**WITH EFFECT FROM THE ACADEMIC YEAR 2004-2005**

## SCHEME OF INSTRUCTION & EXAMINATION

## B.E III YEAR (REGULAR)

## (ELECTRONICS & COMMUNICATION ENGINEERING)

### SEMESTER - I

| Sl. No. | Syllabus Ref.No | SUBJECT | Scheme of Instructions Periods per Week L/T | D/P | Scheme of Examination Dura-tion in Hrs | Maximum Marks Univ. Exam | Sessionals |
|---|---|---|---|---|---|---|---|
| | | **THEORY** | | | | | |
| 1. | EC 301 | Linear Integrated Circuits & Applications | **4** | **-** | **3** | **75** | **25** |
| 2. | EC 302 | Digital Integrated Circuits & Applications | **4** | **-** | **3** | **75** | **25** |
| 3. | EC 303 | Computer Organization and Microprocessors | **4** | **-** | **3** | **75** | **25** |
| 4. | EC 304 | Analog Communications | **4** | **-** | **3** | **75** | **25** |
| 5. | EC 305 | Automatic Control Systems | **4** | **-** | **3** | **75** | **25** |
| 6. | EC 306 | Electronic Measurements & Instrumentation | **4** | **-** | **3** | **75** | **25** |
| | | **PRACTICALS** | | | | | |
| 1. | EC 331 | Linear Digital Integrated Circuits Lab | **-** | **3** | **3** | **50** | **25** |
| 2. | EC 332 | Microprocessor Lab | **-** | **3** | **3** | **50** | **25** |
| 3. | EC 333 | Communication Engineering Lab | **-** | **3** | **3** | **50** | **25** |
| | | **TOTAL** | **24** | **9** | **-** | **600** | **200** |

**EC 301**

# LINEAR INTEGRATED CIRCUITS AND APPLICATIONS

| | |
|---|---|
| Instruction | 4 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 75 Marks |
| Sessional | 25 Marks |

**UNIT- I**

DC amplifiers. Drift and compensation techniques. Difference amplifier analysis. CMRR, Operational amplifier and its architecture. Operational amplifier characteristics. Measurement of parameters. Frequency response and compensation. Op-Amps ma 741, MCI530 IC version architecture, analysis 1. and characteristics.

**UNIT -2.**

Analysis of operational amplifiers: inverting, non-inverting and differential modes,
Basic applications of operational amplifiers. Active filters: low-pass, high-pas~ 3. band-pass, band-elimination and all-pass types, Butterworth and Chebyshev filters.

**UNIT-lll**

Basic operation of regenerative comparator (Schmitt Trigger) with Op-Amps.. Analysis and design of comparators, monostable and astable multivibrators using:- Op-Amps, logic gates, digital ICs and monolithic IC timer (NE555). Voltage Controlled Oscillators (VCOs)- operation and its applications (using NE 566 IC). Phase locked loops- operation and its applications (using NE 565 IC PLL).

**UNIT -IV**

Analysis and design of function generators with Op-amps; IC function generators-analysis and design (using 8038 IC). Analysis and design of voltage regulators using 78xx /79xx and 723 monolithic ICs.

Time-base generators, sweep speed, transmission and displacement. errors. Study of different types of voltage and current ramp generators with discrete components.

**UNIT-V**

Sampling gates, Sample and hold circuits. Data converters- Analysis and design of different types of AID and *D/A* converters. Monolithic ADC and DAC circuits, Design of DVM using dual slope integration**.**

**Suggested Reading: .**

1. Millman, J ., and Grabel,A., *Microelectronics,* 2nd edition, MGH ISE ,2001
2. Gayakwad R.A., *Op-Amps and Linear Integrated Circuits,* 3rd edition., PHI 2000.

3. J. Choudhry, D.R. and Jain , S., *Linear Integrated Circuits,* Wiley Eastern Ltd,1991.
4. Bell, D.A., *Solid Slole Pulse Circuits,* 4th edition, PHI, 1992.
5. Millman, J ., and Taub, H., *Pulse, Digital and Switching waveform,* TMH, 2001.

**Additional Reading:**

1. Franco, S., *Design with Operational Amplifiers and Analog Integraled Circuits.* 3rd edition, TMH, 2003.
2. Conghlin, R.F. and Priscall, F.F., *Operational Amplifiers and Linear integraled circuits,* 6th edition, Pearson
Educations Asia.
3. Bell. D.A. , *Operational Amplifiers and Linear ICs,* 2nd edition, 2003
4. Johns, D.A. and Martin K., *Analog Integrated Circuit Design;* John wiley, 2002

**EC 302**

## DIGITAL INTEGRATED CIRCUITS AND APPLICATIONS

| | |
|---|---|
| Instruction | 4 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 75 Marks |
| Sessional | 25 Marks . |

**UNIT-l**

Classification of Integrated Circuits; Comparison of various logic families ; Digital IC terminology, DTL Logic family; TTL logic family, Standard TTL Nand gate-Analysis and characteristics, Standard and other TTL series and characteristics; TTL open collector outputs; Tristate TTL, The ECL digital IC family; MOS and CMOS digital ICs and their characteristics, CMOS open drain and tristate outputs, CMOS transmission gate (bilateral switch); IC interfacing-TTL driving CMOS and CMOS driving TTL.

**UNIT -II**

Design using TTL- 74xx and CMOS 40xx series: code converters, decoders, demultiplexers, decoders and drivers for LED and LCD displays, Encoders, priority encoders; multiplexers and their applications; parity generator/checker circuits. Digital arithmetic circuits -Parallel, Serial and fast binary adder circuits, parallel binary adder/subtractor circuits using 2's complement system; Decimal adders and substractors, Digital comparator circuits.

**UNIT-III**

Flip-flops and their conversions, Design of synchronous and asynchronous counters. Preset table counters; Decade counters, cascading BCD counters; Shift registers and applications; familiarity with commonly available 74xx and CMOS 40xx series of IC counters, Counter applications: Frequency counter and Design of digital clock.

**UNIT-IV**

**Memories:** ROM architecture, types and applications, flash memories, RAM architecture, static and dynamic RAMs; Dynamic RAM structure and its refreshing circuitry. Expanding word size and capacity, non-volatile RAM. Sequential memories, and CCDs.

**UNIT-V**

**Types of ASICs :** Full custom ASICs, Semi custom ASICs and their architectures; Implementing logic functions using programmable logic devices -programmable read only memory (PROM); Programmable array Logic (PAL); Programmable logic array; Multilevel PLDs.

**Suggested Reading :**

1. Tocci, R.J.; Widmer, N.S.; *Digital System Principles and Applications,* 8th edition, PHI, 2003.
2. Sandige, R.S, *Modern Digital Design,* MGH, 1990.
3. Morris R.L. and Miller. J.R.; *Designing with 1TL Integrated Circuits,* MGH ISE, 1985.
4. Jain, *R.P.,Modern Digital Electronics,* 3rd Edition TMH, 2003.

**Additional Reading:**

1. Buchanan, J., CMOS/TTL *Digital Systems Design.* MGH, 1990.
2. Blakeslee. T.R., *Digital Design Techniques for Microcomputers with Standard MSI& LSI,* 2nd edition,1979
3. Demassa, *T.A.* and Ciccona. *T.; Digital Integrated Circuits,* John Wiley, 2001.

**EC 303**

**COMPUTER ORGANIZATION AND MICROPROCESSORS**

| | |
|---|---|
| Instruction | 4 Periods per week Duration of |
| University Examination | 3 Hours |
| University Examination | 75 Marks |
| Sessional | 25 Marks |

**UNIT-I**

Concept Of Von-Neuman Machine, Components in a computer, functions of various components, bus structure, ALU, Computer Arithmetic, Integer and floating point arithmetic operation, BCD arithmetic operations.

Instruction format and instruction set of a computer, addressing modes, processor organization, register organization and stack organization.

**UNIT-II**

I/0 and Memory organization: Memory Devices, Semiconductor memory types, Memory hierarchy, concept of virtual memory, Memory organization and mapping. Partitioning, paging, segmentation, cache memory, virtual memory, magnetic disk and memory management.

I/O Devices: Programmed 1/0, Interrupt driven 1/0; Direct Memory Access;

I/O Addressing: Memory Mapped I/O and I/O mapped I/O; I/O Channel, I/O Processor, Different Printers.

**UNIT-III**

8 bit Microprocessors -over view of Intel, Motorola and Zilog CPUs and their features; Intel 8085 Microprocessor -Architecture, Instruction set, Instruction/ Machine cycle and Timing diagram of different categories of instructions. Interrupt structure and Interrupt priorities. Simple programming using Machine Language codes.

Assembly Language Programming (ALP): Brief overview of assemblers, using ALP -simple program loops, delay loops, Arithmetic problems, sorting, searching, sub-routines and Interrupt programming.

**UNIT- IV**

Interfacing with 8085: Memory interfacing using standard IC Memory chips - RAMs EPROMs, EEPROMs. Interfacing of 1/0 Devices and programmable devices (using LSI/VLSls). Review of Programmable Interface Device concepts: 18255 -Programmable peripheral interface (PPI) Chip, Intel 8253/8254 programmable Interval Timer chip. Interfacing of ADCs, DACs and their programming. Interfacing & programming with peripheral chips: Matrix keyboard, seven-segment LEDs & LCD display modules.

**UNIT-V**

Parallel processing and pipelining: Arithmetic/Instruction pipeline & vector processing. Brief overview of RISC

Architecture and comparison of CISC & C Machines. Array processors.

Systems Programming: Functional aspects of operating system (O.S), Compilers, Assemblers, Loaders, Editors

Language translators and BIQS.

**Suggested Reading:**

**A. For Computer Organization**:

1. Morris Mano.M., *Computer System Architecture,.3rd* edition, PHI, 1994.

2. William Stallings., *Computer Organization and Architecture, Designing for Performance,* 6th edition, PHI,
2003.

3. Hamacher V.C., et al., *Computer Organization,* 5th edition, MGH, 2002.

4. Pal Choudhury P., *Computer Organization and Design,* PHI, 21.1 edition,1998.

5. Hennessy J & Patterson D., *Computer Architecture -A Quantitative Approach,* San Mates, 1990.

**B For Microprocessors :**

1. Gaonkar, R.S., *Microprocessors Architecture, Programming and Applications with* 8085 , Penram International, 2001.
2. M.Rafiquzzaman, *Microprocessors Theory and Applications (Intel and Motorola),* PHI, 2001.
3. Mathur, P., *Introduction to Microproce-ssors,* 3rd edition, TMGH, 1999.
4. Uffenbeck, J., *Micro Computer and Microprocessor* PHI, 2002.

**EC 304**

## ANALOG COMMUNICATIONS

| | |
|---|---|
| Instruction | 4 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 75 Marks |
| Sessional | 25 Marks |

**UNIT -I**

Review of Fourier Transforms, Hilbert transform, pre-envelope, canonical ) representation of band pass signals, band pass systems. Frequency translation 1 and need for modulation. Linear modulation: Generation and demodulation of AM..- DSB, DSB-SC, SSB and VSB. Frequency division multiplexing.

**UNIT-II**

Angle modulation: Frequency and Phase modulation, Narrow band and wide band FM, Transmission bandwidth of FM. Direct and indirect methods of FM signal generation. Demodulation of FM signals. Foster-Seely discriminator, ratio detector and PLL. Threshold effect in FM, Pre-emphasis and De-emphasis.

**UNIT- III**

Transmitters: Classification of transmitters, Block diagram and functions of radio transmitters for AM and FM systems.
Receivers: TRF and super heterodyne receiver RF, mixer and IF stages, Choice of IF, Image frequency. Tracking and alignment. AGC. Receiver characteristics & measurements. Fading and diversity reception. Special features of Communication Receivers.

**UNIT-IV**

Sources of noise, thermal noise and shot noise, noise in linear systems, equivalent noise, bandwidth, noise temperature and noise figure. SIN ratio calculations in AM, DSB-SC, SSB, FM & PM systems.

**UNIT-V**

Sampling process: Types of sampling, sampling theorem, sampling of band- pass signals, practical aspects of sampling, reconstruction of low pass and band pass signals. TDM. Pulse Modulation: PAM, PWM and PPM-generation and detection. SIN ratio in PAM, PWM and PPM.

**Suggested Reading :**

1. Simon Haykin, *Communication Systems,* 3rd edition, Wiley, 1995.
2. Taub and Shilling, *Principles of Communication Systems,* 2nd edition, TMH, 2003.
3. Kennedy, *Electronic Communications Systems.* 4th edition TMH,.
4. Carlson, A.B.; Rutledze.J. and Crilly.P. ; *Communication Systems,* 4th edition, TMH,2002.
5. Sam Shanmugam.K.; *Digital and Al1alog Communication Systems,* Wiley, 1998 ,

**Additional Reading :**

1. Schoenbeck, R.J., *Electronic Communications, Modulation and Transmission,* PHI, 2nd edition, 2002.
2. Roddy D. and Coolen.J., *Electronic Communications,* 41h edition, PHI, 2002.
3. Terman. F.E., *Electronic and Radio Engineering,* TMH.
4. Singh, R.P. and Sapre, S.D., *Communication Systems, Analog and Digital.* TMH,2002.
5. *Schweber. W* ; *Electronic Communication Systems,* PHI, 2002.
6. HSU. HWei P, *Analog and Digital Communications, Schaum's outline series,* TMH,2003.

**EC 305**

## AUTOMATIC CONTROL SYSTEMS

| | |
|---|---|
| Instruction | 4 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 75 Marks |
| Sessional | 25 Marks |

**UNIT-I**

Control System fundamentals and Components: 5 Classification of control systems, Open and closed loop systems, Control system components. Error sensing devices -potentiometers, syncros, AC & DC servo motors -Mathematical modeling of mechanical systems and their conversion into electrical systems. Block diagram representation. Signal flow graphs.

**UNIT – II**

Time response: Transfer function and Impulse response, types of input.. Transient response of second order system for step input. Time domain specifications. Types of systems, static error coefficients, error series, Routh -Hurwitz criterion for stability.

Root locus techniques: Analysis of typical systems using root locus techniques. Effect of location of roots on system response.

**UNIT- III**

Frequency response plots: Bode plots, frequency domain specifications. Gain margin and Phase Margin. Principle of argument, Nyquist criterion for stability. Compensation: Cascade and feedback compensation using Bode plots. Phase lag, lead, lag-Iead compensators. PID controller.

**UNIT -IV**

Discrete Control Analysis: Digital control, advantages and disadvantages and digital control system architecture. The discrete transfer function. Sampled data system. Transfer function of sample data systems.

**UNIT - V**

State Space Representation: Concept of state & state variables. State models of linear time invariant systems, State transition matrix, solution of state equations. Design of digital control systems using state-space concepts. Controllability and observability.

**Suggested Reading :**

1. Kuo, B.C., *Automatic Control Systems.* 7th edition PHI ,2003.
2. Ogata. K , *Modern Control Engineering,* 4th edition, PHI, 2003.
3. Nagrath.J & Gopal.M, *Control System Engineering,* Wiley Eastern, 1993.
4. Gopal M., *Digital Control and State Variable Methods,* 2nd edition, THM, 1997.
5. Bandyopadhyay, M.N.; *Control Engineering Theory and Practice,* PH12003.

**EC 306**

**ELECTRONIC MEASUREMENTS AND INSTRUMENTATION**

| | |
|---|---|
| Instruction | 4 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 75 Marks |
| Sessional | 25 Marks |

**UNIT-I**

Accuracy, Precision, Resolution and Sensitivity. Errors and their types: Absolute, 3 Relative, Gross, Systematic, Random, Probable and limiting error. 4 Standards of measurement, classification of standards, standards of temperature and luminous intensity. IEEE standards.

**UNIT - II**

Transducers: classification, factors for selection of a transducer, transducers 6 for measurement of velocity, acceleration, force, radio activity, Hot wire anemometer. Passive electrical transducers-Strain gauges and strain measurement, LVDT and displacement measurement, capacitive transducer and thickness measurement.
Active electrical transducers: Piezo electric, photo conductive, photo voltaic and photo emissive transducers.

**UNIT –III**

Characteristics of sound, pressure, power and loudness measurement. Microphones and their types. Temperature measurement, resistance wire thermometers, semiconductor thermometers and thermocouples. Humidity measurement, resistive, capacitive, aluminium oxide and crystal Hygrometer types. Magnetic tape recorders, direct recording, FM recording and digital recording.

**UNIT-IV**

Block diagram, specification and design considerations of different types of DVMs. Digital LCR meters, Distortion analyzers, spectrum analyzers. The IEEE 488 or GPIB Interface and protocol.

Delayed time.. base oscilloscope, sampling oscilloscope, digital storage oscilloscope, arid mixed signal oscilloscope.

**UNIT - V**

Bomedical Instrumentation: Human physiological systems and related concepts. o-potential electrodes Bio-potential recorders -ECG, EEG, EMG, X- ray machines and CT scanners, magnetic resonance and imaging. systems, Ultrasonic Imaging systems.

**Suggested Reading:**

1. Murthy D. V.S, *Transducers and Instrumentation,* PHI, 2003.
2. Nakra,B.C, and Chaudhry K.K., *Instrumentation, Measurement and Analysis,* TMH, 2004.
3. Khandpur. R.S., *Handbook of Bio-Medical Instrumentation,* TMH, 2003.
4. Helfric A. D, and Cooper W. D, *Modern Electronic Instrumentation and Measurement Techniques,* PHI, 1994.
5. Cromwell. L. el.al., *Biomedical Instrumentation and Measurements,* PHI, 2003.
6. Bell, D.A. *Electronic Instrumentation and Measurements,* PHI, 2nd edition, 2003.
7. Anand, M.M.S.; *Electronic Instruments and Instrumentation Technology,* PHI 2004.
8. Kalsi, H.S., *Electronic Instrumentation,* TMH, 1998

**EC 331**

**LINEAR AND DIGITAL INTEGRATED CIRCUITS LAB**

| | |
|---|---|
| Instruction | 3 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 50 Marks |
| Sessional | 25 Marks |

**Special note** :

i). Sessional marks are to be awarded as per the following breakup.

a) 15 marks for the regular lab exercises

b) 10 marks for the Mini Project-cum-design exercise(s)

ii). A total of not less than 15 experiments must be carried out during the semester. (Wherever possible more than I lab experiment should be carried out in one lab session of 3 periods per week).

**I. Regular Lab Experiments:**

**a) Linear ICs Using ma741 & MC1530, NE 531, Operational Amplifiers& Other ICs:**

1. Clipping and Clamping Circuits
2. Measurement of parameters of Op-Amps.
3. Op-Amp: Voltage follower, Inverting & Non Inverting Amplifiers, level translators.
4. Op-Amp: Arithmetic Circuits: Summer, Integrator Differentiator
5. Op-Amp Active filters: HP, LP, BP -Butterworth, Chebyschev.
6. Op-Amp Oscillators: RC phase shift, Wein bridge.
7. Op-Amp Oscillators: Regenerative: Astable, Monostable.
8. Op-Amp: Triangle and Square wave Generators.
9. Voltage Controlled Oscillators Using LM 566.
10. Phase locked loop and applications Using LM565.
11. IC Regulators and current boosting.

**b) Digital ICs Using standard TTL and CMOS IC building blocks:**

12. Measurement of propagation delay, fanout, Noise margin and Transfer characteristics of TTL and CMOS IC gates and open collector/drain gates.
13. Designing Code converters using Logic gates and standard code converters.
14. Flip- flop Conversions and latches using ICs
15. Designing Synchronous, Asynchronous Up/Down counters and shift registers; & ring counters using IC flip-flops & standard IC counters.
16. full adder/subtractor using logic gates and multiple bit IC Adder/subtractors and Arithmetic Circuits.
17. Multiplexer- Demultiplexer applications 18. *D/*A Conversion
19. TTL Characteristics
20. 555 Timer applications

Note: Minimum of 6 experiments may be conducted from each part - I & II

**II. Mini Project cum Design Exercise(s):**

13-15. The students should design and realize at least one mini- project using either linear and or digital ICs for given specifications. A report of the case study of the project is recommended.

**Example :**

Design and realize Crystal clock generator for given specifications of frequency, amplitude, duty-cycle, rise and fall times.

**General Note:**

(i) There should not be more than 2 students per batch while performing any of the regular lab experiments.

(ii) Mini Project cum design exercise(s):

(a) The student must design, rig-up, and test the circuits by carrying out the experiments

individually by placing the components on breadboard. The tested circuit should be soldered

on a general PCB.

(b) This exercise carry sessional marks of 10 out of 25 while the remaining 115 marks are for the

regular Lab experiments.

**EC 332**

**MICROPROCESSORS LAB**

| | |
|---|---|
| Instruction | 3 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 50 Marks |
| Sessional | 25 Marks |

**Special note** :

i) Sessional marks are to be awarded as per the following breakup.

a) 15 marks for the regular lab exercises
b) 10 marks for the Mini Project-cum-design exercise(s)

ii) A total of not less than 15 experiments must be carried out during the semester. (Wherever possible more than I lab experiment should be carried out in one lab session of 3 periods per week).

1.& 2. Use of 8085 -Instruction set for simple programs (using 4 to 15 Lines of instruction code) for data transfer, manipulation, Arithmetic operations, Branching operations, Logical operations and testing of "byte/bit patterns" in a given data.

3. Code Conversion.
4. Sorting and searching
5. Single byte, multi byte Binary and BCD addition and'subtraction.
6. Multiplication using repeated addition and shifting techniques.
7. Division using repeated subtraction and shifting techniques
8. Generation of wave forms using DAC interface.
9. ADC interface.
10. Programs using Interrupts
11. Real time clock for 12 hours. I

12,13. & 14. Interface applications using 8255 PPI, 8253 Timer such as traffic light control, 7- segment LED (Common Cathode/Common Anode) displays . & stepper motor Control.

15. Simple programs using monitor utilities ofmp kit for keyboard/displaying the results of a program and interrupting using the keyboard interface.

16. Study and making use of IBM PC with Assembler & Debugger for 8085 application.

17. Study of 8085 simulator and running 2 or 3 programs (as carried out in the above experiments)

**II. Mini Project cum Design Exercise**(s):

13-15. The students should design and realize at least one mini- project using 8085 microcomputer kit and

interface modules/add on modules and its assembly language for given specifications. A report of

the case study of the project is recommended.

**Eumple I:**

Program to synthesize a sine wave using lookup table with 360 digital , samples and to be able to vary its frequency in a given range. A DAC interface and a CRO may be used to observe the wave form and verify the results.

**Example 2:**

Program for generation of musical NOTES and to play it using an audio .amplifier and speaker.

**General Note**:

(iii) There should not be more than 2 students per batch while performing any of the lab experiments.

(iv) Mini Project cum design exercise(s):

a) The student must design, rig-up, and test the circuits where ever necessary by carrying out the

experiments individually by placing the components on a breadboard. The tested circuit should be

soldered on a general PCB and interfaced with the microcomputer kit.

b) This exercise carry sessiorial marks of 10 out of25 while the remaining 15 marks are for the regular Lab experiments.

c)

**Suggested Reading** :

1. L.A. Laventhal, 8085 *Assemb/y /anguage Programming* OSBORNE , publishers.

2. K.A.Krishna Murthy *Microprocessor /ab Primer* interline publishers.

**EC 333**

**COMMUNICATION ENGINEERING LAB**

| | |
|---|---|
| Instruction | 3 Periods per week |
| Duration of University Examination | 3 Hours |
| University Examination | 50 Marks |
| Sessional | 25 Marks |

**Special note** :

i. Sessional marks are to be awarded as per the following breakup.

a) 15 marks for the regular lab exercises

b) 10 marks for the Mini Project-cum-design exercise(s)

ii. A total of not less than 15 experiments must be carried out during the semester. (Wherever

possible more than I lab experiment should be carried out in one lab session of 3 periods per

week).

1. AM Generation & Detection
2. Balanced Modulator
3. FM Generation & Detection (using Function Generator & PLL chips)
4. Pre emphasis & De-emphasis circuits (active)
5. Radio Receiver Measurements: Sensitivity, Selectivity and Fidelity
6. Sampling PAM & reconstruction
7. PWM & PPM generation & Detection
8. Time Division Multiplexing and De-multiplexing
9. Frequency Division Multiplexing and De-multiplexing
10. PLL Characteristics
11. Spectrum Analysis by Spectrum analyzer of Video signal generated by
    a) TV demonstrator Kit
    b) Pattern Generator
12. Active Band-pass and Band-elimination Filters (using IC's)
13. AGC and AFC Circuits
14. Mixer Circuit

**II. Mini Project cum Design Exercise(s):**

13-15. The students should design and realize at least one mini- project/ using either linear and / or

digitallCs for given specifications. A report of the case study of the project is recommended.

**Example 1** : Design, implementation and testing of AM/FM transmitter/receiver. I
**Example 2** : Design, implementation and testing of PAM/PWM/PPM systems.

**General Note**:

*v)* There should not be more than 2 students per batch while performing any of the lab experiments.

*vi)* Mini Project cum design exercise(s):

a) The student must design, rig-up, and test the circuits wherever necessary by carrying out the experiments individually by placing the components on board. The tested circuit should be soldered on , a general PCB.

b) This exercise carry sessional marks of 10 out of25 while the remaining 15 marks are for the regular Lab experiments.