6.1 MOBILE COMMUNICATION

L	T	P	Cr
4	-	2	5

RATIONALE

This subject includes an exposure to modern means of communication i.e. Mobile communication. The mobile communication has revolutionized the means of communication. The subject aims at giving adequate knowledge to the students about digital and mobile communication.

DETAILED CONTENTS

1. Introduction to digital Communication. (02 hrs)

2. Digital Modulation Techniques (06 hrs)

Basic block diagram and principle of working of the following:

- Amplitude shift keying (ASK); Interrupted continuous wave (ICW), two tone modulation.
- Frequency shift keying (FSK)
- Phase shift keying (PSK).

3. Mobile Communication Systems (12 hrs)

Mobile communication systems: Two way mobile radio – cordless telephone – Cellular radio – Analog and Digital systems standards – Personal Communication systems (PCS) and Mobile personal Computers MPC – One way mobile.

4. Radio propagation (12 hrs)

Radio Propagation Concepts: Fundamentals of radio propagation and system concepts – causes for prorogation path loss – fading – Doppler spread – time delay path loss – foliage loss – path loss measurement from point to point prediction model.

5. Frequency Management. (10 hrs)

Frequency management – Frequency bands for mobile communication – frequency reuse techniques – FDMA. TDMA and CDMA techniques.-Comparison between GSM and CDMA.

6. Radio interference (10 hrs)

Mobile radio interference: Noise limited and interference limited environment – co-channel and adjacent channel environment – inter-modulation – Near –end and far-end ratio.

7. Design Parameters (12 hrs)

Design parameters: Design characteristic at base station and mobile unit- Mobile communication satellites – Mobile communication satellites at Geo-synchronous orbits – IRIDIUM satellites- ODYSSEY satellites.

LIST OF PRACTICALS

1. Study the features of cordless telephone .
2. Study the features of cellular Mobile .
3. Troubleshooting of cordless telephone.
4. Troubleshooting of cellular mobile.
5. Add experiments to make list of 8-10 experiments

INSTRUCTIONAL STRATEGY

This vital subject requires a lot of practical work including frequent visits to the communication industry, So that the students can understand the significance of each area. Practical on training kits is necessary in PCM, Digital Modulation, Modems and network. Visits to Digital exchange, Mobile switching centres and research centres may be arranged.

RECOMMENDED BOOKS:

1. William C.Y.Lee: Mobile Cellular Telecommunications Analog and Digital Systems, 2nd Edition, McGrawHill, 1995.
2. Kamilo Fether: Wireless digital communication modulation and spread spectrum applications- Prentice Hall, 1995.
3. Tom Logsdom: Mobile communication satellites theory and applications – McGraw Hill, 1995.
4. William C.Y.Lee: Mobile Communication Design Fundamentals – McGraw Hill,1993.
5. To Generate ASK and demodulate it.
6. To generate FSK and develop it.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs	Marks Allocation
1.	Introduction to Digital Communication	2	5
2.	Digital modulation techniques	6	10
3.	Mobile Communication Systems	12	20
4.	Radio Propagation	12	20
5.	Frequency Management	10	15
6.	Radio Interference	10	15
7.	Design Parameters	12	20
Total		**64**	**100**

6.2 MICROCONTROLLERS AND EMBEDDED SYSTEM

L	T	P	Cr
4	-	2	5

RATIONALE

Embedded systems and Micro-controllers have also assumed a great significance in the electronic and consumer goods industry and are a very vital field. The subject aims expose students to the embedded systems besides giving them adequate knowledge of Micro controllers.

DETAILED CONTENTS

1. Microcontroller series (MCS) – 51 Overview (16 hrs)

   Architecture of 8051/8031 Microcontroller
   - Pin details
   - I/O Port structure
   - Memory Organization
   - Special Function Registers (SFRs)
   - External Memory

2. Instruction Set; Addressing Modes, Instruction types (14 hrs)

   - Timer operation
   - Serial Port operation
   - Interrupts

3. Assembly language programming (14 hrs)

   - Assembler directives
   - Assembler operation

4. Design and Interface (12 hrs)

   Examples like: keypad interface, 7- segment interface etc

5. Introduction and Applications of Embedded systems (08 hrs)

LIST OF PRACTICALS

1. Familiarization with Micro-Controller Kit
2. Assembly Language Programming

3. Use of Assembler for making program
4. Interfacing of key Board and 7 Segment Display with Micro Controller PLCs

INSTRUCTIONAL STRATEGY

More emphasis while teaching this subject should be given on practical aspects along with the theory input. Lots of programming exercises may be given to the students. Mini-projects based on microprocessor and micro-controller operations may be identified and given to students as assignments.

RECOMMENDED BOOKS:

1. Microcontrollers by Ayala

2. Microcontrollers by Mazidi

3 Microcontrollers by Neil Makanzie

4.Micrcontrollers by Deshmukh

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Micro controller series (MCS) – 51 Overview	16	25
2.	Instruction Set; Addressing Modes, Instruction types	14	25
3.	Assembly language programming	14	20
4.	Design and Interface	12	20
5.	Introduction and Applications of Embedded systems	8	10
Total		**64**	**100**

6.3 PLC AND PROGRAMMING

L	T	P	Cr
4	-	2	5

RATIONALE

Anl diploma holder when employed in automated industrial process controls or in automated power station will be required to know the basic of programmable logic controllers, their working and also have an idea of different methods of programming. The subjects aims at giving the adequate knowledge to the students about basic concepts and programming of PLCs.

DETAILED CONTENTS

1 Introduction to PLC (10 hrs)

- Process control
- History of process control
- Advantages
- Applications
- Building block of PLC
- Functions of various blocks
- PLC concepts

2 PLC Hardware (10 hrs)

- Various Components and their functions
- Installing a PLC
- Configuring a PLC
- Understanding the differences between Logo type & Modular type PLC

3 Instruction Set (15 hrs)

- Bit logic – NO, NC, Immediate contacts, coils, set, reset, SR, RS, P,N, NOT
- Compare instructions.
- Timers
- Counters
- Math instructions
- Move instruction
- Special Memory bits

- Application of PLC using sensor technology

4 Programming of PLC (15 hrs)

- Programming concepts
- Addressing of CPU memory areas
- Ladder Programming
- STL Programming
- FBD Programming

5 Develop Small Projects Using PLC (14 hrs)

- Control of 3 phase, 415V, AC, slip ring induction motor by developing logical control program in PLCs
- Reaction vessels process control by appropriate logic control program in PLCs based.
- Automatic lift control in domestic and industrial building by PLCs based logic program.
- Control of 3 phase, 415 V a.c, star-delta motor starter by use of PLCs logic program.
- Sequential control of motors in industrial shop floor production, such as conveyor etc.
- Water level control of a overhead Tank by developing PL control and simulation.
- Operation time control of a Fan in a reaction vessel using PLC.
- Logic development and simulation of Sequential conveyor operation by PLC.

LIST OF PRACTICALS

1 Familiarization with the working of PLC

2 Components/sub-components of a PLC, learning functions of different modules of a PLC system

3. Introduction to step 5 programming language, ladder diagram concepts, instruction list syntax

4 Basic logic operations, AND, OR, NOT, functions

5. Logic control systems with time response as applied to clamping operation

6. Sequence control system e.g in lifting a device for packaging and counting

7. Use of PLC for various mechanical outputs viz motion of a piston in a single cylinder multiple cylinders, driving machine operation etc.

8. Familiarization of the working of PLC

9. Writing entering and testing programs using a hand-held programmer for the following operations:

- Ladder Logic
- Timers
- Counters
- Sequencers

10. Writing, entering and testing programs using computers for the following operations.

- Ladder Logic
- Timers
- Counters
- Sequencers

INSTRUCTIONAL STRATEGY

The inputs shall start with theoretical inputs to architecture, instruction set, assembly language programming, Small projects may be identified, be designed and implemented. PLC ladder diagram and programming should be supplemented with visits to industry. More emphasis may be given to practical work

RECOMMENDED BOOKS

1. Programmable Logic Controller, S. Bran Morris
2. Programmable Logic Controller by Collin Simpson
3. Introduction to Programmable Logic Controller by Gary Dunning
4. Module on PLCs and their Applications by Rajesh Kumar, NITTTR Chandigarh
5. Module on "Allen Bradlag PIC (SLC 500), Institution set-1, by Rajesh Kumar, NITTTR, Chandigarh
6. Module on "PLC Applications based on SLC 5/03" By Rajesh Kumar, NITTTR Chandigarh
7. Lab Manual on PLC based Application on SLC 500 by Rajesh Kumar,NITTTR,Chandigarh.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction to PLC	10	15
2.	PLC Hardware	10	15
3.	Instruction set	15	25
4.	Programming of PLC	15	25
5.	Develop Small Projects using PLC	14	20
Total		**64**	**100**

ELECTIVE-II
6.4 (a) DIGITAL SIGNAL PROCESSING

L	T	P	Cr
4	-	2	5

RATIONALE

Digital signal processing (DSP) is an emerging area, which has a great scope and a lot of job potential in the industry. DSP chips are being widely used in communication industry, consumer electronics etc.

DETAILED CONTENTS

1. Introduction (8 hrs)

   Signal systems Basic elements of a digital signal processing system. Classification of signals, continuous time versus discrete time signals

   Concept of frequency in continuous time and discrete time signals

2. Discrete time signals and systems: (8 hrs)

   Block diagram representation of discrete time systems, Linearity , Stability and Causality. Convolution and correlation of signals.

3. Implementation of discrete time systems, Recursive and non-recursive FIR systems. (8 hrs)

4. Z-transform and its application to LTI systems: Direct and inverse Z transform, properties of Z transform. (8 hrs)

5. Design of Filter structures-Direct Form I, II, cascade and Parallel form (8 hrs)

6. Introduction to Fourier Transform. (10 hrs)
   Discrete Fourier transform, properties of DFT (No proof), Multiplication of time DPTS and circular convolution, use of DFT in linear filtering

7. Fast Fourier transforms: Efficient computation of DFT; FFT, DIT algorithm (8 hrs)

8. Introduction to IIR and FIR filters, Application of DSP baffles system (6 hrs)

LIST OF PRACTICALS

1. Plotting of different Discrete Signals using MATLAB
2. Convolution using Mat Lab or C program
3. Correlation using Mat Lab or C program
4. Divide and conquer Mat Lab or C program

5. Introduction to ADSP 21 XX DSP Chip
6. Demo programs of ADSP 21 XX
7. Building and Simulations small programs (5 programs) using 21 XX simulator

INSTRUCTIONAL STRATEGY

Lectures with hardware practical and programming practice. Visits to the industry.

RECOMMENDED BOOKS

1. Theory and Applications of Digital Signal Processing by Rabiner and Gold; Prentice Hall of India
2 Digital Signal Processing Using MATLAB by Vinay K Ingle and John G Proakis; Vikas Publishing House, New Delhi
3 Digital Signal Processing (Principles, Algorithms and Applications) by John G. Proakis and G Monolakis; Prentice Hall of India
4. Digital Signal Processing by AV Oppenheim and RW Ronald W Schafer; Prentice Hall of India
5. DSP a computer based approach Mitra Sanjit TMH Publication
6. DSP a Practical approach by Ifeachor, Emmanual Pearson Education.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No	Topic	Time Allotted (hrs)	Marks Allocation
1.	Introduction	8	15
2.	Discrete Time Signals and Systems	8	15
3.	Implementation of Discrete Time System	8	10
4.	Z-Transform and its Application	8	15
5.	Design of Filter structures-Direct Form I, II, cascade and Parallel form	8	10
6.	Discrete Fourier Transform	10	15
7.	Fast Fourier Transform	8	10
8.	Introduction to IIR and FIR filters	6	10
Total		**64**	**100**

6.4(b) DIGITAL SYSTEM DESIGN

L	T	P	Cr
4	-	2	5

RATIONALE

Digital design is a vital area in Electronics with a lot of scope in industry and in research. Digital system design involves combinational and sequential system design, both of which are very important fields. This subject forms the basis for R&D in digital systems.

DETAILED CONTENTS

1. Combinational Circuits (14 hrs)

   Review of logic variables, Boolean expressions, Minimization of Boolean expressions using map method; Tabular method of function minimization, optimal realization of Boolean expressions using gates (SSI approach) - Multiplexer /Decoder (MSI approach), 2 bit magnitude comparator, Code Convertors-5421 to 2421, 8421 to 5421, BCD adder Shift register, ROM Types of ROM, PLD-PAL and PLA , ROM/PLA design(LSI approach) , Sequential programmable device-SPLD,CPLD and FPGA

2. Sequential Circuits: (12 hrs)

   Essential components of a sequential circuit, synchronous and asynchronous sequential circuits. Classification of sequential circuits (Mealy & Moore Machines).

   Flip-Flop as memory element : RS, D, JK (including master slave), T, their excitation and characteristic (Truth tables).

3. Design of Sequential Circuits (18 hrs)

   Conversion of JK to D and T. Generation of primitive state table/ diagram. Its minimization of states, state assignment, choice of memory elements. Design of next state decoder, output decoder (SSI, MSI approach). Worked examples for sequential system design, Design of counter(synchronous) using JK flip flop-Modulo -5,modulo-6,modulo -10 etc, Design of counter using D flip flop and T flip flop.

4. Asynchronous Finite state machine analysis , Design, and Issues. (10 hrs)

   Need for asynchronous Circuits, Spikes in output and their removal. Design approach to asynchronous circuits, definitions of cycles races -plotting and reading the excitation map- hazards –map approach to asynchronous design-Contemporary approach to asynchronous Design- Hazard in the circuit developed by MEV method.

5. HDL Language: (10 hrs)

Introduction to HDL-verilog Language. Different modeling techniques-Gate Level modeling, Data Flow modeling and Behavioral modeling, simple Problems on HDL language-full adder, multiplexer, half adder, half subtractor, full subtractor, demultiplexer.

LIST OF PRACTICALS

1. Design and implement a code converter for Binary-to-Gray code conversion using decoder.
2. Design and implement full adder and full subtractor using multiplexer.
3. Using PROM/PLA design and implement a combinational circuit.
4. Design and implement a Modulo-5 synchronous counter using JK sequential circuit.
5. From a given problem statement, design and test a typical sequential circuit.
6. Design a 4-bit sequence generator.
7 Design a traffic signal controller and Parity code generator .
8 Design a any Parity code generator and decoder circuit .
9 Any one programme using Gate level modeling.

INSTRUCTIONAL STRATEGY

Emphasis is to be placed on design aspects in theory. A lot of practical work is required in designing digital systems including practical projects based on both combinational and sequential circuits. Bread Boards to be used to set up and test various circuits. Practical exercises are also required to be done on PLA, PAL and CPLD kits

REFERENCE BOOKS

1) Digital System Design And Microprocessors By Hayes, John TMH Publication

2) Digital Systems, Hardware Organization And Design By Hill, Fedrick Willey Publication

3) Digital System Design Using Vhdl By Roth,Charles H Books/Thomson Learning

4) Digital System,Principles And Application By Tocci, Ronald PHI Publication

5) Engineering Approach To Digital Design By Wiiliam Fletcher PHI Publication

6) Digital Design By Morris Mano

7) Digital Logic Design Principles By Norman Balabanian & Bradley Carlson

8) Modern Digital Electronics By R.P. Jain

9) Digital Circuits & Design By S. Salivahanan & S. Arivazhagan

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Combinational Circuits	14	25
2.	Sequential Circuits:	12	20
3.	Design of Sequential Circuits	18	30
4.	Asynchronous Finite state machine analysis, Design, and Issues.	10	15
5.	HDL Language:	10	10
Total		**64**	**100**

6.5 ENTREPRENEURSHIP DEVELOPMENT AND MANAGEMENT

L	T	P	Cr
4	-	-	4

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. Since diploma technicians are expected to take-up middle level managerial positions, their exposure to basic management principles is very essential. Based on the broad competencies listed above, following detailed contents have been finalized to develop the appropriate competencies.

DETAILED CONTENTS

(1) Entrepreneurship (10 hrs)

- 1.1 Concept/Meaning and its need
- 1.2 Competencies/qualities of an entrepreneur
- 1.3 Entrepreneurial Support System e.g., District Industry Centres (DICs), Commercial Banks, State Financial Corporations, 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 and national level

(2) Market Survey and Opportunity Identification (Business Planning) (10 hrs)

- 2.1 How to start a small scale industry
- 2.2 Procedures for registration of small scale industry
- 2.3 List of items reserved for exclusive manufacture in small scale industry
- 2.4 Assessment of demand and supply in potential areas of growth
- 2.5 Understanding business opportunity
- 2.6 Considerations in product selection
- 2.7 Data collection for setting up small ventures

(3) Project Report Preparation (08 hrs)

- 3.1 Preliminary Project Report
- 3.2 Techno-Economic feasibility report
- 3.3 Project Viability Report

(4) Managerial Aspects of Small Business (10 hrs)

4.1 Principles of Management, Definitions, functions of management viz planning, organization, coordination and control

4.2 Structure of an industrial organization.

4.3 Basic principles of financial management

4.4 Marketing Techniques

4.5 Personnel Management, staff development and training strategies

4.6 Importance and techniques of communication in business

(5) Legal Aspects of Small Business (10 hrs)

5.1 Elementary knowledge of Income Tax, Sales Tax, Patent Rules, Excise Rules, provident fund

5.2 Elementary knowledge of Factory Act, 1948 and Payment of Wages Act 1936, Workmen Compensation Act, Industrial Dispute act 1947, Employees State Insurance Act 1978

(6) Environmental Considerations (04 hrs)

6.1 Concept of ecology and environment

6.2 Factors contributing to Air, Water, Noise pollution

6.3 Air, water and noise pollution standards and control

6.4 Norms and standards of State pollution Board

6.5 Disaster Management – basic idea

(7) Miscellaneous (12 hrs)

7.1 Human resource development in an organization

7.2 Motivation – Incentives, Rewards, Job Satisfaction

7.3 Leadership- types, qualities, functions and factors of effective leadership

7.4 Labor Welfare schemes including wage payment- types, system of wage payment and incentives

7.5 Workers participation in management, case studies in effective Management.

7.6 Accident and Safety: Classification, precaution and treatment after accident, safety practices promotion, personal protection equipment (PPFs) for safety at work places.

7.7 Introduction to Total quality Management (TQM) and steps to achieve this .

7.8 Intellectual Property Rights (IPR): Concept, definition, infringements and remedies related to patents, copy rights, trademarks, designs. Introduction to registering procedure

INSTRUCTIONAL STRATEGY

The aim of this subject is to develop conceptual understanding by giving inputs and exposure about starting ones own business venture/enterprise. The teacher will discuss success stories and case studies with students, which in turn, will develop managerial qualities in the students. There may be guest lectures by successful diploma holding entrepreneurs and field visits also.

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. Industrial management by N. Mohan, and AP Verma, SK Kataria and Sons, Nai Sarak, Delhi-110006
9. Total Quality Management by Dr DD Sharma, Sultan Chand and Sons, New Delhi.
10. Principles of Management by Philip Kotler TEE Publication
11. Intellectual Property Rights and the Law by Dr. GB Reddy.

SUGGESTED DISTRIBUTION OF MARKS FOR FACILITATING THE PAPER SETTER

Sr. No.	Topic	Time Allotted (hrs)	Marks Allocation
1.	Entrepreneurship	10	10
2.	Market Survey and Opportunity Identification (Business Planning)	10	20
3.	Project Report Preparation	08	10
4.	Managerial Aspects of Small Business	10	15
5.	Legal Aspects of Small Business	10	15
6.	Environmental Considerations	04	10
7.	Miscellaneous	12	20
Total		**64**	**100**

6.6 MAJOR PROJECT WORK
(Industry oriented –Practice based)

L	T	P	Cr
-	-	8	4

RATIONALE

Major Project Work aims at developing professional and 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 explained the objectives of the project work and then 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. The identified project work must lead to students exposure and interaction with industry/field organizations in the world of work.

Each teacher is expected to guide the project work of 4-5 students at a time. The project assignments may consist of :

- 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 half wave and full wave rectifiers using ORCAD
27. Simulation of following circuits:

    Integrator, differentiator, adder, subtractor, 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**

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.**

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.