

## 4.1 HOSPITAL MANAGEMENT AND CLINICAL PRACTICES

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### RATIONALE

This subject includes an exposure to Hospital administration, architecture and engineering aspects, which form the back bone to hospital planning. Hospitals particularly are subject to the demands of new developments in function and technology, because they serve a variety of disciplines, each characterized by fluidity rather than constancy. This will enable the participants familiar with hospital environment.

### DETAILED CONTENTS

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|----|--|----------|
| 1. | The Approach to Planning                               | (10 hrs) |
|    | 1.1 What is a Hospital                                 |          |
|    | 1.2 Stating the planning problem                       |          |
|    | 1.3 Planning organisation                              |          |
| 2. | Components and Functions                               | (14 hrs) |
|    | 2.1 The patient housing system – General consideration |          |
|    | 2.2 The patient housing system – Types of facilities   |          |
|    | 2.3 The therapy system – Ambulant care and diagnosis   |          |
|    | 2.4 The therapy system – Radiology department          |          |
|    | 2.5 The supply system                                  |          |
|    | 2.6 The Housekeeping system                            |          |
|    | 2.7 The administrative system and business function    |          |
|    | 2.8 The utilities system                               |          |
| 3. | Trends in Hospital Care and Economics                  | (08 hrs) |
|    | 3.1 Changing concepts to Hospital care                 |          |
|    | 3.2 Economics pressures                                |          |
| 4. | Infection Control                                      | (14 hrs) |
|    | 4.1 Administration and Responsibility                  |          |
|    | 4.2 Sterilization, Disinfecting and cleaning           |          |
|    | 4.3 Central sterile supply                             |          |
|    | 4.4 Types of chemical disinfectant                     |          |
|    | 4.5 Cleaning and disinfection procedure                |          |
|    | 4.6 Prevention of spread of infection                  |          |
|    | 4.7 Care of Hospital Staff infection                   |          |
|    | 4.8 Special wards and departments                      |          |

5. Maintainability of Engineering Services (12 hrs)
- 5.1 Organisation of Engineering Section
  - 5.2 Refrigeration and air conditioning equipment
  - 5.3 Biomedical equipment
  - 5.4 Planning works
  - 5.5 Mechanical and fabrication works
6. Waste Management (06 hrs)
- Categorization, disposal

### RECOMMENDED BOOKS

1. Planning and Community Hospital by Roy Hudenburg – McGraw Hill
2. Control of hospital Infection by E.J.L. Lowbury, G.P.J. Aylifee.
3. Principles of Hospital Administration And Management by Sakharkar

### 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 Allotted%
1	The Approach to Planning	10	15
2	Components and Functions	14	22
3	Trends in Hospital Care and Economics	08	12
4	Infection Control	14	23
5	Maintainability of Engineering Services	12	20
6	Waste Management	06	08
	<b>Total</b>	<b>64</b>	<b>100</b>

## 4.2 PHYSIOTHERAPY AND OPERATION THEATRE (OT) EQUIPMENT

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4 - 3

### RATIONALE

This subject includes an exposure to equipment used in electrotherapy, physiotherapy and operation theatre of a hospital. Physiotherapy and electrotherapy job opportunities are available in assembly, production, sales, repair and maintenance of electro physiotherapy and O.T. equipment.

### DETAILED CONTENTS

1. Introduction to Physiotherapy (06 hrs)  
Common practice of physiotherapy, Principle of high frequency heat therapy, use of simple heat radiation or high frequency energy, advantages of high frequency energy thermo-therapy over the common therapy. Dipole molecules of the body and their orientation under the influence of an electric field.
2. Shortwave(SW) Diathermy (08 hrs)  
Diathermy technique and production of heat within the body. Frequency used in shortwave diathermy unit and its advantages, circuit description of SW diathermy automatic tuning, Application techniques of SW therapy, general faults and symptoms. Dia-pulse therapy, specifications.
3. Microwave Diathermy (04 hrs)  
Production of microwaves, schematic diagram of a microwave diathermy unit and its description, the delay circuit, the magnetron circuit and safety circuit, specifications.
4. Ultrasonic Therapy Unit (06 hrs)  
Use of ultrasonics for therapeutic purposes, ultrasonic generators, circuit description, Dosage control, specifications.
5. Electro diagnostic/therapeutic apparatus (06 hrs)  
Electro diagnosis, intensity-time curve, type of waveforms required for electro diagnosis.
6. Electrotherapy (08 hrs)  
Principle, waveforms used in electrotherapy, galvanic current, faradic current, surging current, etc., types of apparatus, functional blocks diagram description, advantages of constant current therapy, specifications.
7. Stimulators (08 hrs)  
Transcutaneous Electrical Nerve Stimulator (TENS) introduction, pain relief through electrical stimulation, different stimulators like spinal cord stimulator, magnetic stimulator, Bladder stimulator, cerebella stimulator.

8. Instrument for surgery (08 hrs)  
Principle of surgical diathermy introduction to coagulation fulguration, electro surgery techniques, surgical diathermy, Block diagram of electro surgical unit, automated systems, types of electrodes used, safety aspects, introduction to surgical diathermy analyses.
9. Operation Theatre Equipment: (10 hrs)
- Operation theater lights, Basic diagram, Circuit connections, CCTV, repair and maintenance
  - Autoclaves: Basic layout, circuit diagram, connections for inlet and outlet, components of autoclaves, application and usage, operating principle
  - Cold light source, basic principle, applications and components

### LIST OF PRACTICALS

1. Operation and use of electro physiotherapy machines demo.
2. Precautions while using different machines-demo
3. Circuit testing-cold tests live tests precautions, measurement of voltage levels at various test points, wave form tests (where applicable) in good working machines like shortwave diathermy unit and ultrasonic therapy unit.
4. Fault-finding in shortwave diathermy and ultrasonic therapy unit.
5. Precautionary care of the patient and student while testing the above machines.
6. Visit to hospital.

### 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 nearby hospitals, medical college, nursing homes, or any other nursing institute etc may be arranged to make the students better understand the system. In addition, some expert from medical field may be invited to deliver talk on specific topic(s).

### SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER

Sr No	Topic	Time Allotted (Hrs)	Marks Allotted%
1	Introduction to Physiotherapy	6	10
2	Shortwave(SW) Diathermy	08	10
3	Microwave Diathermy	4	5
4	Ultrasonic Therapy Unit	6	10
5	Electro diagnostic/therapeutic apparatus	6	10
6	Electrotherapy	8	12
7	Stimulators	8	13
8	Instrument for surgery	8	15
9	Operation Theatre Equipment:	10	15
	<b>Total</b>	<b>64</b>	<b>100</b>

### 4.3 MICROPROCESSORS AND PERIPHERAL DEVICES

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4 - 2

#### RATIONALE

The study of microprocessors in terms of architecture, software and interfacing techniques leads to the understanding of working of CPU in a microcomputer. The development in microprocessors of 32 bit architecture brings them face-to-face with mainframe finding employment in R&D, assembly, repair and maintenance of hardware of microprocessors and computers. Microprocessors find application in process control industry. They also form a part of the electronic switching system between source and destination in long distance telecommunications. Thus the microprocessor is an area of specialization. Students of electronics and related engineering branches often use microprocessors to introduce programmable control in their projects, in industrial training.

#### DETAILED CONTENTS

1. Evolution of Microprocessor (04 hrs)  
 Typical organization of a microcomputer system and functions of its various blocks. Microprocessor, its evolution, function and impact on modern society
2. Architecture of a Microprocessor (With reference to 8085 microprocessor) (12 hrs)  
 Concept of Bus, bus organization of 8085, Functional block diagram of 8085 and function of each block, Pin details of 8085 and related signals, Demultiplexing of address/data bus generation of read/write control signals, Steps to execute a stored programme
3. Instruction Timing and Cycles (08 hrs)  
 Instruction cycle, machine cycle and T-states, Fetch and execute cycle.
4. Programming (with respect to 8085 microprocessor) (16 hrs)  
 Brief idea of machine and assembly languages, Machines and Mnemonic codes. Instruction format and Addressing mode. Identification of instructions as to which addressing mode they belong. Concept of Instruction set. Explanation of the instructions of the following groups of instruction set. Data transfer group, Arithmetic Group, Logic Group, Stack, I/O and Machine Control Group. Programming exercises in assembly language. (Examples can be taken from the list of experiments).
5. Memories and I/O interfacing (10 hrs)  
 Concept of memory mapping, partitioning of total memory space. Address decoding, concept of peripheral mapped I/O and memory mapped I/O. Interfacing of memory mapped I/O devices.

6. Interrupts (04 hrs)  
 Concept of interrupt, Maskable and non-maskable, Edge triggered and level triggered interrupts, Software interrupt, Restart interrupts and its use, Various hardware interrupts of 8085, Servicing interrupts, extending interrupt system
7. Data Transfer Techniques (04 hrs)  
 Concept of programmed I/O operations, sync data transfer, async data transfer (hand shaking), Interrupt driven data transfer, DMA, Serial output data, Serial input data
8. Peripheral devices (06 hrs)  
 8255 PPI and 8253 PIT, 8257 / 8237 DMA controller, 8279 Programmable KB/Display Interface, 8251 Communication Interface Adapter.

### LIST OF PRACTICALS

1. Familiarization of different keys of 8085 microprocessor kit and its memory map
2. Steps to enter, modify data/program and to execute a programme on 8085 kit
3. Writing and execution of ALP for addition and sub station of two 8 bit numbers
4. Writing and execution of ALP for multiplication and division of two 8 bit numbers
5. Writing and execution of ALP for arranging 10 numbers in ascending/descending order
6. Writing and execution of ALP for 0 to 9 BCD counters (up/down counter according to choice stored in memory)
7. Interfacing exercise on 8255 like LED display control
8. Interfacing exercise on 8253 programmable interval timer
9. Interfacing exercise on 8279 programmable KB/display interface like to display the hex code of key pressed on display
10. Use of 8085 emulator for hardware testing

### INSTRUCTIONAL STRATEGY

The digital systems in microprocessors have significant importance in the area of electronics. Adequate competency needs to be developed by giving sufficient practical knowledge in microprocessors (programming as well as interfacing). Help may be taken in the form of charts, simulation packages to develop clear concepts of the subject. Programming exercises other than the given in the list may be given to the students.

### RECOMMENDED BOOKS

1. Microprocessor Architecture, Programming and Applications with 8080/8085 by Ramesh S Gaonker, Willey Eastern Ltd. New Delhi
2. Introduction to Microprocessor by Mathur, Tata McGraw Hill Education Pvt Ltd, New Delhi
3. Microprocessor and Microcontrollers by Dr BP Singh, Galgotia Publications, New Delhi

4. Microprocessor and Applications by Badri Ram: Tata McGraw Hill Education Pvt Ltd , New Delhi
5. Microprocessor and Microcomputers by Refiquzzaman, Prentice Hall of India Ltd., New Delhi.
6. Microprocessor programming & applications.by sudhir Goyal, North Publication.
7. Digital Logic and Computer Design by Mano, M Morris; Prentice Hall of India, New Delhi
8. Digital Electronics by Rajaraman; Prentice Hall of India Ltd., New Delhi

#### **SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER**

<b>Topic No.</b>	<b>Topic</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted (%)</b>
1.	Evolution of Microprocessor	04	5
2.	Architecture of a Microprocessor (With reference to 8085 microprocessor)	12	20
3	Instruction Timing and Cycles	08	10
4	Programming (with respect to 8085 Microprocessor)	16	25
5.	Memories and I/O interfacing	10	15
6.	Interrupts	04	5
7.	Data transfer techniques	04	5
8.	Peripheral devices	06	15
<b>Total</b>		<b>64</b>	<b>100</b>

## 4.4 DIGITAL ELECTRONICS - II

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3 - 3

### RATIONALE

Digital design is a vital area in electronics with a lot of scope in industry and research. This subject involves conventional and sequential circuit designs both of which are very important fields. This subject forms the basis for research and development of digital systems. This subject will enable the students to learn concept of

### DETAILED CONTENTS

1. Logic Families (08 hrs)
  - a) Logic family classification. TTL, ECL, MOS, CMOS. Types of integration SSI, MSI, LSI, VLSI
  - b) Characteristics of TTL and CMOS and the comparison. Propagation delay. Speed, noise margin. Logic levels., power dissipation, fan-in, fan-out, power supply requirements
  - c) Open collector and totem pole output circuits, operation of a standard TTL, CMOS, NAND, NOR gates
  - d) CMOS to TTL interfacing and TTL to CMOS interfacing
  - e) Introduction to tri-state devices, tri-state buffer and inverter circuits.
  
2. A/D and D/A Converters (08 hrs)
  - a) D/A Converters : Performance characteristics of D/A converters, binary resistor network and resistance ladder network methods of D/A converters and applications
  - b) A/D Converters : Performance characteristics of A/D converters, single slope, dual slope, successive approximation and parallel A/D converters
  
3. Memories (12 hrs)

Memory organisation, classification of semi conductor memories, ROM, PROM, DRAM, EPROM, EEPROM, RAM, expansion of memory. CCD memories, content addressable memory, programmable logic devices, PROM at PLD, programmable logic array (PLA) programmable array logic (PAL), field programmable gate array (FPGA), familiarization with common ICs.



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| 4. | Combinational Circuits<br>Minimization of Boolean expressions using Quine Mcclaaskey method  | (04 hrs) |
| 5. | Sequential Circuits<br><br>Essential components of sequential circuit, synchronous and asynchronous sequential circuits, classification of sequential circuits (Meely and Moore Machine), design of counters using J-K and R-S flip-flops. | (08 hrs) |
| 6. | Arithmetic and Logic Unit<br><br>Basic idea about arithmetic logic unit w.r.t. IC 74181 and applications, implementation of binary multiplication, division, subtraction and addition  | (04 hrs) |
| 7. | Introduction to Fuzzy logic<br><br>Fuzzy sets and classical sets and their operations, Fuzzy relations, Properties of membership functions, Fuzzification, Defuzzification, Fuzzy control system   | (04 hrs) |

#### **LIST OF PRACTICALS**

1. Verify the operation of D/A converter
2. Verify the operation of A/D converter
3. Verify the writing and reading operation of RAM IC
4. Design J-K Flip-flop counter and verify its truth table
5. Familiarity with the use of EPROM programmes and UV index
6. Exercise on programming of EPROM
7. Design and implement full adder and full subtractor
8. Verify the logical operation, arithmetic operation of binary numbers using IC74181

#### **RECOMMENDED BOOKS**

1. Digital Systems and Applications by RJ Tocci, Prentice Hall of India, New Delhi
2. Digital Electronics by RP Jain, Tata McGraw Hill, New Delhi
3. Digital Electronics by KS Jamwal, Dhanpat Rai & Co., New Delhi
4. Digital Logic Designs by Morris Mano, Prentice Hall of India, New Delhi
5. Digital Electronics –II by Yashpal and Sanjeev Kumar, North Publication.
6. Digital Designs by CJ Roth, Jaico Publication

7. Digital Electronics by Rajaraman V, Prentice Hall of India, New Delhi
8. Digital Fundamentals by Malvino and Leachy, Tata McGraw Hill Publishers, New Delhi
9. Digital Systems by Sanjay K Bose, Wiley Eastern (P) Ltd., New Delhi
10. Fuzzy logic with Engineering Application by T.J. Ross; Wiley Eastern (P) Ltd., New Delhi

**SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER**

<b>Sr. No</b>	<b>Topic</b>	<b>Time Allotted (hrs)</b>	<b>Marks Allocation%</b>
1	Logic Families	08	15
2	A/D and D/A Converters	08	15
3	Memories	12	25
4	Combinational Circuits	04	10
5	Sequential Circuits	08	15
6	Arithmetic and Logic Unit	04	10
7	Introduction to Fuzzy Logic	04	10
<b>Total</b>		<b>48</b>	<b>100</b>

## 4.5 MEDICAL LABORATORY INSTRUMENTS

L T P  
3 - 4

### RATIONALE

This subject includes exposure to clinical laboratory equipment/instruments and various principles used in analytical instruments. This will enable the participants to make use of pathological equipment and to carry out preventive maintenance of these equipment.

### DETAILED CONTENTS

1. Bio-chemistry, hematology and microbiology instruments (10 hrs)
 

Photo colorimeter:  
Specifications, critical parameters, working principle, Block diagrams of colorimeter and different types of light sources, optical filters, monochromators and their types,

Spectrophotometers  
Working principle and block diagram of spectrophotometer, light source, diffraction grating monochromators, photodiodes.
2. Flame photometers (08 hrs)
 

Working principle, Block diagram of flame photometer, air compressor, LPG connection, atomizer, optical filter, photo-detectors, etc.
3. pH Meter (06 hrs)
 

Specifications, critical parameter, working principle, pH electrodes, acid base balance, block-diagram of pH meter, electrode signal.

Significance of pH measurement w.r.t .blood.
4. Auto-Analyser (10 hrs)
 

Introduction to auto-analyser, different types, working principle, Block-diagram of auto-analyser and explanation of various sections viz: sampler, pumps, mixer, heater, dialyzer, colorimeter, recorder, digital printer etc., practical applications of auto-analyser.
5. Blood Cell Counters (06 hrs)
 

Working principle, methods of blood cell counting – Microscopic method, Automated optical method, electrical conductivity method

6. Miscellaneous (08 hrs)

Working principle, operation and application of electric centrifuge, microscopes, incubators, ovens, electrophoresis, chromatography, autoclave, sterilization.

### LIST OF PRACTICALS

1. To operate and familiarize with external control panel of photo-colorimeter. To calibrate the equipment. To measure the concentration of unknown sample. Trace the circuit of photo colorimeter.
2. Centrifuge: To operate the electrical centrifuge machine
3. Microtome: To operate and learn the dismantling and assembling of the machine.
4. Microscope: To use the microscope and take precautionary measures while operating the microscope.
5. Flame photometer: To operate the machine and familiarize with its external control of the machine. To find out the concentration of  $\text{Na}^+$ ,  $\text{K}^+$  and  $\text{Ca}^+$  of given blood sample.
6. Spectrophotometer: (i) To operate the machine and to calibrate (ii) To find out the concentration, Optical density and transmittance of unknown sample. (iii) To trace the circuit of the machine and familiarize with various sections.
7. pH Meter
  - To operate the equipment
  - To calibrate the equipment
  - To measure the pH of unknown sample
  - To open the equipment and trace the circuit and familiarize with various sections.
8. Auto-analyser: To operate the equipment. To calibrate the equipment. To find out various parameters of blood sample. To open the equipment and trace its circuit diagram and familiarize with various sections.
9. Blood cell counter: To operate different types of Blood cell counter. To open the equipment and do circuit tracing and familiarize with various sections.

### 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) Biomedical Instrumentation – R.S. Khandpur.
- 2) Introduction to Biomedical Equipment – Joseph Carrt Brown

**SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING PAPER SETTER**

<b>Sr No</b>	<b>Topic</b>	<b>Time Allotted (Hrs)</b>	<b>Marks Allotted%</b>
1	Bio-chemistry, hematology and microbiology instruments	10	20
2	Flame photometers	08	15
3	pH Meter	06	15
4	Auto-Analyser	10	20
5	Blood Cell Counters	06	15
6	Miscellaneous	08	15
	<b>Total</b>	<b>48</b>	<b>100</b>

## 4.6 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 for 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. Basics of instrumentation has been dealt with in this subject

### DETAILED CONTENTS

1. Measurements: (3 hrs)  
Importance of measurement, basic measuring systems, advantages and limitations of each measuring systems and display devices
2. Transducers: (6 hrs)  
Theory, construction and use of various transducers (resistance, inductance, capacitance, electromagnetic, piezo electric type)
3. Measurement of Displacement and Strain: (10 hrs)  
Displacement Measuring Devices: wire wound potentiometer, LVDT, strain gauges and their different types such as inductance type, resistive type, wire and foil type etc. Gauge factor, gauge materials and their selections. 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, measurements of torque by brake, dynamometer, electrical strain gauges, speed measurements; different methods, devices.
5. Pressure Measurement: (5 hrs)  
Bourdon pressure gauges, electrical pressure pick ups and their principle, construction and applications. Use of pressure cells.
6. Flow Measurement: (4 hrs)  
Basic principles of magnetic and ultrasonic flow meters

7. Measurement of Temperature: (5 hrs)  
Bimetallic thermometer, thermoelectric thermometers, resistance thermometers, thermocouple, thermistors and pyrometer. Temperature recorders
8. Measurement of other non electrical quantities such as humidity, pH, level and vibrations (5 hrs)

### **PRACTICAL EXERCISES**

1. To measure the level of a liquid using a transducer
2. To measure temperature using a thermo-couple
3. Study and use of digital temperature controller
4. Use of thermistor in ON/OFF transducer
5. Study of variable capacitive transducer
6. Draw the characteristics of a potentiometer
7. To measure linear displacement using LVDT
8. To study the use of electrical strain gauge
9. To study weighing machine using load cell
10. To study pH meter.

### **INSTRUCTIONAL STRATEGY**

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

### **RECOMMENDED BOOKS**

1. Electronic Measurement and Instrumentation by Dr Rajendra Prasad
2. Electronic Measurement and Instrumentation by JB Gupta, SK Kataria and Sons, New Delhi
3. Electrical and Electronics Measurement and Instrumentation by AK Sawhney, Dhanpat Rai and Co., New Delhi
4. Electronic Instrumentation and Measurement Techniques by WD Cooper, AD Helfrick Prentice Hall of India Pvt. Ltd. New Delhi
5. Industrial Instrumentation by Umesh Rathore, SK Kataria and Sons, New Delhi

**SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER**

<b>Sr. No</b>	<b>Topic</b>	<b>Time Allotted (hrs)</b>	<b>Marks Allocation (%)</b>
1	Measurements	3	6
2	Transducers	6	12
3	Measurement of Displacement and Strain	10	20
4	Force and Torque Measurement	10	20
5	Pressure Measurement	5	12
6	Flow Measurement	4	8
7	Measurement of Temperature	5	12
8	Measurement of other non electrical quantities	5	10
	<b>Total</b>	<b>48</b>	<b>100</b>



## **HIV AND AIDS AWARENESS CAMP**

Note: This Camp will be compulsory for all

This camp shall include:

1. Lectures by experts from Medical Organizations
2. Lectures by expert NGOs
3. Lectures by teacher(s)
4. Slogan Writing
5. Poster Competition
6. Essay writing Competition