 Organization :</p> <ul style="list-style-type: none"> • Definition 	08	16

<ul style="list-style-type: none"> • Steps in organization <p>3.2 Types of organization</p> <ul style="list-style-type: none"> • Line • Line & staff • Functional • Project <p>3.3 Departmentation</p> <ul style="list-style-type: none"> • By product • By process • By function <p>3.4 Principles of Organisation</p> <ul style="list-style-type: none"> • Authority & Responsibility • Span of Control • Effective Delegation • Balance ,stability and flexibility • Communication <p>3.5 Forms of ownership</p> <ul style="list-style-type: none"> • Proprietorship • Partnership • Joint stock • Co-operative Society • Govt. Sector 		
Topic 4: Industrial Safety and Legislative Acts		
<p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ Describe types of accidents & safety measures ➤ State provisions of industrial acts. <p>4.1 Safety Management</p> <ul style="list-style-type: none"> • Causes of accidents • Types of Industrial Accidents • Preventive measures • Safety procedures <p>4.2 Industrial Legislation - Necessity of Acts</p> <p>Important Definitions & Main Provisions of following acts:</p> <ul style="list-style-type: none"> • Indian Factory Act • Workman Compensation Act • Minimum Wages Act 	08	14
Topic 5: Financial Management (No Numerical)		
<p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ Explain functions of financial management ➤ State the sources of finance & types of budgets. ➤ Describe concepts of direct & indirect taxes. <p>5.1 Financial Management - Objectives & Functions</p> <p>5.2 Capital Generation & Management</p> <ul style="list-style-type: none"> • Types of Capitals - Fixed & Working • Sources of raising Capital - Features of Short term, Medium Term & Long Term Sources <p>5.3 Budgets and accounts</p> <ul style="list-style-type: none"> • Types of Budgets 	08	16

<ul style="list-style-type: none"> • 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. <p>5.4 Meaning & Examples of –</p> <ul style="list-style-type: none"> • Excise Tax • Service Tax • Income Tax • Value Added Tax • Custom Duty 		
<p>Topic 6: Materials Management (No Numerical)</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ Describe concept of inventory, ABC analysis & EOQ. ➤ Describe purchase functions & procedures ➤ State features of ERP & MRP <p>6.1. Inventory Concept, its classification, functions of inventory</p> <p>6.2 ABC Analysis - Necessity & Steps</p> <p>6.3 Economic Order Quantity Concept, graphical representation, determination of EOQ</p> <p>6.4 Standard steps in Purchasing</p> <p>6.5 Modern Techniques of Material Management</p> <ul style="list-style-type: none"> • 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
<p>Topic 7 Quality Management</p> <p>Specific Objectives</p> <ul style="list-style-type: none"> ➤ State Principles of Quality Management ➤ Describe Modern Technique & Systems of Quality Management <p>7.1 Meaning of Quality</p> <p>Quality Management System - Activities, Benefits</p> <p>Quality Control - Objectives, Functions, Advantages</p> <p>Quality Circle - Concept, Characteristics & Objectives</p> <p>Quality Assurance - Concept, Quality Assurance System</p> <p>7.2 Meaning of Total Quality and TQM</p> <p>Components of TQM - Concept, Elements of TQM, Benefits</p> <p>7.3 Modern Technique & Systems of Quality Management like Kaizen, 5'S', 6 Sigma</p> <p>7.4 ISO 9001:2000 - Benefits, Main clauses.</p>	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 : Diploma in Medical Electronics
Course Code : MU
Semester : Sixth
Subject Title : Therapeutic Equipments
Subject Code : 17671

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:

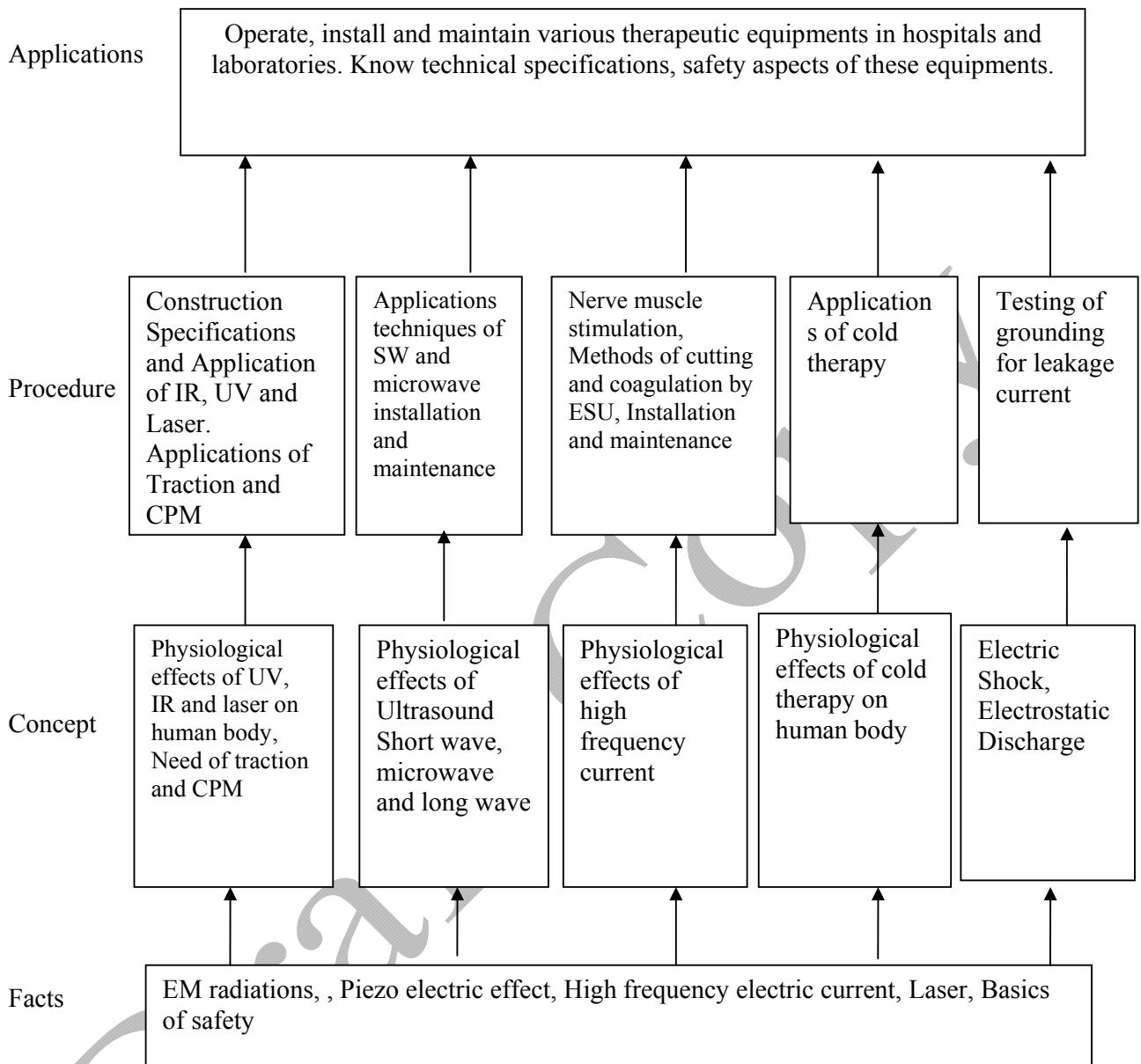
Therapeutic equipments are heart of physiotherapy department that are used not only in the hospitals but also exclusively used in cosmetics, dermatology, and injuries occurred in sports. These all equipments are based on high frequency stimulations, heat radiation, ultrasound and laser. Study of these equipments will provide the student knowledge about physiotherapy application techniques.

General Objectives.

The student will be able to understand:

1. The need of therapeutic equipment.
2. Basic principle, construction and working of the equipment.
3. Application techniques of various equipments.
4. Technical specifications, installation and maintenance of therapeutic equipments.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
<p>Topic 1) Physiotherapy</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Detect the wavelength and frequency of IR and UV radiations ➤ Draw constructional features, working and applications of UV and IR lamps. ➤ State application of CPM and Traction unit. <p>Contents :</p> <p>1.1 Therapeutic uses of IR and UV radiations, Laser [12]</p> <ul style="list-style-type: none"> • Effect of IR and UV on human body, hyperemia, pain relief through IR and UV radiations. • Construction and working of IR lamp. • Construction, assembly, circuit and principle of operation of UV lamp • Review of properties and types of Laser • List and explain medical applications of laser. <p>1.2 Traction and CPM [08]</p> <ul style="list-style-type: none"> • Need, construction, block diagram and principle of operation of traction unit • Continuous passive movement, block diagram and types (Knee and Shoulder) 	08	20
<p>Topic 2) Ultrasound Therapy and Diathermy.</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List out effects of ultrasound and different diathermy on human body. ➤ State the principal of ultrasound and different diathermies. ➤ List different applications and specifications of ultrasound and diathermy. <p>Contents:</p> <p>2.1 Ultrasound Therapy [10]</p> <ul style="list-style-type: none"> • Effect of ultrasound on human body • Construction of ultrasound therapy transducer • Technical specifications, circuit diagram and principle of operation of ultrasound therapy machine <p>2.2 Diathermy [10]</p> <ul style="list-style-type: none"> • Types of different diathermy <ol style="list-style-type: none"> i) Short wave diathermy ii) Microwave diathermy iii) Longwave diathermy • Effect of SW on human body, capacitive and inductive field, applications techniques • Technical specifications, circuit diagram and principle of operation of short wave diathermy and microwave diathermy <p>2.3 Installation and maintenance of ultrasound and diathermy equipments. [04]</p>	10	24

<p>Topic 3) Electrotherapy</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State effect of electric current on nerves and muscles. ➤ State the principle of interference theory <p>Contents :</p> <p>3.1 Effect of electric current on nerves & muscles of human body. [08]</p> <ul style="list-style-type: none"> • Principle of operation of nerve and muscle stimulator, • Circuit diagram of nerve and muscle stimulator • Technical specifications • Application techniques of electrotherapy <p>3.2 Principle of interference therapy [04]</p> <p>3.3 Installation and maintenance of nerve muscles stimulator [04]</p>	08	16
<p>Topic 4) Cold Therapy</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List out effects of cold therapy. ➤ State application techniques of cold therapy <p>Contents:</p> <ul style="list-style-type: none"> • State Principle of cold therapy. • Physiological effects of on human body and uses. • Application techniques of cold therapy • Contra-indications (avoidance of ice treatment) 	08	12
<p>Topic 5) Electro Surgical Unit</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ List safety precautions in cautery machine <p>Contents:</p> <p>5.1 Electrosurgical Unit [12]</p> <ul style="list-style-type: none"> • Effect of electric current on human tissue, • Principle of electro surgery, unipolar and bipolar modes • Different types of cutting and coagulation electrodes • Methods of cutting and coagulation. • Principle, technical specifications, block diagram of solid-state cautery machine • Patients safety in cautery machine. <p>5.2 Maintenance of electrosurgical units [04]</p>	10	16
<p>Topic 6) Safety Instrumentation</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Awareness about safety of patient, attendant and medical equipments <p>Contents:</p> <ul style="list-style-type: none"> • Causes of electric shock micro and macro shock • Physiological effects of electrical shock • Electric hazard in hospital environment and leakage current • Methods of accident prevention • Test of grounding system in patient care area chassis leakage current • Concept of Electro Static Discharge (ESD) 	04	12
TOTAL	48	100

Practical:**Skills to be developed****Intellectual Skills:**

1. Interpretation of different wave forms.
2. Interpretation of results.

Motor Skills:

1. Testing of machines.
2. Fault finding
3. Application techniques of different therapeutic equipments.

Practical:

1. Testing and operation of UV and IR lamp and its circuit.
2. Performance testing of ultrasound therapy machine and operation of its control panel.
3. Observe the performance of shortwave and microwave diathermy machine and operation of its control panel.
4. Generate and observe galvanic and faradic wave forms using electronic circuits.
5. Generate and Observe wave forms of nerve and muscle stimulator on dummy patient.
6. Generation and testing of coagulation/cutting waveforms of solid state cautery machine.
7. Observe the performance of various types of electrodes in different modes of ESU.
8. Generation of 1 MHz frequency wave form for ultrasound therapy using electronic circuit.
9. Test the equipment for optimum performance and locate the fault of ESU.
10. Test the equipment for optimum performance and locate the fault of shortwave diathermy machine.

Assignment:

1. Analyze and prepare a report on laser therapy given to the patient for different medical applications.
2. Prepare a report on interference therapy given to the patient.
3. Prepare a report on traction unit.
4. Prepare a report on CPM unit.

Learning Resources:**Books:**

Sr. No.	Title	Author	Publication
1	Handbook of biomedical instrumentation	R. S. Khandpur	Tata McGraw Hill
2	Clayton's Electrotherapy Theory and Practice	Angela Forster Nigel Palastanga	London; Philadelphia: Baillière Tindall
3	Introduction to Biomedical Instrumentation	Mandeep Singh	Prentice Hall of India
4	Biomedical Instrumentation	M. Armugam	Anuradha agencies
5	Laser Systems and Applications	Nityanand Choudhary Richa Verma	Prentice Hall of India
6	Biomedical Instrumentation & measurement	R. Anandnatrajan	Prentice Hall of India

Websites:

www.medindia.net/pateints/pateintsinfo

www.surgical-tour.org.uk

List of equipments:

1. Therapeutic UV and IR lamp
2. Ultrasound therapy machine
3. Shortwave and microwave diathermy machine
4. Nerve and muscle stimulator
5. Electro Surgical unit
6. Digital Oscilloscope

Draft Copy

Course Name : Diploma in Medical Electronics
Course Code : MU
Semester : Sixth
Subject Title : Intensive Care Equipment
Subject Code : 17672

Teaching and Examination Scheme:

Teaching Scheme			Examination Scheme					
TH	TU	PR	PAPER HRS	TH	PR	OR	TW	TOTAL
03	01	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:

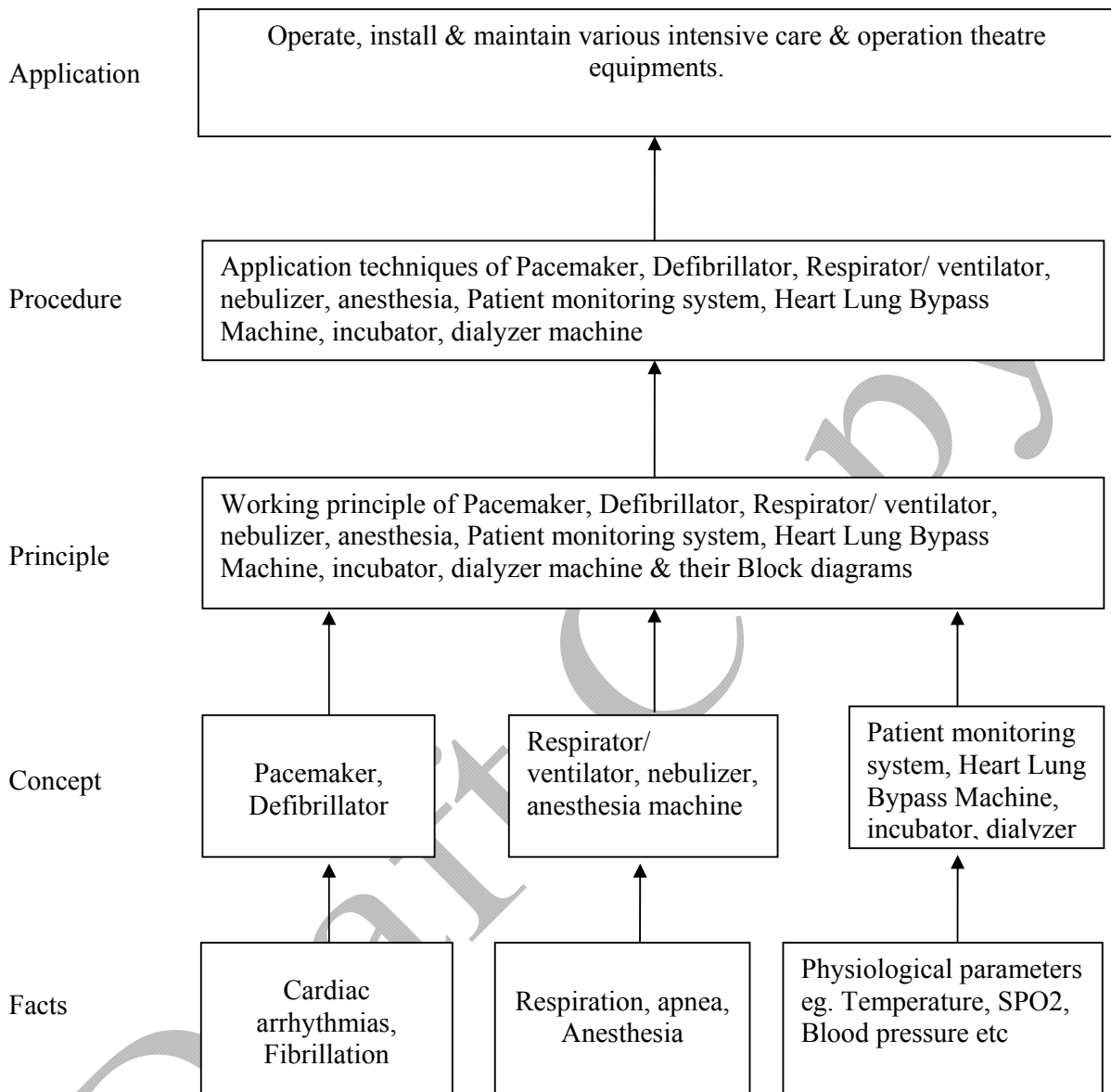
Knowledge of basic subjects such as Human Biology & Biosensor is essential to study IC & OT equipments. In the hospital environment, Intensive Care Unit is oriented with emergency & special case services. Operation theatre (OT) is a unit where different surgeries are performed. In ICU different biomedical equipments are used such as pacemaker, defibrillator, patient monitors etc. Whereas in OT heart lung machine, Anesthesia apparatus etc are used. The topic under this subject covers detail study of equipment's working principle, operating modes, block diagram and technical specifications.

General Objectives

Students will be able to

1. Understand the principle & working of IC & OT equipments.
2. Operate various IC & OT equipments.
3. State technical specification of these equipments.
4. Understand application of these equipments.

Learning Structure:



Theory

Topic & Contents	Hours	Marks
<p>Topic 1) Cardiac Pacemaker</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw a labeled block diagram of pacemaker ➤ Write the technical specifications of pacemaker <p>Contents:</p> <ul style="list-style-type: none"> • Cardiac arrhythmias - heart block & need of cardiac pacemaker • Types of pacing modes, types of pacemaker - internal, external, fixed (asynchronous), demand (synchronous) & programmable. • Difference between i) Internal and external pacemaker. ii) Fixed and demand pacemaker. • Pacemaker leads- Endocardial, myocardial, unipolar & bipolar leads. • Block diagram of : <ul style="list-style-type: none"> i. internal pacemaker, ii. asynchronous pacemaker iii. synchronous: (demand, atrial, rate responsive) pacemaker • Technical specifications of pacemaker. 	12	24
<p>Topic 2) Defibrillator</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Draw circuit diagram of dc defibrillator ➤ Troubleshooting & maintenance of defibrillator <p>Contents:</p> <ul style="list-style-type: none"> • Fibrillation of heart, need of defibrillator, instant & sync modes, electrodes of defibrillator, application techniques • Difference between ac and dc defibrillator. • Technical specifications & principle of dc - defibrillator. • Simplified circuit diagrams of charging & discharging sections of dc-defibrillator. • Concept of AED (Automated External Defibrillator), energy analyzer, biphasic and monophasic defibrillator. • Block diagram of cardioverter. • Troubleshooting & maintenance of defibrillator. 	07	16
<p>Topic 3) Ventilator, Nebulizer & Suction Apparatus.</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State concept of respiration & apnea. ➤ Draw block diagram of IC equipments. ➤ Write technical specification of all these equipments <p>Contents:</p> <ul style="list-style-type: none"> • Concept of respiration & apnea. • Need of respirator /ventilator, nebulizer, suction apparatus, anesthesia apparatus (boils apparatus). • Different modes of ventilator(assist, control, assist/ control) • Block diagram & technical specification of ventilator, nebulizer, 	10	20

<p>suction apparatus, anesthesia machine.</p> <ul style="list-style-type: none"> • Troubleshooting and maintenance of ventilator. 		
<p>Topic 4) Patient Monitoring Systems , Infusion Pump And Balloon Pump</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State purpose of bedside & central monitor ➤ Draw block diagram of bed side monitor <p>Contents:</p> <ul style="list-style-type: none"> • Need of bedside & central monitor. Technical specification, block diagram & principle of operation of bedside & central monitor troubleshooting & maintenance of bedside monitor. • Concept of infusion pump and balloon pump. Evolution levels in the control of drug delivery system, block diagram of programmable microprocessor based infusion pump. 	07	16
<p>Topic 5) Life Support Equipments</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Identify the need of heart-lung bypass machine, dialyzer and incubator ➤ Draw the block diagram of hemodialysis machine, baby incubator & heart lung bypass machine <p>Contents:</p> <ul style="list-style-type: none"> • Need of heart - lung bypass machine, oxygenator, artificial heart pump & heat exchanger. Block diagram & principle of operation of heart lung bypass machine. • Need of artificial kidney & dialyzer. Types of dialyzers. Block diagram & principle of operation of hemodialysis machine. • Need of incubator. Technical specifications, block diagram & principle of operation of baby incubator. Circuit diagram of temperature control & indicator used in baby incubator. 	12	24
Total	48	100

Practicals:

Skills to be developed

Intellectual skills

1. Selection of instruments.
2. Know appropriate use of all equipments in IC & OT.

Motor Skills

1. Operate IC & OT equipment.
2. Troubleshooting and maintenance.

List of Experiments:

1. Testing of charging, discharging & energy control in dc defibrillators with instant & synchronous mode.
2. Test the DC defibrillator for optimum performance and locate the fault of equipment.
3. Identify different sections of nebulizer and operate it.
4. Identify different sections of Ventilator and operate it in different modes.

5. Identify different sections of Anesthesia machine and operate it.
6. Identify different sections of infusion pump and operate it.
7. Monitoring of physiological parameters of different patients and recording of these parameters using central monitor.
8. Identify different sections of hemodialysis machine and its functions.
9. Plot characteristic of Temperature control in baby incubator.
10. Test the ventilator/ bedside monitor for optimum performance and locate the fault of equipment.

List of Assignments:

1. Visit the ICU & OT of the hospital & list various equipments used in it along with their technical specifications
2. Enlist the various parameters of hemodialysis machine & control schemes for those parameters. What is the importance of RO system in hemodialysis machine?
3. Write down the batteries used in pacemaker along with their types
4. Maintenance & calibration of ICU & OT equipments.

Learning Resources:

Books:

Sr. No.	Title	Author	Publisher
1	Handbook of Biomedical Instrumentation	R.S.Khandpur	Tata McGraw Hill
2	Biomedical Instrumentation & Measurements	Lesli P Cromwell, Fred J. Weibell, Erich A. Pfeiffer	Prentice Hall of India
3	Introduction to Biomedical Equipment Technology	Carr Joseph J., Brown J.M	Pearson Education Delhi
4	Medical Instrumentation Application & Design	John G. Webster	John Wiley and Sons
5	Biomedical Instrumentation & Measurements	R. Anandnatarajan	Prentice Hall of India
6	Introduction to Biomedical Instrumentation	Mandeep singh	Prentice Hall of India
7	Biomedical Instrumentation	M. Armugam	Anuradha agencies

Websites:

www.autherstream.com

List of equipments:

1. Defibrillator
2. Pacemaker
3. Ventilator
4. Nebulizer
5. Hemodialysis machine
6. Baby incubator
7. Syringe pump
8. Bedside monitor
9. Heart lung bypass machine
10. Anesthesia machine

Course Name : Diploma in Medical Electronics
Course Code : MU
Semester : Sixth
Subject Title : Medical Imaging Equipments
Subject Code : 17673

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.**
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Rationale:

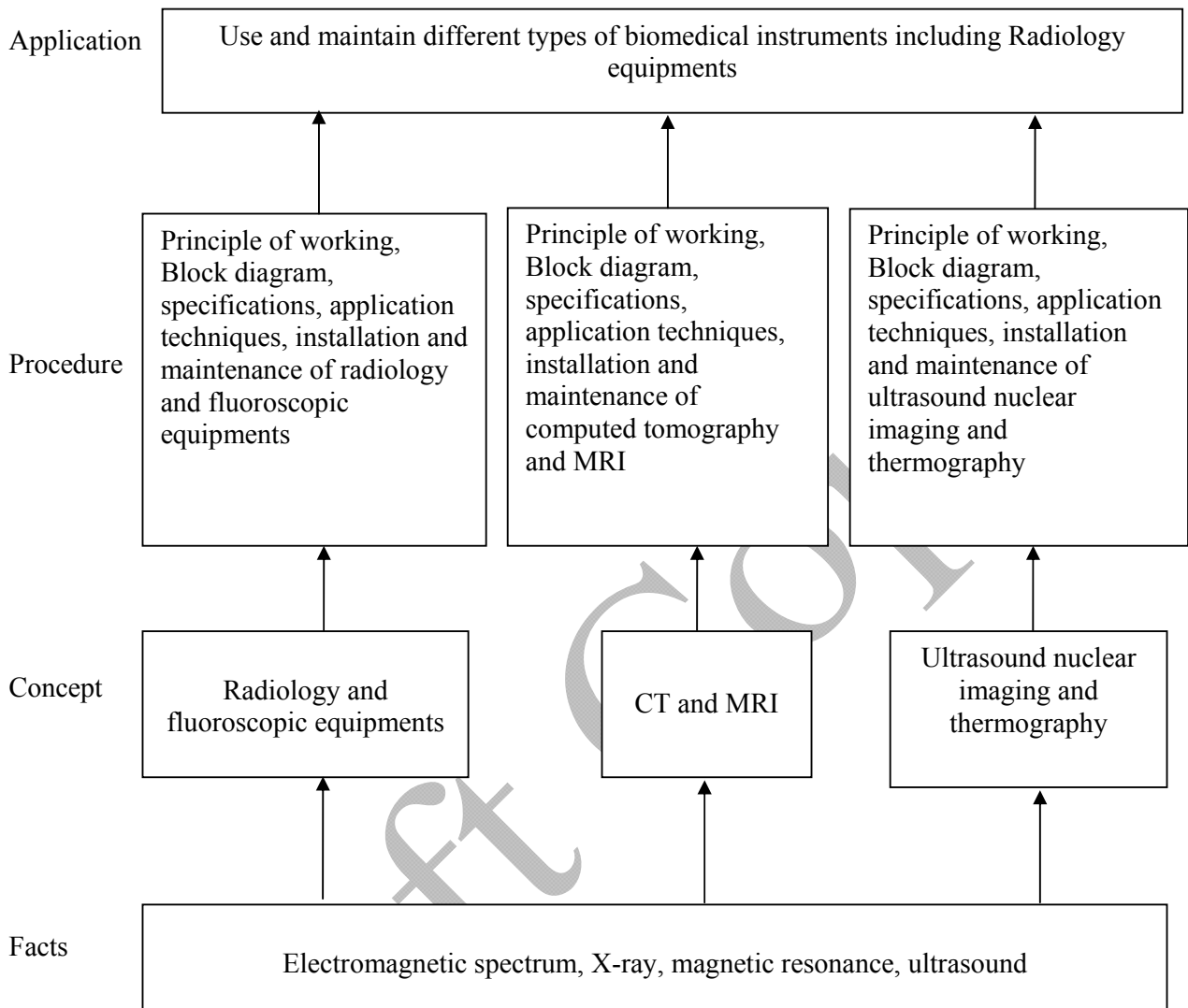
Medical imaging techniques visualize the internal anatomy and part of physiology of human body. These techniques employ radiation source of X-rays, gamma rays, IR rays, magnetic waves and ultrasound waves. This subject will provide students the details of different imaging modalities, quality of image formation and radiation safety.

General Objectives:

The student will be able to:

1. Understand the need and types of radiation sources.
2. State and explain the basic principle of generation and properties of radiation.
3. Explain construction, working and technical specification of imaging equipments.
4. Apply imaging equipment.

Learning Structure:



Theory:

Topic and Contents	Hours	Marks
<p>Topic 1) Basics of radiology and X ray equipments</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State properties of electromagnetic radiations ➤ State principle of working of X ray machine ➤ List advantages, disadvantages, and applications of X ray <p>Contents:</p> <p>1.1 Introduction of thyristor family (SCR, DIAC, TRIAC) construction, symbols, characteristics [04]</p> <p>1.2 Basics of X rays [14]</p> <ul style="list-style-type: none"> • Electromagnetic radiation, types of radiation, wavelength and properties • X rays, X ray spectrum, properties • Advantages and disadvantages of X ray • Medical applications of X rays • X ray assembly and circuits Types of X ray tubes (stationary and rotating), principle, Construction, operation and specifications • X ray tube rating: electric and thermal • Control circuit- High voltage (Kv), filament control and tube Current (mA), exposure timing. • Block diagram of X ray machine- X ray tube, head assembly, filters, collimators, X ray table, bucky, grids, trays, cassettes, film processing. <p>1.3 Installation and maintenance of X ray machine [06]</p> <ul style="list-style-type: none"> • Risk involved in handling of X ray equipments 	14	24
<p>Topic 2) Fluoroscopy, Radiography and Angiography</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Differentiate fluoroscopy and radiography ➤ Draw block diagram of fluoroscopy machine ➤ State the concept of angiography <p>Contents:</p> <p>2.1 Fluoroscopy [06]</p> <ul style="list-style-type: none"> • Concept of fluoroscopy and radiography, difference between fluoroscopy and radiography • Principle, block diagram of fluoroscopy machine • Image intensifier and television camera <p>2.2 Angiography technique and its block diagram [06]</p> <p>2.3 Installation and maintenance of angiography machine [04]</p>	08	16
<p>Topic 3) CT & MRI</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State the working principle of CT machine. ➤ List different parts of CT machine ➤ Draw of block diagram of CT machine 	10	24

<p>➤ Install and maintain CT and MRI</p> <p>Contents:</p> <p>3.1 Computed Tomography [08]</p> <ul style="list-style-type: none"> • Principle of CT, CT number, CT generations, CT detectors, spiral CT, block diagram of CT machine, clinical application • Image reconstruction techniques <ul style="list-style-type: none"> i. Back projection ii. Iterative projection iii. Filtered back projection • Ring artifact <p>3.2 Magnetic Resonance Imaging [08]</p> <ul style="list-style-type: none"> • Basic definition- RF shielding, shimming • Principle of MRI system • Types of magnets • Basic component of MRI system • Block diagram of MRI detection system <p>3.3 Biological effects of MRI imaging, advantages of MRI system [04]</p> <p>3.4 Installation and maintenance of CT machine and MRI machine [04]</p> <p>Risk involved in handling CT and MRI [04]</p>		
Topic 4) Ultrasound Imaging		
<p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State properties of ultrasound ➤ Describe different image scanning in ultrasound ➤ List technical specification of ultrasound scanner ➤ Maintain and install the ultrasound scanner <p>Contents:</p> <p>4.1 Ultrasound [12]</p> <ul style="list-style-type: none"> • Properties of ultrasound, ultrasound transducer, pulse echo techniques, ultrasonic field • Ultrasound imaging <ul style="list-style-type: none"> A scan, B scan, TM scan and real time B scan Sequential/ linear and phased array transducers • Block diagram, technical specification and clinical applications, of ultrasound scanner <p>4.2 Installation and maintenance of ultrasound machine [04]</p>	08	16
Topic 5) Nuclear Medical imaging(NMI), Thermography and Endoscopy		
<p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ State principle of working of nuclear imaging , thermography and Endoscopy ➤ Install and maintain above instruments. <p>Contents:</p>	08	20

<ul style="list-style-type: none"> • Principle of nuclear imaging, radio isotope, gamma camera, nuclear transducer (scintillation counter, Geiger Muller tube) • Principle and block diagram of thermography machine • Principle and block diagram of endoscopy machine • Installation and maintenance of above equipments 		
Total	48	100

Practical:

Skills to be developed:

Intellectual Skills:

1. Now the function of various equipment.
2. Decide about the time setting to run the equipment.
3. Interpret the instructions.

Motor Skills:

1. Operate the machines as per instructions.
2. Check the output for accuracy.
3. Appropriate setting of the equipment.

List of Experiments:

1. Prepare chart for maintenance and troubleshooting of X ray machine.
2. Prepare chart for maintenance and troubleshooting of CT scanner
3. Prepare chart for maintenance and troubleshooting of Ultrasound scanner
4. Prepare chart for maintenance and troubleshooting of MRI scanner
5. Prepare chart for maintenance and troubleshooting of Endoscopy
6. Observe and understand the working of linear array transducer.
7. Observe and understand the working of phase array transducer.
8. Study of CCTV system used in fluoroscopy.
9. Built a timer circuit for X ray.
10. Demonstration of :
 - X -Ray fluoroscopy
 - X-Ray radiography
 - CT scanner
 - MRI scanner
 - Ultrasound scanner
 - Image intensifier
 - Gamma camera

Assignments:

Write technical specifications, manufacturers, cost of following equipments

1. X -Ray fluoroscopy
2. X-Ray Radiography
3. CT scanner
4. MRI scanner
5. Ultrasound scanner
6. Image intensifier
7. Gamma camera

Learning Resources

Books:

Sr. No.	Title	Author	Publisher
01	Introduction to Physics of Diagnostic Radiology	Christen Sen's Thomas S. Curry Jamis E. Dowdey Robert C.Murry	Lea And Febiger Publication
02	Handbook of Biomedical Instrumentation	R.S. Khandpur	Tata McGraw Hill
03	Medical Imaging Physics	William R. Hendee E. Russell Ritenou	Wiley – Liss Publication
04	Biomedical Instrumentation and Measurement	R. Anandnatrajan	Prentice Hall of India
05	The Physics of Diagnostic Imaging	David S. Dowseff, Patric A. Kenny, R. Eugene Johnnton	Chapman And Hall Medical Publication
06	Cheney's Equipment for Student Radiographer	Peter Carter, Audry Paterson, Mike Thornton, Andrew Hyatt	Blackwell Scientific Publication
07	Medical Electrical Equipment	Robert E. Molleoy	B.I. Publication

Website:

www.aerb.gov.in

www.medindia.net/patients/patientsinfo

List of Equipments

1. Demo model of X-Ray fluoroscopy
2. Demo model of X-Ray Radiography
3. Ultrasound scanner
4. Image intensifier 'C' arm
5. Linear array transducer
6. Phase array transducer

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 : 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 Organization

Driver software

Handling multiple tasks

Concepts

Programming Model of Microcontroller

C Programming (IDE)

OS & Communication Interface

Facts

Microprocessor & Microcontroller

Assembly Language Programming

Memory & data

Theory:

Topic and Contents	Hours	Marks
<p>Topic 1: Architecture of Microprocessor and Microcontroller</p> <p>Specific Objectives:</p> <ul style="list-style-type: none"> ➤ Study of Architecture of microcontroller 89C51. ➤ Distinguish Microprocessor and Microcontroller architectures. <p>Contents:</p> <p>1.1 Architecture of Microcontroller 89C51 GPR, SFR</p> <ul style="list-style-type: none"> • Address, Data & Control bus generation. • Memory structure (Data and Program memory) • IO Ports, Interrupts, • Timer/Counter, Serial Communication <p>1.2 Block diagram and description of architectures of Processors:</p> <ul style="list-style-type: none"> • Von Neumann • Harvard • RISC • CISC • DSP • Multi Core Processor 	08	08
<p>Topic 2: Programming Microcontroller 89C51 with ‘C’</p> <ul style="list-style-type: none"> ➤ Use Integrated Development Tools ➤ Develop Program logic with ‘C’. <p>Contents:</p> <p>2.1 Software Development Tools: Operation and selection (08 Marks)</p> <ul style="list-style-type: none"> • Integrated Development Environment (IDE): Cross-Compiler, 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 <p>2.2 Programming with ‘C’: (16 Marks)</p> <ul style="list-style-type: none"> • 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
<p>Topic 3: Communication Protocols</p> <ul style="list-style-type: none"> ➤ Use of communication modes and protocols. <p>Contents:</p> <ul style="list-style-type: none"> • 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

<ul style="list-style-type: none"> 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 		
<p>Topic 4: I/O interfacing</p> <ul style="list-style-type: none"> ➤ Interface different devices to Microcontroller 89C51. ➤ Develop logic of program to work with different devices. <p>Contents:</p> <p>Interfacing:</p> <ul style="list-style-type: none"> 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
<p>Topic 5: Embedded System Design</p> <ul style="list-style-type: none"> ➤ Classify and specify characteristics of embedded system. <p>Contents:</p> <ul style="list-style-type: none"> 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
<p>Topic 6: Real Time Operating System</p> <ul style="list-style-type: none"> ➤ Define, understand and classify operating system. ➤ Define, describe and applications of real time operating system. <p>Contents:</p> <p>Operating System:</p> <ul style="list-style-type: none"> 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	MicroC/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 : 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 : 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:

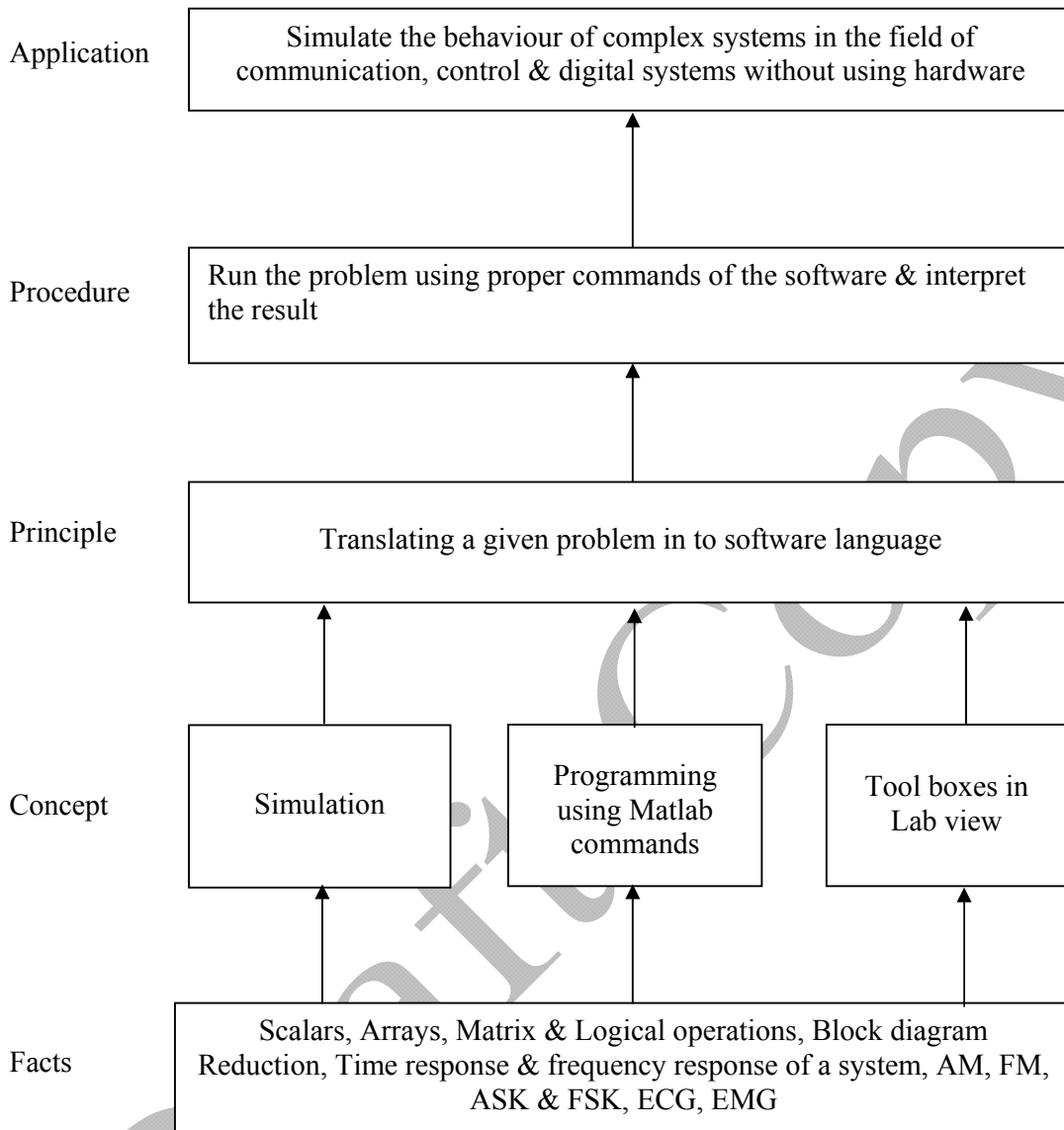
Recent development in technology has put a lot of emphasis on awareness of analytical tools available in the market. The ready to use library functions available in different simulation software enable the user to design circuits without knowing the complex mathematical details. Under this subject students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

General Objectives:

Students will be able to:

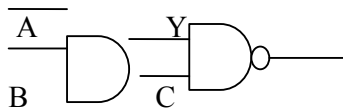
1. Learn the use of various library functions available in the software.
2. Construct given circuit diagram using these library functions.
3. Study the working of the circuit for various inputs.

Learning Structure:



List of Experiments

- Verify simple mathematical operations of all elements in row/column vector. Using MATLAB
 - Sum
 - Mean
 - Length
 - Max
 - Min
 - Prod
 - Sign
 - Round
 - Sort
 - Fix
- Use commands to
 - convert centigrade to Fahrenheit
 - Given the radius of circle. Find the circumference & its area
- Calculate the output for all the eight conditions of A,B,C



- Use of commands to
 - Find the determinant, inverse & transpose of the given 2X2 matrix
 - Evaluate the following expression

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

- Calculate the natural frequency of oscillators for the given RLC circuit. Assume $L=0.01\text{mH}$, $R=100\Omega$ & C varying from 0.1 to 0.5 in steps of 0.1 μF using following equation

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

- A series R-L-C circuit connected across 100V peak, 50 Hz supply, consists of $R=10\Omega$, $L=0.2\text{H}$, $C=100\mu\text{F}$. Write a MATLAB script to determine the resonant frequency & current at resonance

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

- Connect three sine wave sources of given amplitude and frequency but with a phase shift of 0, $2\pi/3$, and $-2\pi/3$ to a 3X1 multiplexer and observe the waveforms on scope. Also, demultiplex these waveforms and observe on the scope.
- 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 $R = 1 \text{ K}\Omega$ and $C = 0.1 \mu\text{F}$ 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 $S^5+2S^4+4S^3+8S^2+3S+1$ 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 tachicardia and bradycardia
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.