FACULTY OF SCIENCE
SYLLABI

FOR

ELECTRONIC EQUIPMENT & MAINTENANCE  (ELECTIVE)
FOR
B.Sc. 1ST YEAR (1ST & 2ND SEMESTER)

&

B.Sc. 2ND & 3RD YEAR (ANNUAL SYSTEM)

EXAMINATIONS  2014-2015
B.Sc. (General)  1st Year

ELECTRONIC EQUIPMENT & MAINTENANCE(ELECTIVE)

SEMESTER –I

Note :  1. There will be two papers of theory and one Laboratory (practical) courses.
2. The number of lectures per week will be three for each theory paper.
3. The number of lectures per week will be six for practicals.
4. The time duration for each theory paper will be three hours.
5. The time duration for practical examinations will be three hours.
6. The use of Non-programmable calculators will be allowed in the examination centre but these will not be provided by the University/College. Mobile phones and pagers are not allowed in the examination Hall.
7. Distribution of Marks & Total Teaching Hours will be as under :

Paper A : Principles of electronics-I:  \((67 + 8\text{*}) = 75\) marks  Total teaching hours : 40
Paper B : Electronic devices and circuits-I  \((67 + 8\text{*}) = 75\) marks  Total teaching hours : 40
Practicals:  \((45+5\text{*})\) marks  Total teaching hours : 125

* Internal assessment

Each paper will consist of three Units

Unit I  There will be three questions from this Unit. Each question will have two parts. Two Questions are to be attempted. Each question will carry fifteen marks.

Unit II  There will be three questions from this Unit. Each question will have two parts. Two Questions are to be attempted. Each question will carry fifteen marks.

Unit III  Unit III will consist of one compulsory question having eight (8) short – answer type parts, out of which five (5) parts are to be attempted. Each part will carry three marks.
PRINCIPLES OF ELECTROICS-I

RESISTORS

General Information; Symbol, Colour Code, Types (such as carbon, metal film, thin-film, thick-film, wire-wound). Variable resistors. Potentiometers (logarithmic, linear, multi-turn wire wound rheostat.

Physical Properties, Temperature Dependence (Thermister), Light Dependence (LDR), Voltage Dependence (VDR).

Technical specifications wattage and working Voltage. Methods of Measurement of very low to very high Resistance Values.

INDUCTORS:

General Information: Symbol; Types such as Air Core, Iron Core, Ferrite Core, Checking Inductors (coil), Frequency response of an inductor.

Methods of measurement of Inductance, Universal Bridge, Design and Fabrication Rules.

TRANSFORMERS:

General Information, Principle, Types of Transformers such as SinglePhase, Auto, Mains and Isolation Transformers, Frequency dependence of Transformers (Audio, IF and RF). Design of Main Transformer and CVT.

CAPACITORS:

General Information, Symbols, Colour Code, Types of Capacitors such as Air, Paper, Electrolytic, Mica, Tantalum Polystyrene, Fixed and Variable Capacitors.


RELAYS:

General Information: Symbol, Types of Relays, such as Reed, Electromagnetic. Specifications, Rating, Application Areas.

MICROPHONES AND LOUDSPEAKERS:

General Information: Principle, Types.


TRANSUDUCERS:

Commonly used Transducers like LDR, Thermistors, Thermocouples, Photodiodes, Photo Transistors, IR Detectors, LVDT.
SWITCHES, CABLES AND CONNECTORS: 3L

SPDT, DPDT, Band Switches, Touch Switches, Thumb-wheel Switches, Micro Switches, Specifications, Application Areas.

BATTERIES: 1L

Dry Cells, Lead Acid Accumulators, Nickel-Cadmium Cells, Standard Cells, Principle, Specifications.

FUSES:
Fast and Slow Fuses, Pilot Lamps.

PCB: 2L

Types of PCB, Layout Techniques, Cables and Connectors for PCB.

NETWORK THEOREMS: 6L

Kirchhoff’s Current and Voltage Law, Maximum Power Transfer Theorem. Thevenin’s Theorem Norton’s Theorem, Superposition Theorem.

THEORY PAPER-II

Marks: 67

ELECTRONIC DEVICES AND CIRCUITS-I

INTRODUCTION TO SEMICONDUCTORS: 3L


JUNCTION DIODES: 6L
Rectifying Diode, Forward and Reverse Bias Characteristic, Switching Diode, Varacter Diode, Photo Diode, Light Emitting Diode, IR sources and detectors, Optical Isolators, Zener Diode.

DIPOLAR JUNCTION TRANSISTOR: 4L
Basic Working Principle (Qualitative), Characteristics, Basic Configurations and Biasing, Operating Point, Load Line, Biasing for Stabilization of Operating Point.

JFET and MOSFET: 4L
Basic Working Principle (Qualitative), Characteristics, Pinch off Voltage.

UNIJUNCTION TRANSISTOR: 2L
Basic Working Principle (Qualitative), Characteristics, Applications, as a Switch.

POWER CONTROL DEVICES: 2L
Four Layer Diode (pnpn), Silicon Controlled Rectifier (SCR) Tracis, Diac, Principles and Characteristics.
AMPLIFIER:

Different Terms used in Amplifiers, such as Signal, Source, Input, Output, Voltage and Current Gain, Power Gain, Decibel, Input and Output Impedance.

Classification according to the Frequency Response, RC Coupled Class A Common Emitter Amplifier, Introduction to the Class B Operation.

FEEDBACK IN AMPLIFIER:

Effect of Negative Feedback on Amplifier performance.

POWER AMPLIFIERS:

Transformer Coupled Equivalent Circuit only in Brief Class A, Class B, Class AB and Class C. Constant Power Hyperbola. AC Load Line Input and Output Considerations. Determination of Non-Linear Distortion.


Class B and C Resonant load Amplifiers, Graphical Class C Analysis, Resonant load Requirements.

ELECTRONICS DEVICES LABORATORY-I

General Guidelines for Physics Practical Examinations:

1. The distribution of marks is as follows:
   (i) One full experiment out of section–A requiring the student to take some data, analyse it and draw conclusions. (Candidates are expected to state their results with limits of error). 20 marks
   (ii) One exercise based on experiment or Computer Programming (To be allotted by the external examiner at the time of examination). 10 marks
   (iii) Viva-Voce 10 marks
   (iv) Record (Practical file) 05 marks

Total: 45 marks

Note for Examiners: The marks scored under each head must be clearly written on the answer sheet.

2. There will be one session of 3 hours duration. The paper will have two sections. Section–A will consist of 4 experiments out of which an examinee will mark 3 experiments and one of these is to be allotted by the external examiner.

3. Section–B will consist of exercises which will be set by the external examiner on the spot. The length of the exercises should be such that any of these could be completed in one hour.

4. The examiner should take care that the experiment allotted to an examinee from section–A and exercise allotted from section–B are not directly related to each other.
5. **Number of candidates in a group for practical examination should not exceed 12.**

6. In a single group, no experiment be allotted to more than three examinees in the group.

List of Experiments

1) Practice for use of
   
a) Multimeter (ordinary and electronic)
b) Power supply
c) Oscilloscope
d) Signal generator

2) Study of Resistor, Capacitor and Diodes

3) Development of soldering skill by constructing a few circuits and testing

4) PCB making

5) Study of Transistors

6) Study of LDR and Thermistor

7) Study of Zener diode and power supply

8) Study on Amplifier

9) Studies on Oscillator

10) Studies on AM/FM Modulator
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PRINCIPLES OF ELECTROICS-II

LCR AND WAVESHAPING CIRCUITS: \(10L\)

Serial and Parallel Response, Idea of Black Box, Equivalent Circuits, Two Terminal and Two Port Networks, Equivalent Circuits, Integration and Differentiation using RC Circuits, Clipping and Clamping.

NUMBER SYSTEMS: \(3L\)

Introduction to Decimal, Binary, Octal, Hexadecimal Number Systems, RCD Codes, Interconversions of Decimal, Binary and RCD Numbers, Parity, Excess-3, Grey and Johnson Codes.

LOGIC GATES: \(3L\)

Positive and Negative Logic, Different Logic Gates such as AND, OR, NOT, NAND, NOR, EXOR, Symbol and Truth Tables, Inverting and Non-Inverting buffers.
BINARY ARITHMETIC AND BOOLEAN ALGEBRA: 4L

Boolean Axioms, D. Morgan’s Theorems, Statement, Verification and Applications.

One Complement, Half Adder, Full Adder, Half Subtractor.

LOGIC FAMILIES: 6L

TTL, ECL and CMOS Parameters like Power Dissipation, Speed, Supply Requirements, Logic level, Fan In, Fan Out, Noise Immunity.

COMBINATIONAL CIRCUITS: 4L

Encoders, Decoders.

SEQUENTIAL CIRCUITS: 8L

Flip Flops (RS, JK, D, T) Shift Registers, Counters, Semiconductor memories.

ELECTRONIC DEVICES AND CIRCUITS – II

OPERATIONAL AMPLIFIER: 10L

Basic idea of an OPAMP with black box concept, inverting and non-inverting inputs, virtual ground.

Parameters such as input impedance, output impedance, Open loop gain, measurements of parameters.

Qualitative description of OPAMP as inverting and non-inverting amplifier, summing and difference amplifier, comparator and linear integrator, Instrumentation amplifier.

OSCILLATORS: 5L

Positive feedback, Barkhausen criteria, Phase shift oscillators, Wien Bridge oscillator, Tuned oscillator, Hartley, Colpits oscillators, Crystal oscillator.

POWER SUPPLIERS: 8L

Regulated power supply, Zener regulated power supply, series and shunt regulated power supply, block diagram of IC 723, regulated supply; sing IC 723. Three terminal ICs power supply. Study of power supply with reference to variation in load and line voltage.

Switched mode power supply, Design principle and application.

MODULATION: 4L

AM and FM Principles, modulation index, modulation bandwidth, balanced modulator.

DEMODULATION: 4L

AM and FM detectors, diode detector, ratio detector, balanced demodulator.
Operation and applications.

INTRODUCTION TO COMMUNICATION SYSTEMS:

Basic Principles and operation of communication system.

ELECTRONICS CIRCUITS LABORATORY-II

General Guidelines for Physics Practical Examinations:

1. The distribution of marks is as follows:
   (i) One full experiment out of section–A requiring the student to take some data, analyse it and draw conclusions. (Candidates are expected to state their results with limits of error). 20 marks
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   Total: 45 marks

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4. The examiner should take care that the experiment allotted to an examinee from section–A and exercise allotted from section–B are not directly related to each other.

5. Number of candidates in a group for practical examination should not exceed 12.

6. In a single group, no experiment be allotted to more than three examinees in the group.

List of Experiments

1) Study of SCR and its firing characteristics
2) Familiarization with bread board, IO types, pin number, IC manual and its use.
3) Determination of logic level of thresholds for the inputs and outputs. To observe the propagation delays.
4) Familiarization and use of different types of LED’s seven segment display.
5) Use of 7447 BCD to 7 segment decoder.
6) Verification of truth tables for two input NOT, AND, OR, NOR Gates.
7) Study of shift registers.
8) Study of counter IC chips.
9) Study of FLIP-Flop IC’s.
10) Study of A/D and D/A converters.
### 2ND YEAR

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<th>No.</th>
<th>Year</th>
<th>Course Title</th>
<th>Credits</th>
<th>Contact Hours</th>
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<td>II</td>
<td>Operational Principles of Audio and Video Equipment</td>
<td>3</td>
<td>-</td>
<td>70</td>
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<td>7.</td>
<td>II</td>
<td>Microprocessor Based Instrumentation and Control</td>
<td>3</td>
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<td>70</td>
<td>Paper-IV</td>
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<td>8.</td>
<td>II</td>
<td>Repair and Maintenance of Audio/Video Equipment Lab.</td>
<td>-</td>
<td>6</td>
<td>20</td>
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<td>9.</td>
<td>II</td>
<td>Repair and Maintenance of Microprocessor Based Equipment</td>
<td>-</td>
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<td>20</td>
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<td>10.</td>
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<td>On Job Training Summer</td>
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### 3RD YEAR

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<td>III</td>
<td>Project</td>
<td>-</td>
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Eight questions be set in the question paper. The students be required to attempt five questions.
B.Sc. (General) II Year

Subject: ELECTRONIC EQUIPMENT MAINTENANCE

THEORY PAPER – III

Marks: 70

OPERATIONAL PRINCIPLES OF AUDIO AND VIDEO EQUIPMENT-I

Revision of AM and FM, communication bands, signal sources, Basic Principles of propagation of e.m. wave through atmosphere and ionosphere, ground wave, sky waves, space waves, dead zones etc.  3L

RECEIVING ANTENNAE:

Antenna parameters like gain, load width, radiation pattern, effective aperture, Ferrite AE. Types of antennae like Wire, Loop, dish yagi, telescopic, their construction and operating principles.  4L

SUPERHETERODYNE RECEIVERS:

Principles, advantages, block diagram, RF input and AE coupling arrangements, RF amplifiers, mixer, local oscillator, IF amp. Detector, audio amplifier, loud speaker, power requirements, tuning/aligning of receivers, waveform, and voltages at different check points. Circuit reading of various radio sets, repair and trouble shooting, automobile radios.  10L

ELEMENTS OF A TELEVISION SYSTEM:

Picture transmission, sound transmission, picture reception, sound reception, synchronization.  2L

COMPOSITE VIDEO SIGNAL:

Scanning sequence details, sync details of the 525 line system, channel bandwidth, vestigial sideband transmission, reception of vestigial sideband signals, frequency modulation, FM channel bandwidth, channel bandwidth for colour transmission, allocation of frequency bands for television signal transmission television standards.  3L

PICTURE TUBES – MONOCHROME AND COLOUR:

Beam deflection, screen phosphor, face plate, picture tube characteristics, picture tube circuit controls.  2L
TELEVISION RECEIVERS: 15L

Types of television receivers, receiver sections, video detector, video section fundamentals, video amplifiers-design principles, video amplifier circuits, automatic gain control and noise cancelling circuits, sync separation circuits, sync processing and AFC circuits, deflection oscillators, vertical deflection circuits, horizontal deflection circuits, sound system, RF tuner, video IF amplifiers, receiver power supplies, television receiver antennae, colour television antennae.

OPERATIONAL PRINCIPLES OF AUDIO AND VIDEO EQUIPMENT-II

TELEVISION APPLICATIONS: 8L

Television broadcasting, cable television, closed circuit television, theatre television, picture phone and facsimile, video tape recording (VTR), television via satellite, TV games, HDTV, flat panel TV, teleconferencing.

TAPE RECORDERS: 12L

Principles of magnetic recording, characteristics of magnetism, the hysteresis loop, recording head, recorded wavelength, response of head during reply, the effect of gap length, low frequency loss, other losses, equalization, the effect of non-linear characteristic of magnetization, recording bias, A.C. bias, erasing the tape, block amplifier, record (Play back) head, erase head, tapes (metal polymer), mechanical transport system, stereo recording, double deck, single deck, microphones (RF, cable), noise, maintenance of mechanical parts, head cleaners, head alignment, graphic equalizers.

TELEPHONES: 10L

Modulation, demodulation, modem, subscriber frequency allotment, channel organization, signaling, switching, manual exchanges, STD, ISD, EPABX, Intercom-stress on equipment and EPABX Value added services like FAX, mail.

MEASURING INSTRUMENTS: 10L

Multi-meters analog/digital, oscilloscopes, signal generators, noise and sound level meters, frequency counter, error sources and precautions during measurement.

General Note:

Familiarization with catalogues, standard specification, knowledge about companies referring to service manual.
Reference Books:


**THEORY PAPER-IV**

Marks : 70

**MICROPROCESSOR BASED INSTRUMENTATION AND CONTROL-I**

MICROCOMPUTER FUNDAMENTALS:  8L

- Introduction, simplified microcomputer architecture, simplified memory organization, instruction set, simplified CPU organization, microcomputer operation.

THE MICROPROCESSOR:  8L

- Data sheet descriptions, pin diagram and function, microprocessor architecture, using the date/address register, using the stack pointer.

INTERFACING THE MICROPROCESSOR:  10L

- Introduction, interfacing with ROM, interfacing with RAM, input/output interfacing basics, interfacing with practical I/O ports, synchronizing I/O data transfers using interrupts, address decoding.

PROGRAMMING THE MICROPROCESSOR:  12L

- Machine and assembly languages, simplified instruction set, instruction set, arithmetic operations, instruction set-logical operations, instruction set-data transfer operations, instructions set branch operations, instruction set – subroutines call and return operations, instruction set-miscellaneous operations writing program, addressing modes, program branching, program looping using subroutines.

**MICROPROCESSOR BASED INSTRUMENTATION AND CONTROL-II**

THE INTEL 8080/8085 MICROPROCESSOR:  8L

- Introduction, the 8085 pin diagram and functions, the 8085 architecture, addressing modes, the 8080/8085 instruction set, the 8080/8085 arithmetic instructions, the 8080/8085 logical instructions, the 8080/8085 branch instructions, the 8080/8085 stack, I/O, and machine control instructions.

PROGRAMMING AND 8080/8085 MICROPROCESSOR:  8L
Introduction, straight-line programs, looping programs, mathematical programs.

APPLICATIONS TO ILLUSTRATE THE USE OF MICROPROCESSOR: 14L

i) Traffic control
ii) Temperature control
iii) Digital clock
iv) Stepper motor control
v) Washing machine control

PERSONAL COMPUTER ORGANIZATION AND WORD PROCESSOR 10L
B.Sc Part II Level

PRACTICE-III

Repair and Maintenance of Audio and Video Equipment

Marks : 20

A.

1. Study of modulator
2. Study of oscillator
3. Tape recorder-testing, assembly and dis-assembly
4. Radio receiver-testing
5. Study of PA system and its testing
6. Study of EPABX, wiring and connectivity with telephone instruments

B: TELEVISION

1. Orientation and connection of TV antenna. Knowledge of booster connection and replacement. Knowledge of balun unit-different types (for different TV sets) and replacement of balun. Replacement of front end.
2. Power supply and resistance-cold tests. Voltage measurement at different points. To build SMPs for voltage between 6-15 volts (using IC’s).
3. Horizontal and vertical oscillator checking and testing using CRO.
4. To see and read circuit diagram and to identify (locate) various blocks on F/S, H and V deflection, Video amplifier, audio section, chroma section. OF section, tuner, tube and deflection yokes (centering and adjustment).
5. Audio section waveform testing step by step-sound separator, sound take off from IF section and then onwards to detector amplifier, IF alignment and loud speaker (inter-carrier sound take off).
6. IF stage testing, IF alignment, tuner and band select.
7. Chroma processor: testing signals at various IC’s.
8. Remote control studies-range, direction various controls, IR transmitter and receiver, coding of signal.
9. Fault finding: Cold testing and voltage testing at various parts (Revision of parts 1 to 9).

C: VCP/VCR
1. Study of block diagram and identification of various parts in VCR.
2. Knowledge of simple audio type recorders, head replacement, bias adjustment, head alignment for reducing cross-talk of stereo.
3. Belt changing, head cleaning, replacement and alignment of heads.
5. Audio Testing.
7. Play back system alignment.
8. Record system alignment.
9. Alignment and fault finding of audio section.

PRACTICE – IV
Repair and Maintenance of Microprocessor based Equipment

Marks : 70

1. Familiarization with 8085 based microprocessor trainer kit, Location of 8085, 8279, 8253, keyboard, display fields, EPROM Programmer, expansion slot, TTY and serial lines.
2. Entering and executing an assembly language program, codes for insertion, deletion memory move, block fill, setting and examining registers and memory, single step execution of a program.
3. Writing of a program to add, substract and multiply two numbers stored in memory (NNNN & NNNN = 1) and place the result in the subsequent memory, (nnnn+2).
4. Writing of a program to test RAM for errors by writing O’s & I’s in alternate location and reading it for checking.
5. Making of a board with a LED’s and four switches to connect to the 8085 kit on the expansion slot (8279).
6. Making of a board with 8 LED’s and four switches to connect to the 2085 kit on the expansion slot (8255).

   a) Program the 8255 to glow/switch off LED’s
   b) Program the 8255 to switch ON and OFF the LED’s every few seconds according to a given pattern (Hint: The patter can be 01010101 and 10101010 or 00100100, or any other)
7. Design and assembly and testing of P based instruments (each equipment to 4 lab work).

   i) Digital Clock
   ii) Temperature Controller
   iii) Washing Machine Controller
Microcontroller 8051 Architecture:


Transmission Modes:

Serial Data Input/output – Serial data interrupts Data Transmission, Data Reception, and Serial Data.

Interrupts:

Timer Flag Interrupt, Serial Port Interrupt, External interrupts Reset, Interrupt Control, Interrupt Priority, Interrupt destination, Software Generated Interrupts.

Basic Assembly Language Programming:


Addressing Operations:

Immediate, register, direct indirect: External data moves, Code memory – read only data moves, opeodes-Push, Pop.

Arithmetic operations:

Flags, Instructions Affecting Flags, Incrementing and decrementing, Addition-Unsigned and signed, Multiple-Byte signed arithmetic, Subtraction: unsigned and signed; Multiplication and Division, Decimal Arithmetic.

Jump and Call instructions:

JUMP and CALL programming, relative, short absolute, long absolute; Jumps-Bit, Byte, Unconditional: Calls and Subroutines subroutines, calls & the stack, calls & returns.

Applications of Microcontroller-8051:
7-Segment display, Traffic Lights
New Technology:

Industrial aspects of consumer electronics, quality control/management, production techniques, business cycle, new technologies, compact disc, laser disc.

Reference Books:

1. Microcontroller 8051: By A.J. Ayala
2. Microcontroller 8051: By Scott Mackenzic
3. Microcontroller 8051: By J.W. Stewart

PAPER-VI

PRACTICALS and PROJECT WORK

Marks: 125 (75 for practical and 50 for project)

Note: AT least 15 practicals as per the availability of apparatus.

1. To interlace a toggle switch and an LED with Microcontroller
2. To generate 1 kHz square in PL I using timer
3. To generate 1 kHz square wave at PL I using timer and 10kHz at PL I using interrupts
4. To transmit and receive a character using serial I/O
5. To Copy the contents of register R7 to external RAM location
6. To interface a DIP switches and to drive 7-segment display
7. To interface a loudspeaker to generate a tone of 440 Hz
8. To interface a Hex/calculator keypad to microcontroller
9. To interface an ADC and DAC to microcontroller
10. To study/interface various active and passive transducers with microcontroller
11. To design an LPF/HPF
12. To Design an LPF using OPAMP
13. To study load/voltage regulation of a UPS
14. To study Load/voltage regulation of a CVT
15. To realize AND, OR, NOT, NAND and NOR gates using PLCs
16. To use single push button switch to ON/OFF a motor using PLCs
17. To use a single push button switch to ON/OFF a conveyor and switch off after 20s with PLCs
18. To realize a stable multi-vibrator using PLCs
19. To demonstrate traffic light control using PLCs
20. To realize a control for an elevator
21. To realize a paid car parking
22. To realize the working of a bottling plant
PROJECT WORK

Project Works: Project work will relate to the design, fabrication, testing, repairing, report writing for setting up small industry by taking loan from financial institution, etc.

Proposed Projects (using Microcontrollers/PLCs):

Note: Any one project for one student

1. Intrusion Alarm System
2. Furnace Temperature Controller
3. Traffic Light Controller
4. Washing Machine Controller
5. Micro Wave Oven Controller
6. SMP
7. Inverter
8. UPS

LIST OF EQUIPMENTS FOR B.Sc LABORATORY

1. TV Receivers       - 2 Nos.
4. Oscilloscopes (20 MHz) - 4 Nos.
5. VCR/VCP            - 2 Nos.
6. Tape Recorders (Stereo) - 2 Nos.
8. Colour Pattern Generator - 1 No.
9. Digital and Analogue Multimeters - 4 each
11. Bread Board       - 10 Nos.
13. Demonstration kits for amplifier, AM and PM Modulator, Oscillators - 2 each

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