6.1 MEDICAL ELECTRONICS

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RATIONALE

A large number of electronic equipment s are being used in hospitals for patient care and diagnosis or carry out advanced surgeries. This subject will enable the students to learn the basic principles of different instruments used in medical science.

DETAILED CONTENTS

1. **Anatomy and physiology** (06 hrs)

   - Elementary ideas of cell structure
   - Heart and circulatory system.
   - Central nervous system
   - Muscle action
   - Respiratory system
   - Body temperature and reproduction system

2. **Overview of Medical Electronics Equipments,** classification, application and specifications of diagnostic, therapeutic and clinical laboratory equipment, method of operation of these instruments (04 hrs)

3. **Electrodes** (08 hrs)

   Bioelectric signals, Bio electrodes, Electrode, Electrode tissue interface, contact impedance, Types of Electrodes, Electrodes used for ECG , EEG

4. **Transducers** (08 hrs)

   Typical signals from physiological parameters, pressure transducer, flow transducer, temperature transducer, pulse sensor, respiration sensor,

5. **Bio Medical Recorders** (12 hrs)

   Block diagram description and application of following instruments

   - ECG Machine
   - EEG Machine
   - EMG Machine

6. **Patient Monitoring Systems** (12 hrs)

- Heart rate measurement
- Pulse rate measurement
- Respiration rate measurement
- Blood pressure measurement
- Principle of defibrillator and pace mark
- Use of Microprocessor in patent monitoring.

7. **Safety Aspects of Medical Instruments** (06 hrs)

- Gross current shock
- Micro current shock
- -Special design from safety consideration
- Safety standards.

RECOMMENDED BOOKS

1. Handbook of biomedical Instrumentation by RS Khandpur

2. Biomedical Instrumentation by Cromwell,

3. Modern Electronics Equipment by RS Khandpur, TMMH, New Delhi

4. Introduction to BioMedical Electronics by Edward J. Perkstein; Howard Bj, USA

6.2 INSTRUMENTATION

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RATIONALE

This subject deals with the various instruments, their construction and working which control the various parameters and operations in any industry. Electrical supervisor employed in maintenance of electrical equipment, machinery is required to diagnose faults, rectify them and test the total system for good performance. Thus there is a need of introducing diploma holders to the basics of Instrumentation.

DETAILED CONTENTS

1. **Measurements** (04 hrs)

   Importance of measurement, Basic measuring systems, advantages and limitations of each measuring systems, generalized measurement system, signal conditioning and display devices

2. **Transducers** (08 hrs)

   Theory, construction and use of various transducers (resistance inductance, capacitance, electromagnetic, piezo electric type)

3. **Measurements of Displacement and Strain** (08 hrs)

   Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges, different strain gauges such as inductance type, resistive type, wire and foil etc. Gauge factor, gauge materials, and their selections, sources of errors and its compensations. Use of electrical strain gauges, strain gauge bridges and amplifiers.

4. **Force and Torque Measurement** (10 hrs)

   Different types of force measuring devices and their principles, load measurements by using elastic Transducers and electrical strain gauges. Load cells, proving rings. Measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements; different methods, devices.

5. **Pressure Measurement** (08 hrs)

   Bourdon pressure gauges, electrical pressure pick ups and their principle, construction application and use of pressure cells.

6. **Flow Measurement** (06 hrs)

Basic principles of magnetic and ultrasonic flow meters

7. **Measurement of Temperature** (08 hrs)

Bimetallic thermometer, pressure thermometers, thermoelectric thermometers, resistance thermometer, thermocouple, thermisters and pyrometer, errors in temperature measurements in rapidly moving fluids. Temperature recorders

8. **Measurement** of other non electrical quantities such as humidity, pH,level, (06 hrs)

9. **Elements** of telemetry and data acquisition system

INSTRUCTIONAL STRATEGY

The teacher should explain the scope of various measuring devices and their practical application in the field. The transducers and measuring devices must be shown to the students and they should be trained in the selection, operation, maintenance and calibrations. Frequent visits to nearby process industries will be of immense help to the students

LIST OF PRACTICALS

1. Measurement and plot of characteristics of optical devices like photodiodes, photocells
2. Characteristics of light operated switch using photo transistor and LDR
1. Measurement of strain using strain gauge
2. Measurement of pressure using pressure using pressure cell
3. Measurement of sound level using sound level meter
4. Measurement of temperature using themistor and thermocopies
5. Measurement of load using load cell
6. Measurement of humidity using humidity meter
7. Measurement of linear and angular displacement
8. Measurement of flow rate using flow sensors
9. Measurement of angular distance using linear variable capacitor

RECOMMENDED BOOKS

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad

2. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi

3. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi

4. Electronics Tests and Measurement Techniques by Rajiv Sapra

6.3 DIGITAL AND DATA COMMUNICATION

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5 – 3

RATIONALE

This course deals with the advanced digital and data communication techniques. It involves the use of modems in synchronous and asynchronous data transmission. It encompasses the modern communication network and integrated services like ISDN and radio paging along with cellular mobile telephones, FAX, electronic exchanges etc. The students should understand the advantages and limitations of various analog and digital modulation systems on a comparative scale and relate to them while studying practical communication systems.

DETAILED CONTENTS

1. **Introduction** (04 hrs)

   Basic block diagram of digital and data communication systems, Their comparison with analog communication system. Synchronous and Asynchronous communication system.

2. **Digital Communication** (12 hrs)

   Basic scheme of PCM system, quantization, quantization error companding, block diagram of TDM-PCM communication system and function of each block Advantages of PCM system, concept of differential PCM (DPCM) system

3. **Data Communication Hardware** (12 hrs)

   UART, USART, their need in communication. Need and function of modems. Mode of modems operation (low speed, medium speed and high speed modems). Modem interconnection, Modem data transmission speed. Modem modulation methods, Modem interfacing (RS 232 interface other interfaces)

4. **Network and Control Considerations** (16 hrs)

   Protocols and their functions
   Data communication network organisation. Basic idea of various modes of digital switching Circuit switching, message switching, packet switching.
   a) Basic concept of integrated services.
   b) Digital Network (ISDN) its need in modern communication, brief idea of ISDN interfaces
   c) Basic idea of local area Network (LAN), and its various topologies, LAN interconnection, Eathernet
   d) Introduction to EPABX

5. **Mobile Communication** (10 hrs)

Operation of Cellular mobile telephone system. cells and frequency reuse, cell spitting, cell sectoring, interference, handover, concept of first generation analog, second generation TDMA (GSM) and CDMA cellular system. Introduction to personal communication system (PCs). Introduction to WLL, Introduction to G_1, G2, G_3 mobile communication

6. **Facsimile (FAX)** (06 hrs)

Basic idea of FAX system and its applications; Principle of operation and block diagram of modern FAX system. Important features of modern FAX machines.

LIST OF PRACTICALS

1. Observe wave forms at pulse code modulation and demodulation
2. To study the construction and working of a telephone handset.
3. To study the construction and working of a FAX machine.
4. To study the features and working of an EPABX.
5. To study the working & features of a cellular mobile system and pagers.
6. To study the working of a LAN system.

NOTE

Visits to the sites of all types of telephone exchanges including mobile and rural exchanges be made with a view to understand their working. A comprehensive report must be prepared by all the students on these visits, especially indicating the dates and locations of their visits.

RECOMMENDED BOOKS

1. Mobile and Wireless Communication by W.Stalling, Pearson Publishers
2. Electronics Communication System by KS Jamwal, Dhanpat Rai & Co., New Delhi
3. Computer Network by Tenenbaun Andrews, Prentice Hall of India, New Delhi
4. Data Communication and Networking by Foronzan TMH, New Delhi

(Elective-II)
6.4 (a) MICRO CONTROLLERS AND PLCs

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RATIONALE

In industry, many manufacturing processes demand a sequence of operation, which are to be performed repetitively. Early automation systems were mechanical in design, timing and sequencing being effected by gears and cams. Slowly these design concepts were replaced by electrical drives which were controlled by relays and now by programmable logic controllers (PLCs). A PLC is a solid state device, designed to operate in noisy industrial environments and can perform all logic functions. PLCs are widely used in all industries for efficient control operations

A diploma holder in industry is called upon to design , modify and troubleshoot such control circuits. Looking at the industrial applications of PLCs in the modern industry, this subject finds its usefulness in the present curriculum.

Micro-controllers have assumed a great significance in the electronic and consumer goods industry and are a very vital field..

DETAILED CONTENTS

1. **Microcontroller series (MCS) – 51 Overview** (08 hrs)
   - Pin details
   - I/O Port structure
   - Memory Organization
   - Special Function Registers (SFRS)
   - External Memory

2. **Instruction Set; Addressing Modes, Instruction types** (8 hrs)
   - Timer operation
   - Serial Port operation
   - Interrupts

3. **Assembly language programming** (08 hrs)
   - Assembler directives
   - Assembler operation

4. **Design and Interface** (08 hrs)

   Eamples like keypad interface, 7- segment interface etc

5. **Introduction to PLCs** (06 hrs)

- Architectural details – Processor
- Memory structure, I/O Structure
- Programming terminal, Power Supply

6. **Working of PLC** (06 hrs)

   Basic principle, response time, effects of response time, relay replacing, Basic instructions, PLC registers and program scan

7. **Instruction Set** (04 hrs)

   Latching, counter, timers one shet, shift register, math, Boolean instructions

8. **Ladder diagram programming** (04 hrs)

9. **Applications of PLCs** in industry with case studies from electronics industry (04 hrs)

RECOMMENDED BOOKS

1. The 8051 Micro controller by I Scot Mackenzie, Prentice Hall International, London
2. The 8051 Micro Controllers Architecture, Programming and Applications by Ayala; Penram International
3. Process Control Instrumentation Technology by Johnson, Curtis; EEE Edition, Prentice Hall of India, New Delhi
4. Programmable Logic Controller by Job Dan Otter; P. H. International, Inc, USA

(Elective-II)
6.4(b) COMPUTER ARCHITECTURE & ORGANISATION.

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RATIONALE

This course will provide the student with the knowledge of detailed organisation of currently available organisation based on bus structure & principle of working of various other components & also they learn as to how the basic components of computer interact with each other. to form a working system.

DETAILED CONTENTS

1. Basic computer organisation & design (10 hrs)

Instruction lodes, indirect & direct address, computer registers, common bus system, computer instructions, timing control, instruction memory reference, Register reference & reference instructions. Interrupts, hard wire & micro-programmed control unit.

2. Central Processing Unit (10 hrs)

Introduction, general register organisation, control word, examples of microinstructions, stack organisation, register stack, reverse. Polish notation evaluation of anith expressions. Instruction formats, Addressing modes, 3 address instructions, 2 Address instructions. One address instructions, zero address instructions. Types of interrupts, compare RISC & CISC.

3. Computer Arithmetic (08 hrs)

Introduction, addition & subtraction, multiplication, & Division algorithms.

4. Register transfer & micro operations (04 hrs)

Register transfer language, arithmetic, logic & shift micro operation:

5. Input-output organisation (12 hrs)

Input-output interface, I bus, & interface4 module, I vs memory bus. Isolated Vs memory mapped I, Modes of data, transfer, first in first out buffer, priority interrupt, daisy chaining priority, parallel priority interrupt priority encoder, interrupt cycle, Direct memory access, DMA controller, DMA transfer.

6. Memory organisation (12 hrs)

Memory hierarchy, main memory, memory, address, map, RAM & ROM chips, memory connection to CPU, Anxillary memory, Associative memory, Read & write operation. Cache memory, Associative maping, Virtual memory, memory

management hardware, memory segmentation .

RECOMMENDED BOOKS

1. Computer System and Architecture by M. Mano: Prentice Hall India Pvt. Ltd., New Delhi.
2. Computer Architecutre and Organizationn by JP Hays, MC Graw Hill company, New Delhi.
3. Computer Organization and Architecutre by W. Stallings: Prentice Hall of India Ltd., New Delhi.

6.5 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

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RATIONALE

Entrepreneurship Development and Management is one of the core competencies of technical human resource. Creating awareness regarding entrepreneurial traits, entrepreneurial support system, opportunity identification, project report preparation and understanding of legal and managerial aspects can be helpful in motivating technical/ vocational stream students to start their own small scale business/enterprise. Based on the broad competencies listed above, following detailed contents are arrived to develop the stated competencies.

DETAILED CONTENTS

(1) Entrepreneurship (4 hrs)

- 1.1 Concept/Meaning
- 1.2 Need
- 1.3 Competencies/qualities of an entrepreneur

(2) Entrepreneurial Support System (6 hrs)

- 2.1 District Industry Centres (DICs)
- 2.2 Commercial Banks
- 2.3 State Financial Corporations
- 2.4 Small Industries Service Institutes (SISIs), Small Industries Development Bank of India (SIDBI), National Bank for Agriculture and Rural Development (NABARD), National Small Industries Corporation (NSIC) and other relevant institutions/organizations at State level

(3) Market Survey and Opportunity Identification (Business Planning) (6 hrs)

- 3.1 How to start a small scale industry
- 3.2 Procedures for registration of small scale industry
- 3.3 List of items reserved for exclusive manufacture in small scale industry
- 3.4 Assessment of demand and supply in potential areas of growth
- 3.5 Understanding business opportunity
- 3.6 Considerations in product selection
- 3.7 Data collection for setting up small ventures

(4) Project Report Preparation (6 hrs)

4.1 Preliminary Project Report
4.2 Techno-Economic feasibility report
4.3 Project Viability

(5) Managerial Aspects of Small Business (8 hrs)

5.1 Principles of Management (Definition, functions of management viz planning, organisation, coordination and control
5.2 Operational Aspects of Production
5.3 Inventory Management
5.4 Basic principles of financial management
5.5 Marketing Techniques
5.6 Personnel Management
5.7 Importance of Communication in business

(6) Legal Aspects of Small Business (6 hrs)

6.1 Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules
6.2 Factory Act and Payment of Wages Act

(7) Environmental considerations (6 hrs)

7.1 Concept of ecology and environment
7.2 Factors contributing to Air, Water, Noise pollution
7.3 Air, water and noise pollution standards and control
7.4 Personal Protection Equipment (PPEs) for safety at work places

(8) Miscellaneous (6 hrs)

8.1 Human relations and performance in organization
8.2 Industrial Relations and Disputes
8.3 Relations with subordinates, peers and superiors
8.4 Motivation – Incentives, Rewards, Job Satisfaction
8.5 Leadership
8.6 Labour Welfare
8.7 Workers participation in management

(9) Motivation (4 hrs)

9.1 Factors determining motivation
9.2 Characteristics of motivation
9.3 Methods of improving motivation
9.4 Incentives – pay, promotion, rewards

(10) Leadership (2 hrs)

10.1 Need for leadership
10.2 Functions of a leader

10.3 Factors to be considered for accomplishing effective leadership

RECOMMENDED BOOKS

1. A Handbook of Entrepreneurship, Edited by BS Rathore and Dr JS Saini; Aapga Publications, Panchkula (Haryana)
2. Entrepreneurship Development by CB Gupta and P Srinivasan, Sultan Chand and Sons, New Delhi
3. Environmental Engineering and Management by Suresh K Dhamija, SK Kataria and Sons, New Delhi
4. Environmental and Pollution Awareness by Sharma BR, Satya Prakashan , New Delhi
5. Thakur Kailash, Environmental Protection Law and policy in India: Deep and Deep Publications, New Delhi
6. Handbook of Small Scale Industry by PM Bhandari
7. Marketing Management by Philip Kotler, Prentice Hall of India, New Delhi
8. Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.
9. Principles of Management by Philip Kotler TEE Publication

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 based circuits/ instruments.

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

1. Microprocessor based rolling display/bell and calendar
2. Microprocessor based stepper motor control.
3. Speed control of DC Machines by Microprocessors.
4. Temperature monitoring using microprocessor based systems.
5. Microprocessor based liquid level indicator and control/solar tracking system
6. Fabrication and assembling of digital clock.
7. Design and fabrication of timing circuits using 555 and counters.
8. Design and fabrication of amplifiers and oscillators circuits.
9. Fabrication of demonstration type Radio receiver
10. Fabrication of PCB circuits using ORCAD/ Fagu Software.
11. Fabrication of ON line/OFF line UPS of different ratings and inverters
12. Design, fabrication and testing of different types of experimental boards as per the curriculum of Electronics and Communication Engineering.
13. Repair of X-Ray Machines, ECG, EEG, EMG, Calorimeter and Centrifuge etc.
14. Repair and fault location of telephone exchanges and intercom system.
15. Repair of oscilloscope, function generator, Power supply
16. Design and developing web sites of organizations
17. Installation of computer network (LANS).
18. Microprocessor based solar tracking system
19. Car or home security system

20 Bank token display

21. Printer sharing unit

22. Caller Identification unit for phone
23. LCR-Q meter and frequency meter
24. µP-Based A/D converter
25. µP-Based D/A converter
26. Simulation of halfwave and full wave rectifiers using ORCAD
27. Simulation of following circuits:

    Integrator, differenciator, adder, substractor, V-I converter comparator etc. using OP-AMPs.
28. Simulation of class A, Class B, Class AB and Class C amplifiers
29. Simulation of different wave forms like sine, square, triangular waves etc.

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 criteria 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				
			Exce-llent	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-evaluated 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 100 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 another 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. 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 industries are approached for instituting such awards.