6.1 EMPLOYABILITY SKILLS – II

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-	-	2

RATIONALE

The present day world requires professionals who are not only well qualified and competent but also possess good communication skills. Our diploma students not only need to possess subject related knowledge but also soft skills to get good jobs or to rise steadily at their work place. The objective of this subject to prepare students for employability in job market and survive in cut throat competition among professionals.

DETAILED CONTENTS

1. Oral Practice

i)	Mock interview	(05 hrs)
ii)	Preparing for meeting	(05 hrs)
iii)	Group discussion	(05 hrs)
iv)	Seminar presentation	(05 hrs)
v)	Making a presentation	(12 hrs)

a) Elements of good presentation
b) Structure and tools of presentation
c) Paper reading
d) Power point presentation

6.2 INSTALLATION AND MAINTENANCE OF MEDICAL EQUIPMENT

L	T	P
3	-	3

RATIONALE

This subject intends to equip the students with relevant concepts and principles of installation, maintenance of biomedical equipment. The subject includes an exposure to testing of electrical installation keeping in view the equipment as well as patient's safety. The students will carry out preventive/breakdown maintenance as well as troubleshoot faults in various bio-medical equipment/machines in addition to preparing maintenance schedule of machines.

DETAILED CONTENTS

1. Installation of Medical Equipment (10 hrs)

Selection of proper site for the installation of small equipment available in institute, availability of electrical connections (sockets/switches) of proper ratings, minimal use of loose wiring. Non-conducting (electrical) Lab tables for equipment installation. Space for handling of equipment.

Design and Fabrication of an electronic circuit, equipment, nature of faults, troubleshooting (fault-location, fault-finding) aids.

Trouble-shooting techniques, procedure, component tests, Ground systems, systematic trouble shooting checks.

Temperature sensitive intermittent problems, corrective action, preventive maintenance, service and maintenance laboratory, professional qualities and work habits.

2. Maintenance and Servicing of Medical Equipment (12 hrs)

a) ECG machine
b) EEG Machine
c) X-Ray Machine
d) Colorimeter
e) Auto analyzer
f) Electro surgical unit
g) Incubator
h) Bed Side Monitor
i) Defibrillator

3. Stabilizers, Inverters and power supplies (08 hrs)

Use and installation of stabilizers, generators in Hospital, Nursing Home, in laboratory of the institute, their ratings.

- Time delays of CVT, SMPS, UPS
- UPS: various type, Basic principles, block diagrams of online, and off-line, systems.
- Inverters: Selection of Inverter, load calculation, voltage and ampere ratings
- Use and installation of above kind of equipment

4. Safety Aspects (08 hrs)

a) Introduction
b) Radiation safety instrumentation
c) Physiological effects due to 50 Hz current passage
d) Micro-shock and macro-shock hazards of medical instruments
e) Electrical accidents in hospitals
f) Devices to protect against electrical hazards
g) Hospital architecture, hospital regulation, inspections of equipment, emergency power system, Oxygen safety, safety in the operating room, hazards of gases, pressure chambers, preventive maintenance.

5. Servicing of Medical Equipment (10 hrs)

Use and operation of equipment, understanding of probable defects, operation of the equipment, cold tests - visual and by use of test instruments (generally multimeter), finding loose, broken/burn-out parts and components, electrical wire, fuse etc. Live tests - testing of power leads, fuses, and power supply circuit testing (voltage measurements) tests at different points in a machine. Finding faults in a machine and its repairs.

LIST OF PRACTICALS

1. Testing of electrical installation in the institute from electrical power meter output to the electrical output points (sockets), safety devices and their proper installations, loose connection. Earthing preparation and installation of proper earthing and its extension to electrical points.
2. Installation of small medical equipment in laboratories of the institute, precautions to be taken.
3. Study of large medical equipment in hospital/nursing home (Special emphasis to x-ray machines).
4. Installation of stabilizers, inverters, generators in laboratory of the institute nursing home/ hospital.
5. Maintenance schedule for different equipment and their records in a hospital
6. Servicing of small medical machines/equipment in Laboratory.

RECOMMENDED BOOKS

1. Introduction to Biomedical Equipment Technology by Carr and Brown, Regents and Prentice Hall of India, New Delhi

2. Principles of Bio-medical Instrumentation and Measurements by Leslie Cromwell, Fred J Weibell, Erich A Pfeiffer Prentice Hall of India, New Delhi

3. Principles of Biomedical Instrumentation and Measurements by Richard and Aston by MERRIL an Imprint of Macmillan Publishers Co New York.

4. Modern Electronic Equipment Trouble shooting, Repair and Maintenance by RS Khandpur, Tata McGraw Hill Publishing House, New Delhi

5. Bio-medical Instrumentation by M Arumugam, Anuradha agencies Publishers, Vidayakaruppur, Kumbakonam RMS

6. Hospitals Planning, Design and Management, by GD Kunders, S Gopinath and A Katakam, Tata McGraw Hill, Publishing House, New Delhi

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Sr No	Topic	Time Allotted (hrs)	Marks Allocation%
1	Installation of Medical Equipment	10	20
2	Maintenance & Servicing of Medical Equipment	12	25
3	Stabilizers, Inverters and power supplies	08	15
4	Safety Aspects	08	15
5	Servicing of Medical Equipment	10	25
Total		**48**	**100**

6.3 RADIOLOGY AND IMAGING

L T P
3 - 4

RATIOANALE

Electronics is being used in medical science to a large extent. A large number of new equipment is being used in hospital and research labs. The most important equipment i.e x-ray, ullrasonic, CT scan, MRI field and radiology and page imaging. The subject covers all the images of human being (bony structure) which is very useful in medical diagnosis. So, the practical work done in this area will hone skills in the servicing and maintenance of the Radiology and Imaging. This will make students aware about various precautions to be taken equipment.

DETAILED CONTENTS

1. Introduction to X-ray machine. (12 hrs)

   - Origin and nature of X-rays, their units and properties or Medical Diagnosis, Block diagram of X-Ray machine & X-Ray circuits
   - Types of X-rays machine as per their use
     a) General purpose X-rays
     b) Digital X-rays
     c) Mobile X-rays
   - X-rays procedure and processing
   - Safety issues
   - Maintenance of X-ray machines

2. Ultrasound Imaging (10 hrs)

   2.1 Introduction of ultrasonic scanners, modes of scanning.
   2.2 Generation and detection of ultrasonic, transducers used, color Doppler, Doppler principle, Computed sonography
   2.3 Block diagram of ultrasonic machine and its description

3. C.T. Scanner (08 hrs)

   Introduction, block diagram and types of C.T. Scanner

4. MRI (Magnetic Resonance Imaging) (06 hrs)

   Introduction, block diagram and different types of MRI

5. Angiography (06 hrs)

Principle of operation, components of digital radiography system, Block diagram and operation, advantages of digital subtraction angiogram.

6. Nuclear Medicine Instruments (06 hrs)

Radio active particle, Gamma Camera

LIST OF PRACTICLS

1. Demonstration front panel control and operation of X-ray machine
2. Identification of components of x-ray machine and interconnection.
3. Identification of different P.C.B cards and their function, testing, circuit tracing.
4. Fault finding in x-ray machine
5. Developing of x-ray films in dark room.
6. Demonstration of front panel and rear panel control and operation of Ultrasonic machine.
7. Identification of different PCB cards used in the ultrasonic machine
8. Familiarization with different probes sector and electronic
9. Demonstration and operation of computer-controlled ultrasonic scanner (Color Doppler)
10. Troubleshooting of various common faults in Color Doppler Machine
11. Demonstration of working of CT scanners in Hospital
12. Demonstration of MRI in Hospital diagnostic center
13. General fault finding and trouble shooting

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. Handbook of Biomedical Engineering – IEEE Press
2. Introduction to Biomedical Equipment Technology – Joseph J. Carr and John M Brown.
3. Principles of Biomedical Instrumentation and Measurement – Richard Aston.
4. X-ray Equipment for student Radiographers-Chesney and Chesney-CBS Publishers.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Sr No	Topic	Time Allotted (Hrs)	Marks Allotted (%)
1	Introduction to X-ray machine	12	25
2	Ultrasound Imaging	10	20
3	C.T. Scanner	08	15
4	MRI (Magnetic Resonance Imaging)	06	15
5	Angiography	06	13
6	Nuclear Medicine Instruments	06	12
	Total	**48**	**100**

6.4 COMMUNICATION SYSTEM AND TELEMETRY

L T P
4 - 3

RATIONALE

This course provides the basics of electronic communication systems including transmitters, receivers, antennas and various modes of propagation of signals. In addition to components and systems of fiber optic communication, the students will learn the basics of satellite communication. Biomedical Telemetry i.e. wireless telemetry, modulation techniques used in telemetry and interfacing Bio-analog signal to computers for interpretation and diagnostic and monitoring purpose. This course will provide the students with perspectives of different communication systems.

DETAILED CONTENTS

1. AM/FM Transmitters (08 hrs)

   a) Classification of transmitters on the basis of modulation, service, frequency and power
   b) Block diagram of AM transmitters and working of each stage
   c) Block diagram and working principles of reactance FET and armstrong FM transmitters

2. AM/FM Radio Receivers (14 hrs)

   a) Principle and working with block diagram of super heterodyne AM receiver. Function of each block and typical waveforms at input and output of each block
   b) Performance characteristics of a radio receiver: sensitivity, selectivity, fidelity, S/N ratio, image rejection ratio and their measurement procedure. ISI standards on radio receivers (brief Idea)
   c) Selection criteria for intermediate frequency (IF). Concepts of simple and delayed AGC
   d) Block diagram of an FM receiver, function of each block and waveforms at input and output of different blocks. Need for limiting and de-emphasis in FM reception
   e) Block diagram of communication receivers, differences with respect to broadcast receivers.

3. Typical ECG Telemetry System (16 hrs)

   Block diagram of single channel telemetry system, Block diagram of high frequency section of ECG telemetry receiver, Block diagram of ECG demodulation and circuits in ECG telemetry receiver, Telemetering, multi channel wireless telemetry system, telemetry of ECG and respiration, computer aided ECG analysis.
   Implantable telemetry system

   Implantable telemetry system for blood flow and blood pressure, Transmission of analog physiological signals over telephone lines, multi-channel EEG telephone telemetry, Temperature telemetry system.

4. Multiplexing (08 hrs)

Time division and frequency division multiplexing. Channel bandwidth, wireless telemetry Sampling; definition and necessity, qualification, encoding, modulation, amplification and transmission. Decoding and reconstruction of transmitted signals

5. Fibre Optic Communication: (12 hrs)

- Advantages of Fibre Optic Communication
- Block Principle of Light Penetration and Propagation, Numeric Aperture (NA)
- Types of optical fibres and cables.
- Brief idea of Losses in Optical Fibres and Dispersion
- Working principles and characteristics of optical light sources and light detectors.
- Block diagram of fibre optic communication link.
- Basic idea of fibre connection techniques - splicing and lensing

6. Satellite Communications: (06 hrs)

- Basic idea, passive and active satellites, Meaning of the terms; orbit, apogee, perigee
- Geo-stationary satellite and its need. Block diagram and explanation of a satellite communication link.

LIST OF PRACTICALS

1. To observe the waveforms at different stages of a AM transmitter
2. To observe the waveforms at different stages of a Radio Receiver
3. Familiarisation and identification of fibre optic components such as fibre optic light source, detector, connector assembly etc
4. To assemble the fibre optic communication set up (using teaching module) and compare the transmitted signal with the output of the receiver
5. To measure the light attenuation of the optic fibres
6. Demonstration of Single channel telemetry system.
7. To study the multiplexing techniques.

NOTE: Visits to appropriate sites of digital/data communication networks, satellite communication, telemetry centres (like remote sensing) and fibre optic communication installations should be made with a view to understand their working. A comprehensive report must be prepared by all students on these visits, especially indicating the dates and locations of their visits.

INSTRUCTIONAL STRATEGY

The subject requires both theory and practical emphasis simultaneously, so that the student can understand the practical significance of the various areas. Visits to instrumentation and communications industries must be carried out, so as to make the students can understand where and how the various instruments are used in the industry.

RECOMMENDED BOOKS

1. Communication Systems by George Kennedy, Tata McGraw Hill Education Pvt Ltd, New Delhi.
2. Communication Systems by A.K. Gautam, SK Kataria and Sons, New Delhi.
3. Fundamentals of Communication System by Fitz, Tata McGraw Hill Education Pvt Ltd, New Delhi
4. Electronic Communication Sytesms by K.S. Jamwal, Dhanpat Rai and Sons, New Delhi.
5. Electronic Communication System by Roddy and Coolen, Prentice Hall of India, New Delhi.
6. Handbook of Experiments in Electronics and Communication Engineering by S. Poornachandra Rao, and B Sasikala, Vikas Publishing House Pvt Ltd, Jangpura, New Delhi

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Sr No	Topic	Time Allotted (Hrs)	Marks Allotted%
1	AM/FM Transmitters	08	10
2	AM/FM Radio Receivers	14	25
3	Typical ECG Telemetry System	16	25
4	Propagation	08	15
5	Fibre Optic Communication	12	20
6	Satellite Communications	06	5
	Total	**64**	**100**

6.5 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L T P
3 - -

RATIONALE

In the present day scenario, it has become imperative to impart entrepreneurship and management concepts to students so that a significant percentage of them can be directed towards setting up and managing their own small enterprises. This subject focuses on imparting the necessary competencies and skills of enterprise set up and its management.

DETAILED CONTENTS

SECTION – A ENTREPRENEURSHIP

1. Introduction (14 hrs)

- Concept /Meaning and its need
- Qualities and functions of entrepreneur and barriers in entrepreneurship
- Sole proprietorship and partnership forms of business organisations
- Schemes of assistance by entrepreneurial support agencies at National, State, District level: NSIC, NRDC, DC:MSME, SIDBI, NABARD, Commercial Banks, SFC's TCO, KVIB, DIC, Technology Business Incubator (TBI) and Science and Technology Entrepreneur Parks (STEP)

2. Market Survey and Opportunity Identification (10 hrs)

- Scanning of business environment
- Salient features of National and State industrial policies and resultant business opportunities
- Types and conduct of market survey
- Assessment of demand and supply in potential areas of growth
- Identifying business opportunity
- Considerations in product selection

3. Project report Preparation (08 hrs)

- Preliminary project report
- Detailed project report including technical, economic and market feasibility
- Common errors in project report preparations
- Exercises on preparation of project report

SECTION –B MANAGEMENT

4. Introduction to Management (04 hrs)

- Definitions and importance of management
- Functions of management: Importance and Process of planning, organising, staffing, directing and controlling
- Principles of management (Henri Fayol, F.W. Taylor)
- Concept and structure of an organisation
- Types of industrial organisations

  a) Line organisation
  b) Line and staff organisation
  c) Functional Organisation

5. Leadership and Motivation (03 hrs)

a) Leadership

- Definition and Need
- Qualities and functions of a leader
- Manager Vs leader
- Types of leadership

b) Motivation

- Definitions and characteristics
- Factors affecting motivation
- Theories of motivation (Maslow, Herzberg, McGregor)

6. Management Scope in Different Areas (06 hrs)

a) Human Resource Management

- Introduction and objective
- Introduction to Man power planning, recruitment and selection
- Introduction to performance appraisal methods

b) Material and Store Management

- Introduction functions, and objectives
- ABC Analysis and EOQ

c) Marketing and sales

- Introduction, importance, and its functions
- Physical distribution
- Introduction to promotion mix
- Sales promotion

d) Financial Management

- Introductions, importance and its functions
- Elementary knowledge of income tax, sales tax, excise duty, custom duty and VAT

7. Miscellaneous Topics (03 hrs)

a) Customer Relation Management (CRM)

- Definition and need
- Types of CRM

b) Total Quality Management (TQM)

- Statistical process control
- Total employees Involvement
- Just in time (JIT)

c) Intellectual Property Right (IPR)

- Introductions, definition and its importance
- Infringement related to patents, copy right, trade mark

Note: In addition, different activities like conduct of entrepreneurship awareness camp extension lecturers by outside experts, interactions sessions with entrepreneurs and industrial visits may also be organised.

INSTRUCTIONAL STRATEGY

Some of the topics may be taught using question/answer, assignment or seminar method. The teacher will discuss stories and case studies with students, which in turn will develop appropriate managerial and entrepreneurial qualities in the students. In addition, expert lecturers may also be arranged from outside experts and students may be taken to nearby industrial organisations on visit. Approach extracted reading and handouts may be provided.

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development published by Tata McGraw Hill Publishing Company Ltd., New Delhi
3. Entrepreneurship Development in India by CB Gupta and P Srinivasan; Sultan Chand and Sons, New Delhi
4. Entrepreneurship Development - Small Business Enterprises by Poornima M Charantimath; Pearson Education, New Delhi
5. Entrepreneurship : New Venture Creation by David H Holt; Prentice Hall of India Pvt. Ltd., New Delhi
6. EDM by Bajaj and Chawla, Ishan publication
7. Principles and Practice of Management by L M Prasad; Sultan Chand & Sons, New Delhi.

SUGGESTED DISTRIBUTION OF MARKS

Topic No.	Time Allotted (Hrs)	Marks Allotted (%)
1	14	28
2	10	20
3	08	16
4	04	10
5	03	06
6	06	14
7	03	06
Total	**48**	**100**

6.6 MAJOR PROJECT WORK

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RATIONALE

Major Project Work aims at developing innovative skills in the students whereby they apply in totality the knowledge and skills gained through the course work in the solution of particular problem or by undertaking a project. In addition, the project work is intended to place students for project oriented practical training in actual work situation for the stipulated period with a view to:

i) Develop understanding regarding the size and scale of operations and nature of field-work in which students are going to play their role after completing the courses of study.
ii) Develop understanding of subject based knowledge given in the classroom in the context of its application at work places.
iii) Develop first hand experience and confidence amongst the students to enable them to use and apply polytechnic/institute based knowledge and skills to solve practical problems related to the world of work.
Iv) Develop abilities like interpersonal skills, communication skills, positive attitudes and values etc.

The individual students have different aptitudes and strengths. Project work, therefore, should match the strengths of students. For this purpose, students should be asked to identify the type of project work, they would like to execute. The activity of problem identification should begin well in advance (say at the end of second year). Students should be allotted a problem of interest to him/her as a major project work. It is also essential that the faculty of the respective department may have a brainstorming session to identify suitable project assignments for their students. The project assignment can be individual assignment or a group assignment. There should not be more than 3 students if the project work is given to a group. The project work identified in collaboration with industry should be preferred.

This practical training cum project work **should not be considered** as merely conventional industrial training in which students are sent at work places with either minimal or no supervision. This experience is required to be planned in advance and supervised on regular basis by the polytechnic faculty. For the fulfillment of above objectives, polytechnics may establish close linkage with 8-10 relevant organization for providing such an experience to students. It is necessary that each organization is visited well in advance and activities to be performed by students are well defined. The chosen activities should be such that it matches with the curricular interest to students and of professional value to industrial/ field organizations. Each teacher is expected to supervise and guide 5-6 students.

Some of the project activities are given below:

- Projects related to designing small electronic equipment / instruments.
- Projects related to increasing productivity in electronic manufacturing areas.
- Projects related to quality assurance.
- Projects connected with repair and maintenance of plant and equipment.

- Projects related to design of PCBs.
- Projects related to suggesting substitutes of electronics components being used.
- Projects related to design of small oscillators and amplifier circuits.
- Projects related to design, fabrication, testing and application of simple digital circuits and components.
- Projects related to microprocessor/microcontroller based circuits/ instruments.

Some of the projects based on above areas are listed below for the benefit of students:

1. Microprocessor/Microcontroller based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microprocessor/Microcontrollers
4. Temperature monitoring using Microprocessor/Microcontroller based systems.
5. Microprocessor/Microcontroller based liquid level indicator and control
6. Fabrication and assembling of digital clock.
7. Fabrication of PCB circuits using ORCAD/ EAGLE Software.
8. Fabrication of ON line/OFF line UPS of different ratings and inverters
9. Design, fabrication and testing of different types of experimental boards
10. Repair of oscilloscope, function generator
11. Design and developing web sites of organizations
12. Installation of computer network (LANS).
13. Microprocessor/Microcontroller based solar tracking system
14. GSM based car or home security system
15. Bank token display using microcontroller
16. Printer sharing unit
17. Microprocessor/Microcontroller Based A/D converter
18. Microprocessor/Microcontroller Based D/A converter
19. Simulation of half wave and full wave rectifiers using Simulation Software
20. Simulation of class A, Class B, Class AB and Class C amplifiers

21. Simulation of different wave forms like sine, square, triangular waves etc.
22. GPS based vehicle tracking system
23. Calculate BER(Bit Error Rate) of various modulation techniques
24. Design ALU using CPLD/FPGA
25. Design Display System using CPLD/FPGA
26. Electronic Weighing Machines
27. Design fabrication & testing of Pulse rate meter using optical sensor.
28. Design fabrication & testing of Blood pressure meter
29. Design fabrication & testing of Heart rate meter

NOTE:

The list is only the guideline for selecting a project; however a student is at liberty to select any other related project of his choice independently under guidance of his teacher

A suggestive criterion for assessing student performance by the external (person from industry) and internal (teacher) examiner is given in table below:

Sr. No.	**Performance Criteria**	**Max.** Marks**	**Rating Scale**				
			Excellent	**Very Good**	**Good**	**Fair**	**Poor**
1.	Selection of project assignment	10%	10	8	6	4	2
2.	Planning and execution of considerations	10%	10	8	6	4	2
3.	Quality of performance	20%	20	16	12	8	4
4.	Providing solution of the problems or production of final product	20%	20	16	12	8	4
5.	Sense of responsibility	10%	10	8	6	4	2
6.	Self expression/ communication skills	5%	5	4	3	2	1
7.	Interpersonal skills/human relations	5%	5	4	3	2	1
8.	Report writing skills	10%	10	8	6	4	2
9	Viva voce	10%	10	8	6	4	2
Total Marks		**100**	**100**	**80**	**60**	**40**	**20**

The overall grading of the practical training shall be made as per following table.

In order to qualify for the diploma, students must get "Overall Good grade" failing which the students may be given one more chance to improve and re-evaluate before being disqualified and declared "not eligible to receive diploma ". It is also important to note that the students must get more than six "goods" or above "good" grade in different performance criteria items in order to get "Overall Good" grade.

	Range of maximum marks	**Overall grade**
i)	More than 80	Excellent
ii)	79 <> 65	Very good
iii)	64 <> 50	Good
iv)	49 <> 40	Fair
v)	Less than 40	Poor

Important Notes

1. This criteria must be followed by the internal and external examiner and they should see the daily, weekly and monthly reports while awarding marks as per the above criteria.

2. The criteria for evaluation of the students have been worked out for 200 maximum marks. The internal and external examiners will evaluate students separately and give marks as per the study and evaluation scheme of examination.

3. The external examiner, preferably, a person from industry/organization, who has been associated with the project-oriented professional training of the students, should evaluate the students performance as per the above criteria.

4. It is also proposed that two students or two projects which are rated best be given merit certificate at the time of annual day of the institute. It would be better if specific nearby industries are approached for instituting such awards.

The teachers are free to evolve other criteria of assessment, depending upon the type of project work.

It is proposed that the institute may organize an annual exhibition of the project work done by the students and invite leading Industrial organisations in such an exhibition.