# C21_ CURRICULUM

# DIPLOMA IN ELECTRONICS AND COMMUNICATION ENGINEERING

**OFFERED BY**

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING,**

**TELANGANA: HYDERABAD**

## IV SEMESTER

| Sl No | Course Code | Course Name | Teaching Scheme | | | | Credits | Examination Scheme | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Instruction periods per week | | | Total Periods per semester | | Continuous internal evaluation | | | Semester end examination | | | |
| | | | L | T | P | | | Mid Sem 1 | Mid Sem 2 | Internal evaluation | Max Marks | Min Marks | Total Marks | Min marks for Passing including internal |
| 1 | SC-401 | Advanced Engineering Mathematics | 4 | 1 | 0 | 75 | 3 | 20 | 20 | 20 | 40 | 14 | 100 | 35 |
| 2 | EC-402 | Microcontroller Programming | 4 | 1 | 0 | 75 | 3 | 20 | 20 | 20 | 40 | 14 | 100 | 35 |
| 3 | EC-403 | Integrated Circuits & Thyristors | 4 | 1 | 0 | 75 | 3 | 20 | 20 | 20 | 40 | 14 | 100 | 35 |
| 4 | EC-404 | Microwave Communication and Television | 4 | 1 | 0 | 75 | 3 | 20 | 20 | 20 | 40 | 14 | 100 | 35 |
| 5 | EC-405 | Electronic Measuring Instruments | 4 | 1 | 0 | 75 | 3 | 20 | 20 | 20 | 40 | 14 | 100 | 35 |
| 6 | EC-406 | Linear Integrated Circuits Lab | 1 | 0 | 2 | 45 | 1.5 | 20 | 20 | 20 | 40 | 20 | 100 | 50 |
| 7 | EC-407 | Communication Lab | 1 | 0 | 2 | 45 | 1.5 | 20 | 20 | 20 | 40 | 20 | 100 | 50 |
| 8 | EC-408 | Microcontrollers Programming Lab | 1 | 0 | 2 | 45 | 1.5 | 20 | 20 | 20 | 40 | 20 | 100 | 50 |
| 9 | EC-409 | MATLab | 1 | 0 | 2 | 45 | 1.5 | 20 | 20 | 20 | 40 | 20 | 100 | 50 |
| 10 | HU-410 | Employability Skills Lab | 1 | 0 | 2 | 45 | 1.5 | 20 | 20 | 20 | 40 | 20 | 100 | 50 |
| 11 | EC-411 | Skill Upgradation | 0 | 0 | 8 | 120 | 2.5 | 0 | 0 | Rubrics | | | -- | - |
| | Activities: student performance is to be assessed through Rubrics | | | | | | | | | | | | | |

## SC-401 - ADVANCED ENGINEERING MATHEMATICS

| | | | |
|---|---|---|---|
| Course Title | Advanced Engineering Mathematics | Course Code | SC-401 |
| SEMESTER | IV | Course Group | Foundation |
| Teaching Scheme in periods ( L : T : P ) | 4:1:0 | Credits | 3 |
| Methodology | Lecture + Tutorial | Total Contact Periods | 75 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites:**

This course requires the knowledge of Engineering Mathematics at Diploma first year level and Applied Engineering Mathematics at Diploma 3rd Semester level.

**Course Outcomes:**

**At the end of the course, the student will have the ability to:**

| | |
|---|---|
| CO 1 | Solve simple Homogeneous Linear Differential Equations |
| CO 2 | Solve simple Non-Homogeneous Linear Differential Equations and apply them in solving engineering problems. |
| CO 3 | Express f(x) as a Fourier series in the given interval $(c\ ,\ c+2\pi)$ |
| CO 4 | Express f(x) as a Fourier Half-Range Cosine series and Sine series in (0, π) |
| CO 5 | Find Laplace transforms of simple functions. |
| CO 6 | Find Inverse Laplace transforms of simple functions and solve Linear Differential Equations using Laplace Transformations. |

**Course Contents:**

**Unit – I**

**Duration: 07 Periods (L: 5 – T: 2 )**

**Homogeneous Linear Differential equations with constant coefficients**

Homogenous linear differential equations with constant coefficients of order two and higher with emphasis on second order.

**Unit – II**

**Duration: 16 Periods (L: 13 – T: 3)**

**Non-Homogeneous Linear Differential equations with constant coefficients**

Non-homogenous linear differential equations with constant coefficients of the form (D)y = X, where X is in the form k(a constant ) $e^{ax}$, sin(ax), cos( ax), $x^n$, (n= 1,2,3) Complimentary Function (CF), Particular Integral (PI) and General Solution (GS).

**Unit-III**

**Duration: 14 Periods (L: 11 – T: 3)**

**Fourier series**

Orthogonality of trigonometric functions, Representation of a function in Fourier series over the interval $(c\ ,\ c+2\pi)$, Euler's formulae, sufficient conditions for existence of Fourier series for a function f(x). Even, Odd functions and Fourier series over the Interval (0, $2\pi$) and ($-\pi, \pi$)

**Unit – IV**

**Duration: 08 Periods (L: 7 – T:1 )**

**Fourier Half-range series**

Representation of a function f(x) as a Fourier Half-range Sine series and Cosine series over the interval (0, $\pi$)

**Unit – V**

**Duration: 14 Periods (L: 11 – T: 3)**

**Laplace Transformations:**

Definition, sufficient conditions for existence of Laplace Transform, Laplace Transform of elementary functions, linearity property, Change of scale property, First shifting theorem , multiplication by $t^n$, division by t, Laplace Transform of derivatives and integrals, unit step function, Laplace Transform of second shifting theorem

**Unit – VI**

**Duration: 16 Periods (L: 13 – T: 3)**

**Inverse Laplace transforms:**

Inverse Laplace transforms- shifting theorems and change of scale property, multiplication by $s^n$ and division by s –Inverse Laplace Transform using partial fractions – convolution theorem (no proof) – application of Laplace Transformations to solve ordinary differential equations of second order with initial conditions.

**Recommended Books:**


1. Higher Engineering Mathematics, B.S. Grewal.
2. Laplace Transforms - Murray R. Spigel.
3. Ordinary Differential Equations – R. S. Aggarwal.
4. Fourier Series – A.R. Vasishtha and Gupta.


**Suggested E-Learning references:**

1. www.freebookcentre.net/mathematics/introductory-mathematics-books.html
2. E-books:www.mathebook.net

**Suggested Learning Outcomes**

At the end of the course, the student will have the ability to:

**Unit-I**

**1.0 Solve Homogeneous linear differential equations with constant coefficients in engineering situations**

1.1 Solve Differential equations of the type $(aD^2 + bD + c)\ y = 0$ when the roots of the Auxiliary Equation (A.E) are real & different, real & repeated and complex.

1.2 Solve the higher order homogeneous linear differential equations with constant coefficients.

**Unit-II**

2.0 **Solve Non-Homogeneous linear differential equations with constant coefficients in engineering situations**

2.1 Apply the concept of complementary function, particular Integral to get general solution of a differential equation.

2.2 Solve $n^{th}$ order differential equation of the type $f(D)\ y = X$ where $f(D)$ is a polynomial of second order and $X$ is a function of the form k, $e^{ax}$ ,$Sin(ax)$, $Cos(ax)$, $x^n$.

2.3 Solve simple problems on the above types of 2.2

**Unit-III**

**3.0 Understand the Fourier series expansion of functions**

3.1 Know the orthogonality of functions in an interval.

3.2 Identify Fourier series of a function in the interval (C, C+$2\pi$) and use the Euler's Formulae for determining the Fourier coefficients.

3.3 Write sufficient conditions for the existence of Fourier series for a function.

3.4 Expand Fourier series of simple functions in the range (0, $2\pi$) and ($-\pi, \pi$).

3.5 Expand Fourier series for even and odd functions in the interval ($-\pi, \pi$)

3.6 Solve simple problems on even and odd functions in the interval. $(0,2\pi)$ $and$ $(-\pi, \pi)$

**Unit- IV**

**4.0 Understand the Half – Range Fourier series expansion of functions**

4.1 Expand Half – Range Cosine series of a function in the range $(0\ , \pi)$.

4.2 Expand Half – Range Sine series of a function in the range $(0\ , \pi)$.

4.3 Solve simple problems on Half – Range Cosine and Sine series over the interval $(0, \pi)$

**Unit-V**

**5.0 Understand Laplace transforms**

5.1 Apply the definition of Laplace Transform and find Laplace transform of standard functions

5.2 Identify the sufficient conditions for existence of Laplace Transform.

5.3 Use the properties of Laplace Transform – Linearity property, First shifting theorem, Change of Scale property in solving simple problems.

5.4 Apply formulae for Laplace transform of $t^n f(t)$ , $\frac{f(t)}{t}$ , $f^n(t)$ , $\int_0^t f(u)du$ in terms of Laplace transform of f (t) to solve simple problems

5.5 Identify unit step function and write the Laplace Transform of unit step function

5.6 Apply Second shifting theorem in solving simple problems.

**Unit-VI**

**6.0 Use Laplace transforms and Inverse Laplace transforms to solve differential equation in engineering problems**

6.1 Define inverse Laplace Transform and write inverse Laplace Transforms of standard functions.

6.2 Solve simple problems on Inverse Laplace Transforms.

6.3 Write Shifting theorems and Change of scale property of inverse Laplace Transform.

6.4 Solve simple problems on 6.2

6.5 Write inverse Laplace Transforms corresponding to Laplace Transform of the functions $t^n f(t), \frac{f(t)}{t}$ , $f^n(t)$ , $\int_0^t f(u)du$

6.6 Solve simple problems on 6.5

6.7 Define convolution of two functions and state convolution theorem.

6.8 Solve simple problems on Convolution theorem.

6.9 Use Laplace and inverse Laplace Transforms to solve simple differential equations of Second order.

**Suggested Student Activities:**

1. Student visits Library to refer Standard Books on Mathematics and collect related material.
2. Quiz
3. Group discussion
4. Surprise tests

5. Seminars
6. Home Assignments.
7. Mathematics for preparing competitive exams and solving old question papers on Arithmetical ability.

**CO-PO Mapping Matrix**

| CO | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | Mapped POs |
|---|---|---|---|---|---|---|---|---|
| CO1 | 3 | 2 | | | | | 3 | 1,2, 7 |
| CO2 | 3 | 2 | | | | | 3 | 1,2, 7 |
| CO3 | 3 | 2 | | | | | 3 | 1,2, 7 |
| CO4 | 3 | 2 | | | | | 3 | 1,2, 7 |
| CO5 | 3 | 2 | | | | | 3 | 1,2, 7 |
| CO6 | 3 | 2 | | | | | 3 | 1,2, 7 |

## QUESTION PAPER PATTERN FOR MID SEMESTER EXAMS

### MID SEM-I EXAM

| S.No | Unit No | R | U | A | Remarks |
|---|---|---|---|---|---|
| 1 | Unit-I | 1,2 | 5(a) | 7(a) | |
| | | | 5(b) | 7(b) | |
| 2 | Unit-II | 3,4 | 6(a) | 8(a) | |
| | | | 6(b) | 8(b) | |
| Total Questions | | 4 | 4 | 4 | |

### MID SEM-II EXAM

| S.No | Unit No | R | U | A | Remarks |
|---|---|---|---|---|---|
| 1 | Unit-III | 1,2 | 5(a) | 7(a) | |
| | | | 5(b) | 7(b) | |
| 2 | Unit-IV | 3,4 | 6(a) | 8(a) | |
| | | | 6(b) | 8(b) | |
| Total Questions | | 4 | 4 | 4 | |

The length of answer for each question framed in respect of Part-A, B&C shall not exceed ¼ of a page,1page and 2 pages respectively

<table>
<tr><td rowspan="2">Unit No</td><td colspan="4">Questions to be set for SEE</td></tr>
<tr><td colspan="3">R</td><td>U</td><td>A</td></tr>
<tr><td>I</td><td rowspan="6">Q4</td><td colspan="2" rowspan="2">Q1</td><td rowspan="2">Q9(a)</td><td rowspan="2">Q13(a)</td></tr>
<tr><td>II</td></tr>
<tr><td>III</td><td colspan="2" rowspan="2">Q2</td><td rowspan="2">Q10(a)</td><td rowspan="2">Q14(a)</td></tr>
<tr><td>IV</td></tr>
<tr><td>V</td><td rowspan="2">Q3</td><td>Q5,Q6</td><td>Q9(b),<br>Q11(a), Q11(b)</td><td>Q13(b),<br>Q15(a), Q15(b)</td></tr>
<tr><td>VI</td><td>Q7,Q8</td><td>Q10(b),<br>Q12(a), Q12(b)</td><td>Q14(b),<br>Q16(a), Q16(b)</td></tr>
<tr><td>Total Questions</td><td colspan="3">8</td><td>8</td><td>8</td></tr>
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**BOARD DIPLOMA EXAMINATIONS (C21)**
**MID SEM –I, IV SEMESTER**
**SC-401- ADVANCED ENGINEERING MATHEMATICS**

**TIME: 1: 00 Hour** **Max. Marks: 20**

## PART-A

Instructions: 1. Answer **ALL** questions 04 X 01 = 04
2 Each question carries **ONE** mark

1. Write the General solution of $(aD^2+bD+c)\ y = 0$, whose roots of auxiliary equation are real and distinct.
2. Find the roots of auxiliary equation of the differential equation $(D^2 + 2D + 1)y = 0$
3. Find the Particular Integral of $(D^2 - 4D + 1)y = e^{8x}$
4. Find the P.I of $(D^2 - 9)y = cos3x$

## PART-B

Instructions: 1. Answer **ALL** questions 02 X 03 = 06

2. Each question carries **THREE** marks

5 a) Solve $(D^2 + 4D + 13)\ y = 0$

OR

5 b) Solve $(D^2 +16)\ y = 0$

6 a) Solve $(D^2 + 4D + 4)y = 5 + e^{-2x}$

OR

6 b) Find P.I of $(D^3 + D)y$ = sin2x

## PART- C

Instructions: 1. Answer **ALL** questions 02 X 05 = 10

2. Each question carries **FIVE** marks

7 a) Solve $(D^3 – 2D^2 – 4D + 8)\ y = 0$

OR

7 b) Solve $(D^3 – 6D^2 +11\ D – 6)\ y = 0$

8 a) Solve $(D^2 + 36)y = sin^2x$

OR

8 b) Solve : $(D^2 - 3D + 2)y = x + x^2$

**BOARD DIPLOMA EXAMINATIONS (C21)**
**MID SEM –II, IV SEMESTER**
**SC-401- ADVANCED ENGINEERING MATHEMATICS**

**TIME: 1: 00 Hour** **Max. Marks: 20**

**PART-A**

Instructions: 1. Answer **ALL** questions 04 X 01 = 04

2 Each question carries **ONE** mark

1. Define periodic function and give one example
2. Define Fourier series of the function f(x) in the interval $(0, 2\pi)$
3. Write Half-range sine series of f(x) in the interval $(0,\pi)$
4. Find $a_0$ for f(x) $=e^x$ in $0< x < \pi$

**PART-B**

Instructions: 1. Answer **ALL** questions 02 X 03 = 06

2. Each question carries **THREE** marks

5 a) If f(x) = $x^2$ in $(0, 2\pi)$, then find the value of $a_n$ in Fourier series of f(x)

**OR**

5 b) If f(x) =$|x|$ in $(-\pi, \pi)$, then find the value of $a_1$ in Fourier series of f(x)

6 a).Find the value of $a_n$ in half-range Cosine series for the function f(x) = $e^x$ in $(0,\pi)$

**OR**

6 b) Obtain the Fourier Half – Range Sine series for f(x) = $(\pi - x) in the interval\ (0, \pi)$

**PART- C**

Instructions: 1. Answer **ALL** questions 02 X 05 = 10

2. Each question carries **FIVE** marks

7 a) Obtain the Fourier series for f(x) = x in the interval $0< x < 2\pi$

**OR**

7 b) Find the Fourier series for f(x) = $(x - x^2)$ in the interval $(-\pi, \pi)$. Hence show that

$$\frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} + \ldots\ldots\ldots + = \frac{\pi^2}{12}$$

8 a) Express f(x) = $\pi$ x – $x^2$ as a half-range Sine series in $(0,\pi)$

**OR**

8 b) Find the half –range cosine series for the function f(x) =$x^2$ in the interval $(0,\pi)$

**BOARD DIPLOMA EXAMINATION, (C-21)**
**IV SEMESTER END EXAMINATION**
**SC-401- ADVANCED ENGINEERING MATHEMATICS**

**Time: 2 hours** **[Total Marks: 40]**

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**PART-A**

Instructions: 1. Answer **ALL** questions 08 X 01 = 08

2 Each question carries **ONE** mark

1. Find the roots of auxiliary equation of the differential equation $(D^2 + 4D)y = 0$ .
2. Define Fourier Series for the function f(x) in the interval ( c, c+2$\pi$)
3. Find the Particular Integral of $(D^2 - 4D + 1)y = e^x$
4. Find $L(e^{2t} + Cos3t)$
5. Find $L(t + 5Cosht)$
6. State the First Shifting theorem of Laplace Transforms.
7. Find $L^{-1}\left(\frac{1}{s-3} + \frac{s}{s^2+4}\right)$
8. Find $L^{-1}\left(\frac{1}{2s+5}\right)$

**PART-B**

Instructions: 1. Answer **ALL** questions 04 X 03 = 12

2. Each question carries **THREE** marks

9a) Solve $(D^2+D + 1)\ y = 4e^{3x}$

OR

9 b) Find $L(tCos3t)$

10 a) Find Half Range Sine Series of f(x) = x in $(0\ ,\pi)$

OR

10 b) Find $L^{-1}\left(\frac{s+1}{s^2+6s-7}\right)$

11 a) If L{f(t)} = $\frac{20-4s}{s^2-4s+20}$, find L{f(3t)}

OR

11 b) Find $\int_0^\infty t.e^{-2t}Sin3tdt$ using Laplace Transform Technique

12 a) Show that $L^{-1}\left(\frac{1}{s(s^2+a^2)}\right) = \frac{1-\cos at}{a^2}$

OR

12 b) Find $L^{-1}\left(\frac{s}{(s+2)^2+4}\right)$

**PART- C**

Instructions: 1. Answer **ALL** questions 04 X 05 = 20

2. Each question carries **FIVE** marks

13 a) Solve: $(D^2 + D - 2)\, y = x + \sin x$

OR

13 b) Find $L[te^t sin3t]$

14 a) Expand $f(x) = x^2$ as a Fourier series in the interval $(-\pi, \pi)$

OR

14 b) Find $L^{-1}\left(\frac{s}{(s+1)^2(s^2+1)}\right)$

15 a) Find $L\left(\frac{Sin3t.Cost}{t}\right)$

OR

15 b) Evaluate $L\left\{\int_0^t \frac{\sin t}{t}\, dt\right\}$

16 a) Find $L^{-1}\left(\frac{1}{(s+1)(s+2)}\right)$ using Convolution theorem.

OR

16 b) Solve the differential equation $y'' - 2y' - 8y = \sin t$, when $y(0) = 3$, $y'(0) = 6$ by Laplace Transform method.

# EC-402 – MICROCONTROLLER PROGRAMMING

| Course Title | Microcontroller Programming | Course Code | EC-402 |
|---|---|---|---|
| Semester | IV | Course Group | Core |
| Teaching Scheme in Hrs(L:T:P) | 4:1:0 | Credits | 3 |
| Methodology | Lecture + Assignments | Total Contact Hours | 75 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites :**

This course requires the basic knowledge of digital electronics.

**Course Outcomes:** Upon completion of the course the student should be able to

| CO | Course Outcome | Linked POs | Periods |
|---|---|---|---|
| CO1 : | Analyze the architecture of 8051. | 1,2,3,4,6,7 | 16 |
| CO2 : | Compare the various low level and high level languages and interpret the addressing modes. | 1,2,3,4,6,7 | 10 |
| CO3: | Write simple programs using instructions of 8051. | 1,2,3,4,5,6,7 | 16 |
| CO4 : | Classify and know the working of hardware interfacing devices. | 1,2,3,4,5,6,7 | 10 |
| CO5 : | Analyze the need for programmable interfacing devices. | 1,2,3,4,5,6,7 | 12 |
| CO6 : | Make use of instructions to solve programs. | 1,2,3,4,6,7 | 11 |

**Course content:**

**UNIT 1**

**Architecture ofMicrocontroller8051**

**Duration: 16 Periods (L: 13– T:3)**

-Compare Microprocessors and Microcontrollers- applications of microcontrollers-INTEL microcontroller family chips.--features of various INTEL microcontroller family chips-Compare the various INTEL microcontroller families-features of Intel 8051 Micro Controller- multiplexing and de-multiplexing in 8051. Functional block diagram of 8051 microcontroller-function of each block- register structure of 8051- function of various special function registers-pin diagram of 8051 micro controller -purpose of each pin-internal memory Organization in 8051-interrupts in 8051.

**UNIT 2**

**Assembly language and addressing modes.**

**Duration: 10 Periods (L: 9– T:1)**

Define bit, nibble, byte and word related to microcontrollers- machine language, assembly language, and mnemonics- Differences between machine level and assembly level programming-Differences between low level and high level languages-need for assembly level programming-need for an instruction set-instruction format of 8051 -Classify the instruction set of 8051-one byte, two byte and three byte instructions of 8051-What is addressing mode with reference to microcontroller-various addressing modes of 8051-need for bit level addressing..

**UNIT 3**

**Instruction set of 8051.**

**Duration: 16 Periods (L: 12– T:4)**

**Explain the instruction set of 8051**

Function of data transfer instructions and the effect of flags- data transfer instructions with examples. Programs in mnemonics to illustrate the application of data copy instructions-function of arithmetic group of instructions and the effect of flags-arithmetic group of instructions with examples. Programs in mnemonics to illustrate the application of arithmetic instructions-function of logical instructions and the effect of flags-logical instructions with examples- programs in mnemonics to illustrate the application of logical instructions-function of branching instructions and the effect of flags-unconditional jump instructions-conditional jump instructions-bit manipulation or Boolean instructions.

**UNIT 4**

**Hardware Interfacing**

**Duration: 10 Periods (L: 8– T:2)**

**Classify and know the working of hardware interfacing devices.**

Interfacing and its need- Distinguish between input and output interfacing-interfacing of pushbutton switch to 8051- interfacing of LED to 8051-interfacing of seven segment display -assembly level program for the above- functions of pins of LCD-instruction command code for programming a LCD- interfacing of LCD to 8051-assembly language Program for interfacing LCD - key press and detect mechanism- interfacing of 4x4 matrix key board.

**UNIT 5**

**Programmable peripheral devices.**

**Duration: 12Periods (L: 9– T:3)**

**Analyze the need for programmable interfacing devices.**

Need for programmable peripheral devices- Classify various programmable interfacing devices- block diagram of PPI 8255- control word format of 8255- PIN diagram of 8255 and function of each PIN- need for DMA controller-block diagram of DMA controller 8257- PIN diagram of 8257 and function of each PIN- need for programmable communication interface-block diagram of serial communication interface 8251- PIN diagram of 8251 and function of each PIN- RS 232 standards-RS232 pin, DB25 and DB9 connectors.

**UNIT 6**

**8051ProgrammingConcepts**

**Duration: 11 Periods (L: 7– T:4)**

**Make use of instructions to solve programs.**

Various symbols used in drawing flow charts-flow charts for simple problems-flow chart illustrating counter technique--program using counter techniques-programs of instructions to perform single byte, double byte and multi byte addition and subtraction-subroutine and its advantages-operation of stack with PUSH & POP instructions- branching instructions related to subroutines-sequence of program when subroutine is called and executed-information exchange between the program counter and the stack and identification of stack pointer register when a subroutine is called-concept of nesting, multiple ending and common ending in subroutines- input/output, machine related statements in writing assembly language programs- debugging a program-important steps in writing and trouble shooting a simple program-principles of single step and break point debugging techniques-simple programs to setup time delay using counter & a single register-time delay in the program given the clock frequency.

**Suggested Learning Outcomes**

1.0 **Comprehend the architecture of Microcontroller8051**

1.1 Compare Microprocessors and Microcontrollers. List the applications of microcontrollers.

1.2 Compare the various INTEL microcontroller families.

1.3 State the features of Intel 8051 Micro Controller.

1.4 Explain multiplexing and de-multiplexing in8051.

1.5 Draw the functional block diagram of 8051microcontroller.

1.6 Explain the function of each block.

1.7 Draw the register structure of 8051andexplain.

1.8 Explain the function of various special function registers.

1.9 Draw the pin diagram of 8051 micro controller and specify the purpose of each pin.

1.10 Explain internal memory Organization in8051.

1.11 Explain interrupts in 8051.

**2.0 Understand the languages and addressing modes of 8051 microcontroller.**

2.1 Define bit, nibble, byte and word related to microcontrollers.

2.2 Define the terms machine language, assembly language, and mnemonics.

2.3 Write the differences between machine level and assembly level programming.

2.4 Write the differences between low level and high-level languages.

2.5 State the need for assembly level programming.

2.6 State the need for an instruction set.

2.7 Write the instruction format of 8051 & illustrate these terms by writing an instruction.

2.8 Classify the instruction set of8051.

2.9 Explain one byte, two byte and three-byte instructions of8051.

2.10 What is addressing mode with reference to microcontroller.

2.11 List the various addressing modes of 8051and Explain with examples.

2.12 State the need for bit level addressing.

**3.0 Understand the instruction set of 8051.**

3.1. Explain the function of data transfer instructions and the effect of flags.

3.2. Explain the data transfer instructions with examples.

3.3. Write programs in mnemonics to illustrate the application of data copy instructions.

3.4. Explain the function of arithmetic group of instructions and the effect of flags.

3.5. Explain the arithmetic group of instructions with examples.

3.6. Write programs in mnemonics to illustrate the application of arithmetic instructions.

3.7. Explain the function of logical instructions and the effect of flags.

3.8. Explain the logical instructions with examples.

3.9. Write programs in mnemonics to illustrate the application of logical instructions.

3.10. Explain the function of branching instructions and the effect of flags.

3.11. Explain unconditional jump instructions.

3.12. Explain conditional jump instructions

3.13. Explain bit manipulation or Boolean instructions.

## 4.0 **Hardware Interfacing**

4.1 What is interfacing and its need?

4.2 Distinguish between input and output interfacing.

4.3 Explain the interfacing of pushbutton switch to8051.

4.4 Explain the interfacing of LED to 8051.

4.5 Explain the interfacing of seven segment display.

4.6 Write the assembly level program for the above.

4.7 Explain the functions of pins of LCD.

4.8 List instruction command code for programming a LCD.

4.9 Explain interfacing of LCD to8051.

4.10 Explain key press and detect mechanism.

4.11 Explain interfacing of 4x4 matrix keyboards.

4.12 Explain assembly language Program for interfacing LCD

## 5.0 **Programmable peripheral devices.**

5.1 Explain the need for programmable peripheral devices.

5.2 Classify the various programmable interfacing devices.

5.3 Draw and explain the block diagram of PPI 8255.

5.4 Write the control word format of 8255.

5.5 Draw the PIN diagram of 8255 and explain the function of each PIN.

5.6 State the need for DMA controller.

5.7 Draw and explain the block diagram of DMA controller8257.

5.8 Draw the PIN diagram of 8257 and explain the function of each PIN.

5.9 State the need for programmable communication interface.

5.10 Draw and explain the block diagram of serial communication interface8251.

5.11 Draw the PIN diagram of 8251 and explain the function of each PIN.

5.12 Explain RS 232standards.

5.13 List RS232 pin, DB25 and DB9connectors.

5.14 Explain the need for MAX 232 and 233 IC's and their circuits used for interfacing.

6.0 **Comprehend 8051 Programming Concepts**

6.1 List the various symbols used in drawing flowcharts.

6.2 Draw flow charts for simple problems.

6.3 Draw a simple flow chart illustrating counter technique.

6.4 Write a program using counter techniques.

6.5 Write programs to perform single byte, double byte and multi byte addition and subtraction.

6.6 Define a subroutine and write its advantages.

6.7 Explain the operation of stack with PUSH & POP instructions.

6.8 Explain the branching instructions related to subroutines.

6.9 Explain the sequence of program execution when subroutine is called and executed.

6.10 Explain information exchange between the program counter and stack when a subroutine is called.

6.11 Illustrate the concept of nesting, multiple ending and common ending in subroutines.

6.12 Use input/output, machine related statements in writing assembly language programs.

6.13 Explain the term debugging a program.

6.14 List the important steps in writing and troubleshooting a simple program.

6.15 Explain the principles of single step and break point debugging techniques.

6.16 Write simple programs to setup time delay using counter & a single register.

6.17 Calculate the time delay in the program given the clock frequency.

**Recommended books**

1. The 8051 Micro controller and Embedded systems , by Muhammad Ali Mazidi, Janice Mazidi, Janice Gillispie Mazidi Pearson-Prentice hall publication
2. The 8051 Microcontroller By Kenneth J. Ayala -Thomson Delmar publications
3. Programming customizing the 8051 Microcontroller by Myke Predko,TMH
4. Introduction to microprocessors for engineers and scientists by by Ghosh & Sridhar, Prentice-Hall. 5.Microprocessors and Microcontrollers by N.Senthil Kumar, M. Saravanan, S. Jeevanathan, Oxford press.

**Suggested e-learning resources**

1. www.nptel.com
2. www.electronics4u.com

**CO/PO Mapping Matrix**

| Course Outcome | | CL | Linked PO | Teaching Periods |
|---|---|---|---|---|
| CO1 | Analyze the architecture of 8051. | U/A | 1,2,3,4,6,7 | 16 |
| CO2 | Compare the various languages and interpret the addressing modes. | R/U | 1,2,3,4,6,7 | 10 |
| CO3 | Explain the instruction set of 8051 and write simple programs. | R/U/A | 1,2,3,4,5,6,7 | 16 |
| CO4 | Classify and analyze the hardware interfacing devices. | R/U/A | 1,2,3,4,5,6,7 | 10 |
| CO5 | Analyze the need for programmable interfacing devices. | R/U | 1,2,3,4,5,6,7 | 12 |
| CO6 | Make use of instructions to solve programs. | R/U/A | 1,2,3,4,6,7 | 11 |

## MID SEM EXAMINATIONS

| S.No | Unit Name | MID SEM-I EXAM | | | |
|---|---|---|---|---|---|
| | | R | U | A | Remarks |
| 1 | Unit-I | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-II | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| | Total Questions | 4 | 4 | 4 | |
| **S.No** | **Unit Name** | **MID SEM-II EXAM** | | | |
| | | R | U | A | Remarks |
| 1 | Unit-III | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-IV | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| Total Questions | | 4 | 4 | 4 | |

## SEMESTER END EXAMINATIONS

| Sl No | Unit No. | Questions to be set for SEE | | | | Remarks |
|---|---|---|---|---|---|---|
| | | R(1 Mark) | | U(3 Marks) | A(5 Marks) | |
| 1 | I | 4 | 1 | 9(a) | 13(a) | |
| 2 | II | | | | | |
| 3 | III | | 2 | 10(a) | 14(a) | |
| 4 | IV | | | | | |
| 5 | V | | 3 | 9(b) | 13(b) | |
| | | | 5, 6 | 11(a) | 15(a) | |
| | | | | 11(b) | 15(b) | |
| 6 | VI | | 7,8 | 10(b) | 14(b) | |
| | | | | 12(a) | 16(a) | |
| | | | | 12(b) | 16(b) | |
| Total Questions | | 8 | | 8 | 8 | |

**BOARD DIPLOMA EXAMINATION,**

**EC-402 MICROCONTROLLER PROGRAMMING**

**MODEL PAPER**

**MID- SEM I**

**TIME :1HOUR** **MAX. MARKS :20**

**PART-A**

Answer ALL questions. 4 x 1= 4M

1. List any 2 applications of microcontrollers.

2. List the interrupts of 8051microcontroller.

3. Define bit and nibble related to microcontrollers.

4. Write the instruction format of8051.

**PART – B**

Answer ALL questions. 2 x 3 = 6M

5(a) State the features of 8051 microcontroller.

**OR**

5(b) List any 6 SFR's and their functions.

6(a) Write the difference between machine level and assembly level programming.

**OR**

6(b) Classify the instruction set of 8051.

**PART – C**

Answer ALL questions. 2 x 5 = 10M

7(a) Draw the register structure of 8051 and explain.

**OR**

7(b) Draw the PIN diagram of 8051 and explain the function of each PIN.

8(a) Explain one byte, two byte and three byte instructions with example for each.

OR

8(b) Explain the addressing modes of 8051 microcontroller with an example for each.

**BOARD DIPLOMA EXAMINATION,**

**EC-402 - MICROCONTROLLER PROGRAMMING**

**MODEL PAPER**

**MID- SEM II**

**TIME :1HOUR** **MAX. MARKS :20**

## PART-A

Answer ALL questions.

4 x 1= 4M

1. Write the function of the instruction MOV @R0,A.
2. Write the number of bytes and the type of addressing mode for the instruction MOV DPTR, #6500H.
3. What is interfacing?
4. List any 2 input devices and 2 output devices.

## PART – B

Answer ALL questions.

2 x 3 = 6M

5(a) Write an assembly language program to add the numbers 3Ah and 19H.

OR

5(b) Write an assembly language program to multiply two binary numbers.

6(a) Explain the interfacing of pushbutton switch to 8051.

OR

6(b) Write functions of pins of LCD.

## PART – C

Answer ALL questions. 2 x 5 = 10M

7(a) Write an assembly language program to load numbers into registers R1 and R2 using indirect addressing mode, then exchange the data between them.

OR

7(b) Write any 5 arithmetic group of instructions and explain them with an example for each

8(a) Explain the interfacing of seven segment LED display to 8051.

**OR**

8(b) Explain the interfacing of LCD display to 8051.

**BOARD DIPLOMA**

**EXAMINATION,**

**EC-402 - MICROCONTROLLER PROGRAMMING**

**MODEL PAPER**

**SEMESTER END EXAMINATION**

**TIME : 2HOUR**
**MAX. MARKS :40**

PART-A

Answer ALL questions. 8 x 1= 8M

1. Define machine language and mnemonics.

2. Define interfacing.

3. List any 2 pins of DB 9connector.

4. What is the need for programmable peripheral devices?

5. Write the function of IC's 8255 and8257.

6. What is control word with reference to8255.

7. List any 4 flow chart symbols.

8. Define a subroutine.

**PART – B**

**Answer ALL questions. 4 x 3 = 12M**

9(a) List the interrupts of 8051 and write their vector addresses and order of priority.

**OR**

9(b) Write the control word format of 8051.

10(a) Write an assembly language program to rotate a number in register R4 twice towards left with carry.

**OR**

10(b) Explain the operation of stack with

PUSH and POP instructions. 11(a) Draw the

PIN diagram of 8257.

**OR**

11(b) Explain the standards of RS – 232.

12(a) Explain the term debugging.

**OR**

12(b) Write an assembly language program to generate a time delay of 10 microseconds using a register and operating with a clock frequency of 10MHz.

**PART – C**

**Answer ALL questions.** **4 x 5 = 20 M**

13(a) Draw and explain the functional block diagram of 8051.

**O**
**R**

13(b) Draw and explain the block diagram of 8251.

14(a) Explain the key press and key detect mechanism.

OR

14(b) Explain the sequence of program execution when a subroutine is called and executed.

15(a) Draw and explain the block diagram of 8255.

**O**
**R**

15(b) Explain MAX 232 and MAX 233 IC with necessary diagrams.

16(a) Write an assembly language program to transfer a block of 5 numbers stored in i-RAM locations from 10H onwards to off-chip RAM locations from 6400H onwards.

**O**
**R**

16(b) Write an assembly language program to add a block of 5 numbers stored in i-RAM locations from 10H onwards. Store the sum onto off-chip RAM locations from 6400H and

# EC-403 - INTEGRATED CIRCUITS & THYRISTORS

| | | | |
|---|---|---|---|
| Course Title | Integrated Circuits & Thyristors | Course Code | EC-403 |
| Semester | IV | Course Group | Core |
| Teaching Scheme in Periods(L:T:P) | 4:1:0 | Credits | 3 |
| Methodology | Lecture + Assignments | Total Contact Hours | 75 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites :**

This course requires the basic knowledge of Basic Physics and Mathematics at Secondary school level ,and basics of electrical and electronics

**Course Outcomes:**

Upon completion of the course, the student should be able to

| Course Outcome | Linked POs | Periods | |
|---|---|---|---|
| CO1 | Compare different IC fabrication techniques | 1,2,10 | 10 |
| CO2 | Construct basic application circuits using op-amp | 1,2,9 | 12 |
| CO3 | Construct oscillators and multi-vibrators using Op-amp | 1,2,5,7 | 16 |
| CO4 | Develop Timers and PLL using Op-amp | 1,2,5 | 12 |
| CO5 | Compare various power electronic device characteristics; identify their Application | 1,2,5 | 15 |
| CO6 | Identify the use of thyristors as choppers, rectifiers | 1,2,3,7 | 10 |

**Course contents**

**UNIT1- IC Manufacturing:**

**Duration: 10Periods (L: 8– T:2)**

Merits and de-merits of Integrated Circuits-Classification of ICs based on manufacturing process (monolithic, thin film, thick film and hybrid)- Manufacturing process of monolithic ICs- fabrication of resistor, and capacitor on monolithic IC- Fabrication of diode and transistor on monolithic IC- different IC packages- - Power rating of above packages- Various levels of integration (SSI, MSI, LSI, VLSI etc.,)- Surface Mount Technology (SMT)- Merits of SMT Technology

**UNIT 2 –Op-amp applications**

**Duration: 12 Periods (L: 9– T:3)**

Inverting amplifier configuration of Op Amp- input and output waveforms- Equation for voltage gain- Effect of feedback on input impedance and Bandwidth for inverting amplifier configuration- Non Inverting amplifier configuration of Op Amp- formula for Voltage gain- Effect of feedback on input impedance and Bandwidth- For Non inverting amplifier configuration. Use of operational amplifier as i) inverter , ii) Voltage Buffer iii) Summing Amplifier iv)Scale changer v) Integrator vi) Differentiator- Reasons for not implementing differentiator circuit in high frequency applications-*Voltage to current* converter circuit- applications of *Voltage to current* converter- *Current to Voltage* converter circuit - *Current to Voltage* converter circuit - Applications of *Current to Voltage* converter-Active and Passive filters- Op amp Active low pass filter with circuit diagram of first order- Frequency response - Op amp Active high pass filter of first order- Frequency response of the above circuit- Merits of active filters

**UNIT -3: Oscillators and Multi- vibrators using Op-amp**

**Duration: 16Periods (L: 13– T:3)**

OP-Amp Wein-bridge Oscillator circuit- - Output waveform - Conditions required for stable operation - RC Phase shift oscillator using OP Amp - conditions for stable operation - Classification of Multi vibrators- OP-Amp Bistable multi vibrator - OP-Amp Bistable multi vibrator- output waveforms- OP-Amp Monostable multi vibrator with waveforms- Astable multi vibrator using OP-Amp- OP-Amp based Astable multi vibrator- waveforms- applications of multi vibrators- OP-Amp Schmitt trigger circuit- fundamental consideration of sweep waveform- Hysteresis of Schmitt trigger circuit.

**Unit 4- Timers and PLL**

**Duration: 12 Periods (L: 9– T:3)**

Block diagram of 555 IC - Astable multi using 555 IC- Monostable Multi vibrator using 555 IC.- Phase locked loops - Block diagram of PLL – LM565- operation of VCO (LM566)- Lock range of PLL- Capture range of PLL-Give design rules(Formulas) for implementing PLL circuit - Applications of PLL.

**Unit-5-Thyristors**

**Duration:15 Periods (L: 12– T:3)**

Different thyristor family devices- circuit symbols - Constructional details of SCR- Working of SCR using two Transistor analogy- Volt-Ampere characteristics of SCR- Ratings of SCR- forward break over voltage, latching current, holding current, turn on triggering time, turn off time of SCR- volt-ampere characteristics of Diac&Triac under forward/Reverse bias- Compare SUS, SBS, SCS & LASCR- SCR circuit triggering by UJT - input and Output waveforms- Volt-ampere characteristics of Diac - Volt-ampere characteristics of Triac- Phase

control circuit using Diac and Triac for AC power control- input and output waveforms. Need for protection of power devices- Important specifications of power electronic devices from Manufacturer's data sheet - Important applications of power electronic devices

**Unit-6-Applications of thyristors as choppers and rectifiers.**

**Duration:10 Periods (L: 8– T:2)**

Need for a chopper- types of choppers- principle of operation of choppers-need for a controlled rectifier- single phase half-wave controlled rectifier- single phase full -wave controlled rectifier- 3-phase half-wave controlled rectifier- 3- phase full -wave controlled rectifier

**Suggested Learning Outcomes :**

After completing this course the student will be able to

**1.0 Explain the IC manufacturing methods**

1.1. List the advantages and disadvantages of Integrated Circuits over discrete assembly.

1.2. Classify ICs based on fabrication techniques (monolithic, thin film, thick film and hybrid).

1.3. Compare the different types of above fabrication techniques

1.4. Explain the manufacturing process of monolithic ICs.

1.5. Explain the fabrication of resistor, and capacitor on monolithic IC.

1.6. Explain the fabrication of diode and transistor on monolithic IC.

1.7. List different IC packages.

1.8. Draw the sketch of above package types

1.9. Mention the power rating of above packages.

1.10. Explain various levels of integration (SSI, MSI, LSI, VLSI etc.,).

1.11. Explain the Surface Mount Technology (SMT)

1.12. List 6 merits of SMT Technology.

**2.0 Operational amplifier applications using negative feedback**

2.1 Explain the Inverting amplifier configuration of Op Amp with input and output waveforms.

2.2 Derive the equation for voltage gain of an inverting amplifier

2.3 Explain the concept of virtual ground and Virtual short

2.4 Derive the equation for voltage gain of an inverting amplifier

2.5 Explain the Non Inverting amplifier configuration of Op Amp

2.6 Derive the formula for Voltage gain of above

2.7 Explain the use of operational amplifier as i) inverter , ii) Buffer ii) Summing Amplifier iv)Scale changer v) Integrator vi) Differentiator

2.8 Mention the reasons for not implementing differentiator circuit in high frequency applications

2.9 Draw the Voltage to current converter circuit

2.10 Explain the operation of above circuit

2.11 List 3 applications of Voltage to current converter

2.12 Draw the Current to Voltage converter circuit

2.13 Explain the operation of Current to Voltage converter circuit

2.14 List 3 applications of Current to Voltage converter

2.15 Distinguish between Active and Passive filters

2.16 Explain the working of Op amp Active low pass filter with circuit diagram of first order

2.17 Draw the frequency response of the above circuit

2.18 Explain the working of Op amp Active high pass filter with circuit diagram of first order

2.19 Draw the frequency response of the above circuit

2.20 Mention the merits of active filters

**3.0 Explain the working of Oscillators and Multi- vibrators using Op-amp**

3.1 Explain Wien-bridge Sine wave Oscillator circuit using an OP-Amp

3.2 Mention the reason for using non linear element in the feedback circuit.

3.3 State the conditions required for stable operation and frequency of oscillation of above circuit

3.4 Explain RC Phase shift oscillator circuit using OP Amp

3.5 Mention the conditions and frequency of oscillation for stable operation of the above circuit

3.6 Explain Gain Bandwidth product of Op-Amp

3.7 Classify Multi vibrators.

3.8 Draw and explain the operation of transistor Astable multivibrator.

3.9 Draw OP-Amp Bistable multi vibrator

3.10 Explain the working of OP-Amp Bistable multi vibrator with output waveforms.

3.11 Draw and explain the working of OP-Amp Monostable multivibrator with waveforms.

3.12 Draw the circuit of Astable multi vibrator using OP-Amp.

3.13 Explain the working of OP-Amp based Astable multi vibrator with output waveforms.

3.14 List 6 applications of multivibrators

3.15 Draw OP-Amp Schmitt trigger circuit.

3.16 Explain the working of OP-Amp Schmitt trigger circuit.

**4.0 Explain the working of Timers and PLL**

4.1 Draw the block diagram of 555 IC and explain.

4.2 Explain the working of astable multi using 555 IC.

4.3 Explain the working of Monostable Multivibrator using 555 IC.

4.4 Explain the concept of Phase locked loops

4.5 Draw and explain the block diagram of PLL – LM565.

4.6 Explain the operation VCO (LM566)

4.7 Define lock range of PLL

4.8 Define capture range of PLL.

4.9 Give design rules(Formulas) for implementing PLL circuit

4.10 List the applications of PLL.

4.11 Explain use of PLL as frequency multiplier.

**5.0 Understand the working of Thyristors.**

5.1. List different thyristor family devices.

5.2. Sketch the circuit symbols for each device.

5.3. Explain constructional details of SCR.

5.4. Explain the working of SCR using two Transistor analogy.

5.5. Explain the Volt-Ampere characteristics of SCR.

5.6. Mention the important ratings of SCR.

5.7. Define forward break over voltage, latching current, holding current, turn on triggering time, turn off time of SCR.

5.8. Distinguish between SUS, SBS, SCS & LASCR

5.9. Explain SCR circuit triggering by UJT with a circuit diagram andDraw input and Output waveforms.

5.10. Mention the use of SCR in single phase and three phase Power rectifiers.

5.11. Explain the working and Volt-ampere characteristics of Diac

5.12. Explain the working and Volt-ampere characteristics of Triac.

5.13. Explain the Phase control circuit using Diac and Triac for AC power control and Draw the input and output waveforms.

5.14. Give important specifications of power electronic devices from Manufacturer's data sheet.

5.15. List the six important applications of power electronic devices.

**6.0 Understand the applications of Thyristors as Choppers and Rectifiers.**

6.1 Define choppers.

6.2 What is the need for a chopper?

6.3 List the types of choppers.

6.4 Explain the principle of operation of choppers.

6.5 What is the need for a controlled rectifier?

6.6 Draw and explain the principle of operation of single phase half-wave controlled rectifier.

6.7 Draw and explain the principle of operation of single phase full -wave controlled rectifier.

6.8 Draw and explain the principle of operation of 3-phase half-wave controlled rectifier.

6.9 Draw and explain the principle of operation of 3- phase full -wave controlled rectifier

**Recommended Books:**


1. Electronic Devices and Circuits – T.F. Bogart Jr., J.S.Beasley and G.Rico, Pearson Education,6th edition, 2004.
2. Linear Integrated circuits – D.Roychoudhury&Shail.B. Jain – New age International Publishers – II Edition –2004.
3. Op-amps and linear integrated circuits, Ramakanth A. Gayakwad, ISBN-9780132808682
4. Principles of Electronics, Rohit Mehta and V K Mehta, S. Chand and Company Publishing, ISBN-9788121924504
5. Electronic Devices and Circuits, David A. Bell, Oxford University Press,
6. Power Electronics by P.C.Sen Tata McGraw-Hill Education

7. Industrial Electronics and Control by S.K.Bhattacharya, S.Chatterjee TTTI Chandigarh – TES
8. Industrial And Power Electronics (Paperback) By: G. K. Mithal (Author) | Khanna Publishers

**Suggested E-Learning references**

1. http://electrical4u.com/
2. www.electronics-tutorials.ws
3. www.nptel.ac.in

**CO/PO Mapping Matrix:**

| Course Outcome | | CL | Linked PO | Periods |
|---|---|---|---|---|
| CO1 | Compare different IC fabrication techniques | R/U | 1,2,10 | 10 |
| CO2 | Familiarize operational amplifier and its characteristics | R/U/A | 1,2,5,6,7 | 12 |
| CO3 | Construct basic application circuits using op- amp | R/U/A | 1,2,9 | 16 |
| CO4 | Construct oscillators and multi-vibrators using Op-amp | R/U/A | 1,2,5,7 | 12 |
| CO5 | Compare various power electronic device characteristics; identify their Applications | R/U/A | 1,2,5 | 15 |
| CO6 | Identify the use of thyristors as choppers, rectifiers | R/U/A | 1,2,3,7 | 10 |

| S.No | Unit Name | MID SEM-I EXAM | | | |
|---|---|---|---|---|---|
| | | R | U | A | Remarks |
| 1 | Unit-I | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-II | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| | Total Questions | 4 | 4 | 4 | |
| **S.No** | **Unit Name** | **MID SEM-II EXAM** | | | |
| | | R | U | A | Remarks |
| 1 | Unit-III | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-IV | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| Total Questions | | 4 | 4 | 4 | |

**SEMISTER END EXAMINATIONS**

| Sl No | Unit No. | Questions to be set for SEE | | | | | Remarks |
|---|---|---|---|---|---|---|---|
| | | R(1 Mark) | | | U(3 Marks) | A(5 Marks) | |
| 1 | I | 4 | 1 | | 9(a) | 13(a) | |
| 2 | II | | | | | | |
| 3 | III | | 2 | | 10(a) | 14(a) | |
| 4 | IV | | | | | | |
| 5 | V | | 3 | 5, 6 | 9(b) | 13(b) | |
| | | | | | 11(a) | 15(a) | |
| | | | | | 11(b) | 15(b) | |
| 6 | VI | | | 7,8 | 10(b) | 14(b) | |
| | | | | | 12(a) | 16(a) | |
| | | | | | 12(b) | 16(b) | |
| Total Questions | | 8 | | | 8 | 8 | |

**BOARD DIPLOMA EXAMINATION, (C-21)**
**EC-403 INTEGRATED CIRCUITS & THYRISTORS**
**MODEL PAPER**
**MID- SEM I**

**TIME : 1 HOUR** **MAX. MARKS : 20**

## PART-A

**Answer All questions. Each carries 1 mark.** **4X1=4 Marks**

1. List different IC packages?
2. List merits of SMT technology?
3. List the important characteristics of ideal operational amplifier?
4. Define the common mode gain?

## PART-B

**Answer ALL questions. Each carries 3 marks.**

**2X3=6 Marks**

5.a Explain manufacturing process of monolithic IC?

(OR)

5.b Explain the fabrication process of diode on monolithic IC?

6.a Draw the pin diagram of IC741 and mention the function of each pin?

(OR)

6.b List important features of ICs CA 3011 and LM 324?

## PART-C

**Answer ALL questions. Each carries 5 marks.**

**2X5 =10 Marks**

7.a Explain the Surface Mount Technology (SMT)?

(OR)

7.b Explain fabrication of a transistor on monolithic IC?

8.a Define Slew rate and CMRR of operational amplifier? Explain their importance in the operation of operational amplifier?

(OR)

8.b Explain power supply requirements of Operational Amplifier?

**BOARD DIPLOMA EXAMINATION, (C-21)**
**EC-403 INTEGRATED CIRCUITS & THYRISTORS**
**MODEL PAPER**
**MID- SEM II**

**TIME : 1 HOUR** **MAX. MARKS : 20**

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**PART-A**

**Answer <u>All</u> questions. Each carries 1 marks.** **4X1=4 Marks**

1. List the applications of Voltage to Current converter?
2. List the merits of active filters?
3. Classify Multi-vibrators?
4. List the applications of Multi-vibrators?

**PART-B**

**Answer ALL questions. Each carries 3 marks.**

**2X3=6 Marks**

5.a. Give the reason for using non-linear element in the feedback circuit of Wien-bridge oscillator?

(OR)

5.b. Give the conditions for stable operation of RC – Phase shift oscillator?

6.a Explain Gain-Bandwidth product of Op-amp?

(OR)

6.b Explain RC phase shift oscillator circuit using Op-amp?

**PART-C**

**Answer ALL questions. Each carries 5 marks.**

**2X5 =10Marks**

7.a Draw and explain the working of first order active low pass filter using op-amp?

(OR)

7.b Draw and explain the Non-inverting amplifier configuration of op-amp and derive the expression for voltagegain?

8.a Draw and explain the working of Bi-stable multi-vibrator using Op-amp?

(OR)

8.b Draw and explain the chmitt-Trigger circuit using Op-amp?

**BOARD DIPLOMA EXAMINATION, (C-21)**
**EC-403 INTEGRATED CIRCUITS & THYRISTORS**
**MODEL PAPER**
**SEMESTER END EXAMINATION**

**TIME : 2 HOUR** **MAX. MARKS : 40**

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**PART-A**

**Answer <u>All</u> questions. Each carries 1 mark.** **8X1=8 Marks**

1. Draw the Summing amplifier circuit using Op-amp?
2. Define lock range and capture range of PLL?
3. L ist different applications of PLL
4. List different ic packages
5. Define *forward break over voltage*
6. Define *latching current*
7. Define choppers
8. List the types of choppers

**PART-B**

**Answer ALL questions. Each carries 3 Marks.**

**4X3=12Marks**

9.a Draw the block diagram of operational amplifier?.

(OR)

9.b Mention the important ratings of SCR

10.a Mention the reasons for not implementing differentiator circuit in High Frequency applications?

(OR)

10.b What is the need for a controlled rectifier?

11.a Distinguish between SUS, SBS, SCS & LASCR

(OR)

11.b Mention the use of SCR in single phase Power rectifiers

12.a What is the need for a chopper?(OR)

12.b What is the need for a controlled rectifier?

**PART-C**

**Answer ALL questions. Each carries 5 Marks.**

**4X5=20Marks**

13.a Define Slew rate and CMRR of operational amplifier? Explain their importance in the operation of operational amplifier?

(OR)

13.b Explain constructional details of SCR.

14.a For the subtractor circuit using an op-amp input voltages are V1=5V and V2=2V and R1=10K andR2=20k respectively. Calculate the output voltage.

(OR)

14.b Explain the principle of operation of choppers.

15.a Explain the Volt-Ampere characteristics of SCR

(OR)

15.b Explain the working and Volt-ampere characteristics of Diac

16.a Draw and explain the principle of operation of single phase half-wave controlled rectifier.

(OR)

16.b Draw and explain the principle of operation of 3- phase full -wave controlled rectifier

## EC-404 - MICROWAVE COMMUNICATION AND TELEVISION

| | | | |
|---|---|---|---|
| Course Title | Microwave Communication and Television | Course Code | EC-404 |
| Semester | IV | Course Group | Core |
| Teaching Scheme in Hrs(L:T:P) | 4:1:0 | Credits | 3 |
| Methodology | Lecture + Assignments | Total Contact Hours | 75 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites:**

This course requires the basic knowledge of networks analysis, electronic circuits and Analog Communication.

**Course Outcomes:**

Upon completion of the course, the student should be able to

| CO | Course Outcome | Linked PO | Periods |
|---|---|---|---|
| CO1 | Comprehend Basic Concepts of transmission lines and waveguides. | 1,2,3,4,5,6,7 | 13 |
| CO2 | Explain working of microwave tubes and semiconductor devices. | 1,2,3,4,5,6,7 | 12 |
| CO3 | Explain the principle of radar systems. | 1,2,3,4,5,6,7 | 13 |
| CO4 | Understand the working of satellite communication | 1,2,3,4,5,6,7 | 12 |
| CO5 | Comprehend TV Picture & Composite video signal | 1,2,3,4,5,6,7 | 13 |
| CO6 | Understand the basics of Colour Television and digital TV. | 1,2,3,4,5,6,7 | 12 |

**Course Contents:**

**UNIT1- Basic Concepts of transmission lines and wave guides**

**Duration: 13 Periods (L: 10–T:3)**

Transmission Lines- types and Electrical equivalent circuit- Primary and Secondary constants - group and phase velocities - types of distortions- Reflection coefficient and SWR-relation -equation for input impedance of a transmission line terminated with load $Z_L$- various bands in microwave frequency range- dominant mode and cut-off wavelength in rectangular waveguide-cut-off frequency, cut-off wavelength, guide wavelength, phase velocity, group velocity and characteristic impedance in rectangular waveguide- need for microwave bends, corners and twists- different T-Junctions-- need for isolators and circulators-

**UNIT -2: Working of microwave tubes and semiconductor devices.**

**Duration: 12 Periods (L: 10- T:2)**

types- working and applications of Multi cavity Klystron amplifier- working of Reflex Klystron oscillator - applications of various microwave tubes such as Klystron and magnetron- working of TWT and its applications- need for microwave semiconductor devices-distinguish between ordinary semiconductor devices and microwave semiconductor devices- Gunn Effect- applications of GUNN diode-

**UNIT – 3:**

**Duration: 13 Periods (L: 11–T:2**)

basic Radar range equation- range performance factors from range equation- block diagram of pulsed Radar system- need for duplexer in Radar- working of branch type Duplexer with sketch- types of indicators used in radar systems- disadvantages of pulsed radar- principle of CW radar- block diagram of CW radar- limitations of a CW Radar- block diagram of MTI Radar-applications of various Radar systems

**UNIT-4: Working of Satellite Communication**

**Duration: 12 Periods (L: 10–T:2)**

Uses of microwave links- fixed microwave link with block diagram-need for satellite communication-

Classify satellites- advantages of satellite communication over terrestrial radio communication- features of satellites in LEO,MEO,GEO - applications of satellites - azimuth and elevation with reference to satellites--terms apogee and perigee- uplink frequency and down link frequency- block diagram of communication satellite-functions of

a transponder- types transponders used in satellites (single conversion, double conversion and regenerative)- working of the three types of transponders- block diagram of Earth station

**UNIT- 5: TV Picture & Composite video signal**

**Duration: 13 Periods (L: 9–T:4)**

Formation of picture- need for horizontal and vertical scanning- frame and field frequencies- need for vertical synchronization, horizontal synchronization and blanking pulses- Important standards of T.V. transmissions as per C.C.I.R- different types of scanning- Distinguish between progressive and interlaced scanning- standard scanning pattern in an interlaced scanning - need for interlaced scanning with reference to Bandwidth- different pulses in a composite video signal- positive and negative modulation-compare- composite video signal as per I.S.I. specification- need for front porch and back porch in blanking pulses- necessity of equalizing pulses and serrated vertical blanking pulses.

**Unit-6: Understand the basics of Colour Television and digital TV.**

**Duration: 12 Periods (L: 10–T:2)**

Main characteristic of human eye with regard to perception of colours-additive and subtractive mixing of colours- complementary colours, hue, saturation, and Colour circle- compatibility and reverse compatibility in TV system- three standards of Colour transmission system NTSC, PAL and SECAM- chrominance signals are transmitted on one carrier in PAL system- block diagram of a Colour TV transmitter- block diagram of a Colour TV receiver -processing of Colour video signal (PAL system) in a Colour receiver- need of satellite for TV broadcasting over wide area - DTH and the merits - need for Set Top Box- features of HDTV- Explain the features of SMARTTV.

**Suggested Learning Outcomes:**

After completing this course the student will be able to

**1.0 Comprehend the Basic Concepts of Transmission lines and waveguides**

1.1. List different types of Transmission Lines.

1.2. Draw the Electrical equivalent circuit of a Transmission line.

1.3. Define Primary and Secondary constants of a Transmission line.

1.4. Define group and phase velocities in transmission lines

1.5. List two types of distortions in transmission lines

1.6. Define Reflection coefficient and SWR

1.7. Derive the relation between Reflection Coefficient & SWR

1.8. Derive the equation for input impedance of a transmission line terminated with load ZL

1.9. List the various bands in microwave frequency range.

1.10. List the different types of wave guides.

1.11. Define dominant mode and cut-off wavelength in rectangular wave guide.

1.12. Give the expression for cut-off frequency, cut-off wavelength, guide wavelength, phase velocity, group velocity and characteristic impedance in rectangular waveguide.

1.13. State the need for microwave bends, corners and twists

1.14. List different T-Junctions

1.15. State the need for isolators and circulators.

1.16. State the need for directional coupler.

2.0 **Working of microwave tubes and semiconductor devices.**

2.1 State the need for microwave tubes.

2.2 List the various microwave tubes.

2.3 Explain the working of Multi cavity Klystron amplifier.

2.4 List the applications of Multi cavity Klystron

2.5 Explain the working of Reflex Klystron oscillator

2.6 List the applications of various microwave tubes such as Klystron and magnetron.

2.7 Explain the working of TWT and its applications.

2.8 State the need for microwave semiconductor devices

2.9 Distinguish between ordinary semiconductor devices and microwave semiconductor devices.

2.10 Define Gunn Effect.

2.11 List the applications of GUNN diode.

2.12 Explain the working of IMPATT diode.

2.13 List the applications of IMPATT diode.

2.14 List the applications of TRAPATT diode.

2.15 State the need for microwave integrated circuits (MICs).

2.16 List the applications of micro-strip antennas.

3.0 **Explain the principles of radar systems**

3.1 State the basic principle of Radar with a block diagram.
3.2 Derive the basic Radar range equation.
3.3 Predict the range performance factors from range equation.
3.4 Draw and explain the block diagram of pulsed Radar system.
3.5 State the need for duplexer in Radar
3.6 Explain the working of branch type Duplexer with sketch.
3.7 List the types of indicators used in radar systems.
3.8 State the disadvantages of pulse dradar.
3.9 Explain the principle of CW radar.
3.10 Draw and explain the block diagram of CW radar.
3.11 List the limitations of a CW Radar
3.12 Draw and explain the block diagram of MTI Radar.
3.13 List the applications of various Radar systems.

**4.0 Understand the working of satellite communication**

4.1 Mention the uses of microwave links.
4.2 Explain fixed microwave link with block diagram.
4.3 State the need for satellite communication
4.4 Classify satellites.
4.5 List the advantages of satellite communication over terrestrial radio communication.
4.6 List the applications of satellites
4.7 Define azimuth and elevation with reference to satellites.
4.8 Define terms apogee and perigee.
4.9 Define uplink frequency and down link frequency
4.10 Draw and explain the block diagram of communication satellite.
4.11 List the functions of a transponder.
4.12 List three types transponders used in satellites (single conversion, double conversion and regenerative)
4.13 Explain the working of the three types of transponders.
4.14 Draw and explain the block diagram of Earth station.

**5.0 Comprehend TV Picture & Composite videosignal**

5.1 Explain formation of picture.
5.2 State the need for horizontal and vertical scanning.
5.3 State the frame and field frequencies.
5.4 State need for vertical synchronization, horizontal synchronization and blanking pulses.
5.5 Mention important standards of T.V. transmissions as per C.C.I.R.
5.6 List different types of scanning
5.7 Distinguish between progressive and interlaced scanning.
5.8 Draw the standard scanning pattern in an interlaced scanning and explain.
5.9 State the need for interlaced scanning with reference to Bandwidth.
5.10 List the different pulses in a composite video signal.
5.11 Define positive and negative modulation.
5.12 State and compare positive and negative modulation.
5.13 Sketch the composite video signal as per I.S.I. specification.
5.14 State the need for front porch and back porch in blanking pulses.
5.15 State the necessity of equalizing pulses and serrated vertical blanking pulses.

**6.0 Understand the basics of Colour Television and digital TV.**

6.1 Explain the main characteristic of human eye with regard to perception of colours.
6.2 Distinguish between additive and subtractive mixing of colours and draw circle diagrams.
6.3 Define complementary colours, hue, saturation, luminance and chrominance, and Colour circle.
6.4 Explain compatibility and reverse compatibility in TV system.
6.5 List three standards of Colour transmission system NTSC, PAL and SECAM.
6.6 Explain how chrominance signals are transmitted on one carrier in PAL system.
6.7 Draw the block diagram of a Colour TV transmitter and state the function of each block.
6.8 Draw the block diagram of a Colour TV receiver and state the function of each block.
6.9 Explain the processing of Colour video signal (PAL system) in a Colour receiver.

6.10 State the need of satellite for TV broadcasting over wide area.

6.11 Explain DTH system and list merits of DTH system.

6.12 State the need for Set Top Box.

6.13 Explain the features of HDTV.

6.14 Explain the features of SMART TV.

**RECOMMENDED BOOKS**


i. Electronic communication system by George Kennedy,TMH

ii. Electronic communications systems by Roy Blake, ThomsonDelmar,2002.

iii. Introduction to RADAR Engineering by Merryl I Skolnik.TMH

iv. Microwave Integrated circuits by Samuel Leo 3 ed.-PrenticeHall

v. Transmission lines Umesh Sinha.

vi. Satellite communication by DC Agarval


**Suggested E-Learning resources**

i. www.electronics-tutorials.ws

ii. www.nptel.ac.in

iii. www.electronics-tutorials.ws

## MID SEM EXAMINATIONS

| S.No | Unit Name | MID SEM-I EXAM | | | |
|---|---|---|---|---|---|
| | | R | U | A | Remarks |
| 1 | Unit-I | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-II | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| | Total Questions | 4 | 4 | 4 | |
| **S.No** | **Unit Name** | **MID SEM-II EXAM** | | | |
| | | R | U | A | Remarks |
| 1 | Unit-III | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-IV | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| Total Questions | | 4 | 4 | 4 | |

## SEMESTER END EXAMINATIONS

| Sl No | Unit No. | Questions to be set for SEE | | | | Remarks |
|---|---|---|---|---|---|---|
| | | R(1 Mark) | | U(3 Marks) | A(5 Marks) | |
| 1 | I | 4 | 1 | 9(a) | 13(a) | |
| 2 | II | | | | | |
| 3 | III | | 2 | 10(a) | 14(a) | |
| 4 | IV | | | | | |
| 5 | V | | 3 | 9(b) | 13(b) | |
| | | | 5, 6 | 11(a) | 15(a) | |
| | | | | 11(b) | 15(b) | |
| 6 | VI | | 7,8 | 10(b) | 14(b) | |
| | | | | 12(a) | 16(a) | |
| | | | | 12(b) | 16(b) | |
| Total Questions | | 8 | | 8 | 8 | |

**BOARD DIPLOMA EXAMINATION, (C-21)**

**EC-404 MICROWAVE COMMUNICATION AND TELEVISION**

**MODEL PAPER-MID- SEM I**

**TIME :1HOUR** **MAX. MARKS :20**

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PART- A

Total marks:20

Answer all questions. Each question carries one mark. 1x4=4M

a. Give the expression for cut-off frequency in a rectangular wave guide.

b. Define Primary and Secondary constants of a Transmission line.

c. List any 4 microwave tubes.

d. List any 4 applications of IMPATT diode.

PART-B

Answer all questions. Each question carries three marks. 3x2=6M

5.(a) Derive the relation between reflection co-efficient and SWR.

OR

5.(b) State the need for directional coupler .

6.(a) State the need for microwave tubes.

OR

6.(b) Distinguish between ordinary semiconductor devices and microwave devices.

**PART-C**

**Answer all questions. Each question carries five marks. 5x2=10M**

7.(a) Derive the equation for input impedance of a transmission line terminated with load ZL .

OR

7.(b) State the need for isolators and circulators.

8.(a) Explain the working of Multi-cavity Klystron Amplifier.

OR

8.(b) Explain the working of Travelling wave tube.

**BOARD DIPLOMA EXAMINATION, (C-21)**
**EC-404 MICROWAVE COMMUNICATION AND TELEVISION**
**MODEL PAPER**
**MID- SEM II**

**TIME :1HOUR** **MAX. MARKS :20**

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## PART- A

**Answer all questions. Each question carries one mark. 1x4=4M**

i. List the types of radars.

ii. List the limitations of CW radar.

iii. Classify satellites.

iv. Define apogee and perigee.

## PART-B

**Answer all questions. Each question carries three marks. 3x2=6M**

v. (a) State the need of duplexer in radar.

OR

5.(b) List the disadvantages of pulsed radar.

6.(a) List the functions of transponder.

OR

6.(b) Define azimuth and elevation with respect to satellites.

## PART-C

**Answer all questions. Each question carries five marks. 5x2=10M**

7.(a) Explain the working of branch type duplexer with a sketch.

OR

7.(b) Draw and Explain the block diagram of CW radar.

8.(a) Explain fixed microwave link with a block diagram.

OR

8.(b Draw and Explain the block diagram of earth station.

**BOARD DIPLOMA EXAMINATION, (C-21)**
**EC-404 MICROWAVE COMMUNICATION AND TELEVISION**
**MODEL PAPER**
**SEMESTER END EXAM (SEE)**

**TIME : 2HOUR** **MAX. MARKS :40**

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## PART- A

**Answer all questions. Each question carriesonemark.8X1 =8M**

1. List 2 types of distortions in transmission lines.
2. State the need for satellite communication.
3. State the frame and field frequencies.
4. State the need for synchronization.
5. Define positive modulation.
6. State the need for horizontal and vertical scanning.
7. List the primary and secondary colours.
8. Define hue and saturation.

## PART-B

**Answer all questions. Each question carries three marks.** **4X3=12M**

9.(a) State the need for isolators and circulators.

OR

(b) Draw standard interlaced scanning pattern.

10(a) Define uplink and down link frequency.

OR

(b) What is compatibility and reverse compatibility in TV ?.

11(a) State the need for front porch and back porch in blanking pulses.

OR

**(b) Compare positive and negative modulation**

12(a) Draw circle diagrams for additive and subtractive mixing of colours.

OR

(b) Draw the block diagram of colour TV transmitter.

## PART-C

**Answer all questions. Each question carries five marks. 4X5=20M**

13(a) Draw and explain reflex klystron with timing diagram.

OR

(b) Draw and explain composite video signal.

14(a) Explain the working of MTI radar with block diagram.

OR

(b) Explain the block diagram of colour TV receiver.

15(a) Distinguish between progressive and interlaced scanning.

OR

(b) State the need for front porch and back porch in blanking pulses.

16. (a) Explain the processing of Colour video signal (PAL system) in a Colour receiver.

OR

(b) Explain the features of HDTV.

# EC-405 - ELECTRONIC MEASURING INSTRUMENTS

| | | | |
|---|---|---|---|
| Course Title | Electronic Measuring Instruments | Course Code | EC-405 |
| Semester | IV | Course Group | Core |
| Teaching Scheme in Periods(L:T:P) | 4:1:0 | Credits | 3 |
| Methodology | Lecture + Assignments | Total Contact Periods : | 75 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites**

This course requires the basic knowledge of Analog and digital circuits

**Course Outcomes**

Upon completion of the course, the student should be able to

| Course Outcome | |
|---|---|
| CO1 | Use Analog instruments for measuring Basic Electrical Quantities |
| CO2 | Use ac and dc bridges for determining unknown parameters |
| CO3 | Use digital instruments for measuring the given electrical quantities |
| CO4 | Understand the working of AF, RF signal generators and power meters |
| CO5 | Understand the working principles of CRO and its applications |
| CO6 | Use the Test instruments in Laboratory applications |

**Course Contents**

**1.0 Analog instruments**

Characteristics of ideal Voltmeter and ideal Ammeter- Construction and principle of operation of PMMC instrument- Principle of extending the range of DC ammeter- Principle of extending the range of DC voltmeter- Principle and working rectifier type voltmeter and ammeter- Construction and principle of series and shunt type ohmmeters- Use of Megger for measuring the insulation resistance- loading effect with an example- Need for high input impedance for Voltmeters- working of FET input voltmeter with a circuit diagram- Drift problem in FET Voltmeters- Working of differential voltmeters-

**2.0 DC & AC bridges**

Use of high voltage probe and clamp-on current probe- Construction of AC Bridge- Conditions for bridge balance- Types of DC bridges and AC bridges- Use of above bridges- Resistance measurement using Wheat Stone Bridge- Inductance measurement using Maxwell's Bridge- capacitance measurement using Schering Bridge- important errors and their prevention in bridge measurements- Limitations of AC bridge method for measurement of small inductances and capacitances

**3.0 Digital instruments**

Advantages of digital instruments over Analogue instruments- Working of Ramp type digital voltmeter with block diagram- Successive approximation type digital voltmeters with block diagram- Specifications of digital voltmeters- Working of digital frequency meter with block diagram- Important specifications of digital frequency meter- Accuracy and Resolution of a meter- Factors effecting the accuracy and Resolution of a frequency meter- Working of digital LCR meter with block diagram- specifications of digital LCR meter.

**4.0 Working principle of AF, RF signal generators and power meters**

Working of AF Oscillator (sine & square) - Block diagram- Front panel controls and specifications of AF Oscillator-Working of function generator with block diagram- Applications of AF oscillators and function generators- Working of RF signal generator- Specifications of RF signal generator- Important Applications of RF signal generators- Importance of shielding in RF generators- Working of AF power meter- Applications of power meters.

**5.0 Working principle and use of CRO**

Block diagram of general purpose CRO - Function of each block- Necessity of time base and deflection amplifiers- Deflection sensitivity of CRO - Conditions for stationary wave forms- Conditions for flicker free waveforms- Triggered sweep with necessary circuit- Advantages of triggered sweep- Function of various controls on front panel of CRO- Procedure for measurement of a)Voltage (DC & AC) b) frequency c) Phase angle d)Time interval e) Depth of modulation-Define a pulse - Waveform of a pulse-Define the pulse parameters - Pulse width - Rise time - Fall time - Duty cycle-delay time- procedure for measuring above pulse parameters with CRO- Different types of probes and connectors used in oscilloscopes.

**6.0 Test instruments**

Stray inductance and stray capacitance of a coil- Q meter with a block diagram- Parameters that can be measured using Q meter- Distortion factor- Distortion Factor Meter with block diagram- Digital IC tester with block diagram- Working of logic analyser with block diagram- Working principle of spectrum analyser and uses- Plotters and Recorders- XY recorders- plotter- logic probe.

**REFERENCE BOOKS:**


1. Modern Electronic Instrumentation and Measurement techniques - Albert D. Helfrick William David Cooper-PHI Publications
2. Electrical and Electronics Measurements and Instrumentation - A.K. Sawhney ,Puneet Sawhney Dhanpat Rai & Company, 2010
3. **Electronic Instrumentation** - HS Kalsi ,-Tata McGraw Hill


**Specific Learning Outcomes:**

**After completing this course the student will be able to**

**1.0. Understand the working of analog instruments.**

1.1. List the characteristics of ideal volt meter and ideal ammeter.

1.2. Explain the construction and principle of operation of PMMC instrument.

1.3. Explain the principle of extending range of DC ammeter.

1.4. Explain the principle of extending range of DC voltmeter.

1.5. Explain the principle & working of rectifier type voltmeter.

1.6. Explain the principle of series & shunt type ohmmeters.

1.7. Explain the use of Megger for measuring the insulation resistance.

1.8. Explain loading effect of voltmeter with an example circuit

1.9. Explain the need for high input impedance for voltmeters.

1.10. Explain the working of FET input voltmeter with a circuit diagram.

1.11. Explain the drift problems in FET voltmeters.

1.12. Explain the working of differential voltmeters.

1.13. Explain the use of high voltage probe & clamp-on current probe.

**2.0 DC bridges and AC Bridges**

2.1 Explain the construction of AC bridge

2.2 State the conditions for AC bridge balance.

2.3 List 4 types of AC bridges.

2.4 Mention the use of above bridges.

2.5 Explain the resistance measurement using Wheatstone Bridge.

2.6 Explain the inductance measurement using Maxwell's Bridge.

2.7 Explain the capacitance measurement using Schering Bridge.

2.8 List 4 important errors and their prevention in bridge measurements.

2.9 Mention the limitations of AC bridge method for measurement of small inductances and capacitances.

**3.0 Understand the working of Digital Instruments.**

3.1 List 4 advantages of digital instruments over analog instruments.

3.2 Explain the working of RAMP type digital voltmeter with block diagram.

3.3 Explain the working of Successive approximation type digital voltmeter with block diagram.

3.4 List 4 important specifications of digital voltmeter.

3.5 Explain the working of digital frequency meter with block diagram.

3.6 List 4 important specifications of digital frequency meter.

3.7 Define accuracy and resolution of a meter.

3.8 Explain factors effecting the accuracy and resolution of a frequency meter.

3.9 Explain the working of digital LCR meter with block diagram.

3.10 List 4 specifications of digital LCR meter.

**4.0 Understand the construction and working of signal generators & power meters.**

4.1 Explain the working of AF oscillator with block diagram.

4.2 List the front panel controls and specifications of AF oscillator.

4.3 Explain the working of function generator with block diagram.

4.4 List the applications of AF oscillators and function generators.

4.5 Explain the working of RF signal generator with block diagram.

4.6 List the specifications of RF signal generator.

4.7 Mention 3 important applications of RF signal generator.

4.8 Explain the importance of shielding in RF generators.

4.9 Explain the working of AF power meter.

4.10 List the applications of power meter

**5.0 Understand construction and working of CRO.**

5.1 Draw the block diagram of general purpose CRO and describe the function of each block.

5.2 Explain the necessity of time base and deflection amplifiers.

5.3 Define deflection sensitivity of CRO.

5.4 List the conditions for stationary waveforms.

5.5 Mention the conditions for flicker free waveforms.

5.6 Explain the triggered sweep with necessary circuit.

5.7 Mention the advantages of triggered sweep.

5.8 Explain the function of various controls on front panel of CRO.

5.9 Explain the procedure for measurement of a) voltage (DC & AC) b) frequency c) phase angle d) time interval e) depth of modulation.

5.10 Define a pulse.

5.11 Draw the waveform of a pulse.

5.12 Define the pulse parameters a) pulse width b) rise time c) fall time d) duty cycled) delay time.

5.13 Explain the procedure for measuring above pulse parameters with CRO.

5.14 List different types of probes and connectors used in CRO's.

**6.0 Understand the construction and working of test instruments.**

6.1 Define stray inductance and stray capacitance of a coil.

6.2 Explain the working of Q-meter with a block diagram.

6.3 List various parameters that can be measured using Q-meter.

6.4 Define distortion factor.

6.5 Explain the working of distortion factor meter with block diagram.

6.6 Explain the working of distortion factor meter with block diagram.

6.7 Explain the basic working principle of spectrum analyser and mention its use.

6.8 State the need for plotters and recorders.

6.9 Explain the working of XY recorders.

6.10 Explain the working of plotters.

6.11 Explain the working of logic probe

**Suggested Student Activities**

1. Student visits Library to refer to Manuals and related books of electronic instruments
2. Student inspects the available equipment in the Lab
3. Visit nearby Industry to familiarize with working of various electronic instruments
4. Participate in the Quiz & discussion
5. Search internet for knowing latest trends in electronic instruments

**Suggested E-Learning references**

1. www.electronics-tutorials.ws
2. www.nptel.ac.in
3. www.Techopedia.com
4. www.circuitdigest.com

**CO - PO MAPPING MATRIX**

| Course Outcome | | Linked PO |
|---|---|---|
| CO1 | Use Analog instruments for measuring Basic Electrical Quantities | 1,2 |
| CO2 | Use ac and dc bridges for determining unknown parameters | 1,2,3,5, |
| CO3 | Use digital instruments for measuring the given electrical quantities | 1,2,5,9 |
| CO4 | Explain the working of AF, RF signal generators and power meters | 1,2,5,7 |
| CO5 | Understand the working principles of CRO and it's applications | 1,2,5,7 |
| CO6 | Use the Test instruments in Laboratory applications | 1,2,3,7,10 |

**MID SEM-I EXAM**

| S.No | Unit Name | R | U | A | Remarks |
|---|---|---|---|---|---|
| 1 | Unit-I | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-II | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| Total Questions | | 4 | 4 | 4 | |

**MID SEM –II EXAM**

| S.No | Unit Name | R | U | A | Remarks |
|---|---|---|---|---|---|
| 1 | Unit-III | 1, 2 | 5(a)<br>5(b) | 7(a)<br>7(b) | |
| 2 | Unit-IV | 3, 4 | 6(a)<br>6(b) | 8(a)<br>8(b) | |
| Total Questions | | 4 | 4 | 4 | |

**Semester End Examination**

| Sl No | Unit No. | Questions to be set for SEE | | | | Remarks |
|---|---|---|---|---|---|---|
| | | R | | U | A | |
| 1 | I | 4 | 1 | 9(a) | 13(a) | |
| 2 | II | | | | | |
| 3 | III | | 2 | 10(a) | 14(a) | |
| 4 | IV | | | | | |
| 5 | V | | 3 (5, 6) | 9(b)<br>11(a)<br>11(b) | 13(b)<br>15(a)<br>15(b) | |
| 6 | VI | | 3 (7,8) | 10(b)<br>12(a)<br>12(b) | 14(b)<br>16(a)<br>16(b) | |
| Total Questions | | 8 | | 8 | 8 | |

| Legend: | Remembering (R) | 1 Mark |
|---|---|---|
| | Understanding (U) | 3 Marks |
| | Application (A) | 5 Marks |

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING: TS: HYDERABD**

**EC-405, IV SEMESTER, ELECTRONIC MEASURING INSTRUMENTS**

**MID EXAM - I MODEL QUESTION PAPER**

**Time: 1 hour** **Max. Marks: 20**

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**PART-A**

**Answer <u>All</u> questions. Each carries 1 mark. 4X1=4 Marks**

1. List the characteristics of ideal ammeter
2. State the importance of high input impedance of voltmeter
3. State the conditions for AC bridge balance
4. List the limitations of AC bridge for measuring of small inductance.

**PART-B**

**Note: Answer all questions. Each carries 3marks. 2X3=6 Marks**

5.(a) Explain loading effect of volt meter

(or)

5. (b) Explain the principle of extending range of DC voltmeter

6. (a) Explain the resistance measurement using Wheatstone Bridge

(or)

6. (b).Explain the capacitance measurement using Schering bridge

**PART-C**

**Note: Answer all questions. Each carries 5 marks. 2X5=10 Marks**

7.(a)Explain the construction and principle of operation of PMMC instrument

(or)

7.(b)Explain the principle & working of rectifier type voltmeter

8.(a) Explain the inductance measurement using Maxwell's Bridge

(or)

8.(b).State the conditions for AC bridge balance and Explain the construction of AC bridge

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING: TS: HYDERABD**

**EC-405, IV SEMESTER, ELECTRONIC MEASURING INSTRUMENTS**

**MID EXAM - II MODEL QUESTION PAPER**

**Time: 1 hour** **Max. Marks: 20**

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## PART-A

**Answer All questions. Each carries 1 mark. 4X1=4 Marks**

1. List two advantages of digital instruments over analog instruments
2. Define accuracy of a meter
3. List the front panel controls of AF oscillator.
4. Mention 3 important applications of RF signal generator.

## PART-B

**Note: Answer all questions. Each carries 3marks. 2X3=6 Marks**

5.(a)Explain factors effecting the accuracy and resolution of a frequency meter

(or)

5.(b)Explain the working of RAMP type digital voltmeter with block diagram.

6.(a) Explain the importance of shielding in RF generators

(or)

6.(b).Explain the importance of shielding in RF generators

## PART-C

**Note: Answer all questions. Each carries 5 marks. 2X5=10 Marks**

7.(a)Explain the working of Successive approximation type digital voltmeter with block diagram

(or)

7.(b) Explain the working of digital frequency meter with block diagram.

8.(a) Explain the working of function generator with block diagram.

(or)

8.(b).Explain the working of AF power meter.

**STATE BOARD OF TECHNICAL EDUCATION & TRAINING: TS: HYDERABD**
**EC-405, IV SEMESTER, ELECTRONIC MEASURING INSTRUMENTS**
**SEMESTER END EXAMINATION MODEL QUESTION PAPER**

**Time: 2 hours** **Max. Marks: 40**

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**PART-A**

**Answer All questions. Each carries 1 mark. 8X1=8 Marks**

1. List the characteristics of ideal volt meter.
2. Define resolution of a digital instrument.
3. List any two applications of a power meter.
4. Define pulse parameters like rise time and duty cycle.
5. Define deflection sensitivity of CRO.
6. State the conditions for stationary wave forms.
7. Define distortion factor.
8. State the need for plotters.

**PART-B**

**Answer all questions. Each carries three marks. 4X3=12Marks**

9.(a) Explain loading effect of voltmeter

(or)

9. (b) Explain the procedure for measurement of voltage(AC) and Frequency using CRO.

10.(a)Explain factors effecting the accuracy and resolution of a frequency meter

(or)

10.(b)Draw the block diagram of Q-meter.

11.(a)Mention the function of various controls on front panel of CRO.

(or)

11.(b)Explain the triggered sweep with necessary circuit.

12.(a)Draw the block diagram of distortion factor meter.

(or)

12.(b) State the basic working principle of spectrum analyzer and mention its use.

. **PART-C**

**Answer all questions. Each carries 5 marks. 4X5=20Marks**

13.(a) Explain the capacitance measurement using Schering Bridge.

(or)

13. (b) Draw the block diagram of general purpose CRO and describe the function of each block.

14. (a)Explain the working of function generator with block diagram.

(or)

14. (b) Explain the working of XY recorders

15. (a)Explain the necessity of time base and deflection amplifiers..

(or)

15. (b) Explain the procedure for measuring pulse parameters like parameters a) pulse width b) rise time c) fall time d) duty cycle e) delay time with CRO

16. (a) Explain the working of logic probe

(or)

16. (b) Explain the working of plotters

# EC-406 - LINEAR INTEGRATED CIRCUITS LAB

| | | | |
|---|---|---|---|
| Course Title | Linear Integrated Circuits Lab | Course Code | EC-406 |
| Semester | IV | Course Group | Core |
| Teaching Scheme in Periods(L:T:P) | 1:0:2 | Credits | 1.5 |
| | | | |
| Methodology | Lecture + Practicals | Total Contact Hours : | 45 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites**

This course requires the basic skills of Handling Basic Electronics tools and Components, knowledge of connecting cables and meters

**Course Contents**

**List of Experiments**

**I. Operational Amplifier Circuits**

1. Familiarize with Operational amplifier 741 and Quad Op-amp LM 324 and comparator LM 339 ICs
2. Determine the CMRR and Slew Rate of the OP-AMP.
3. Implement and test 741 Op-Amp as
    a) Inverting amplifier
    b) Non Inverting amplifier
    c) Voltage follower (Buffer),
4. Implement and test 741 Operational amplifier as
    a) Summing Amplifier
    b) Difference amplifier
    c) Scale changer (with two Op-Amps)
5. Implement Wave shaping circuits using Op-Amp
    a) Implement & test Differentiator and Integrator circuits
    b) Implement & test a Voltage comparator Circuit
    c) Implement &test Op-amp Schmitt trigger and draw characteristics

## II. Signal conditioning Circuits using Op-amp

6. Implement &test Current to Voltage converter using Op-amps
7. Implement &test Voltage to current converter
    a) Implement & test a Voltage to current converter that produces a proportionate current in the range of 4mA to 20mA corresponding to input voltages from 0 to 5V

## III. Opamp Oscillators &555 Timer IC

8. Implement & test Sine wave Oscillator Circuits using Op-Amp CA 3011
    a) RC-phase shift oscillator
    b) Wien bridge oscillator
9. 
    a) Implement &test Monostable multi-vibrator circuit and observe output waveforms on CRO b) Implement & test Astable multi-vibrator observe output waveforms on CRO
10. Verify different modes of 555 IC.
    a) Implement Monostable multi vibrator and observe output waveforms on CRO
    b) Implement Astable multivibrator and observe output waveforms on CRO
11. Verify functions of 565 Phase Locked loop IC
    a) Implement 565 Phase locked loop circuit and determine VCO free running frequency Lock range , Capture Range Practically and observe output waveforms on CRO
    b) Implement Frequency demodulator using 565 and observe output waveform on CRO.
12. Use 566 as a square and Triangular wave generator
    a) Implement waveform /Function generator using 566
    b) Produce Frequency modulation using 566 and observe output waveform on CRO.
13. Verify the features of Tone Decoder IC 567 IC ( Refer to the application notes and implement following circuits)
    a) Implement 10 Khz signal detector and test
    b) Implement frequency Doubler and test

14. Implement &Test Precision Rectifier using Op-amp

15. Assemble Audio Power Amplifier circuit using LM 380 IC and Test the performance.

**E Learning Resources**

1. http://electrical4u.com/
2. www.electronics-tutorials.ws
3. www.nptel.ac.in

| | Course Outcome | Linked PO | No of Periods |
|---|---|---|---|
| CO1 | Analyze op-amp characteristics and apply the knowledge of op- amp in basic applications | 1,2,3,4,5,6,7,8 | 21 |
| CO2 | Apply the knowledge of Op-amp in Signal conditioning circuits | 1,2,3,4 | 9 |
| CO3 | Design and test the working of Timers, PLL | 1,2,3 | 6 |
| CO4 | Design simple circuits using op-amp and implement | 1,2,3,10 | 9 |

# EC-407 - COMMUNICATION LAB

| | | | |
|---|---|---|---|
| Course Title | Communication Lab | Course Code | EC-407 |
| Semester | IV | Course Group | Core |
| Teaching Scheme in Periods(L:T:P) | 1:0:2 | Credits | 1.5 |
| Methodology | Lecture + Practical | Total Contact Hours : | 45 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites**

This course requires the Basic Knowledge of analog communication, digital electronics.

**Course outcomes**

On successful completion of the course, the students will be able to attain below Course Outcome

| | **Course Outcome** | **CL** | **Linked PO** | **Teaching Hours** |
|---|---|---|---|---|
| CO1 | Verify the Generation and Demodulation of AM and FM signals | R/U | 1,3,4 | 9 |
| CO2 | Analyze a Pulse modulation system and interpret the modulated and demodulated waveforms | R/U/A | 1,2,3,4,5,6, 7,8 | 15 |
| CO3 | Demonstrate TDM and FDM process using Pulse amplitude modulation signals | R/U/A | 1,2,3,4 | 6 |
| CO4 | Analyze digital modulation and demodulation techniques. | R/U/A | 1,2,3,4 | 9 |
| CO5 | Verify the generation and decoding of DTMF signals | A | 1,2,3,10 | 6 |
| | | | Total | 45 |

**Course Contents**

**I. Modulation & Demodulation Techniques**

1.

a) Implement and observe AM signal and determine Modulation index using CRO

i. Using Envelop method

ii. Trapezoidal Pattern method

iii. Observe the effect of Over modulation and under modulation

b) Implement diode demodulator circuit and observe the detected waveform

2.

a) Identify different sections in AM/FM radio receiver.

b) Observe the different types of inductors used in the radio tuned circuits.(Local oscillator coils, IFT coils, Ferrite cored)

3. Generate FM signal and determine Modulation index
   a) Demodulate F.M signal and compare the output signal with original modulating signal. .

II. **Pulse Modulation Techniques**

4. Implement an op-amp sample and hold circuit and test
5. Implement D/A converter using R-2R ladder network/Binary Weighted type.
6.
   a) Verify sampling theorem and observe waveforms on CRO
   b) Sample an analog signal (using IC 398) at Nyquist rate and above Nyquist rate. And observe the waveforms
7. Verify and observe Pulse amplitude modulation and demodulation waveforms on CRO
8. Verify pulse position modulation and demodulation waveforms on CRO
9. Verify and observe Pulse Width modulation and demodulation waveforms on CRO
10. Verify and observe Pulse Code Modulation and Demodulation waveforms on CRO
11. Verify and observe Delta modulation and demodulation waveforms on CRO

III. **Time Division &Frequency Division Multiplexing**

12. Verify 2-channel TDM and observe input/output waveforms on CRO
13. Verify FDM and observe input/output waveforms on CRO

IV. **Signal Encoding (Keying ) Techniques**

14. Generate and demodulate ASK signal and observe input/output waveforms on CRO
15. Generate and demodulate FSK signal and observe input/output waveforms on CRO
16. Generate and demodulate PSK signal
17. Observe line encoder &Decoder ( NRZ Signal)waveforms on CRO for
    a) Unipolar and b) Bipolar techniques

V. **DTMF Signaling**

18. Generate and decode DTMF signals using UM91214B IC/5089IC or any other equivalent ICs and observe the waveforms on CRO

**E Learning Resources**

1. Electronics laboratory primer, S. Poorna Chandra, B.Sasikala, S. Chand Technical Publication. ISBN 81-219-2459-6
2. Digital Communications, Dr. K. N. Hari Bhat and Dr. D. Ganesh Rao, III Edition, Sanguine Technical Publishers.
3. www.nptel.ac.in

**QUESTION BANK**

1. Observe an AM signal through a CRO and find out the modulation index using envelope method.
2. Obtain a AM detected signal through a CRO using an AM detector and find out its frequency and amplitude.
3. Identify the various sections of AM receiver and observe different types of inductors used in tuned circuits like RF , IF and AF amplifiers.
4. Identify the various sections of FM receiver and observe different types of inductors used in tuned circuits like RF , IF and AF amplifiers.
5. Observe a FM signal through CRO and find out its modulation index.
6. Demodulate F.M signal and compare the output signal with original modulating signal using a CRO.
7. Verify Sampling Theorem and Observe on CRO?
8. Generate and Demodulate PAM and Observe the waveforms?
9. Generate and Demodulate PPM and Observe the waveforms?
10. Generate and Demodulate PWM and Observe the waveforms?
11. Generate and Demodulate PCM and Observe the waveforms?
12. Generate and Demodulate Delta Modulation and Observe the waveforms?
13. Verify 2-channel TDM and observe input/output waveforms?
14. Verify FDM and observe input/output waveforms?
15. Generate and demodulate ASK signal and observe input/output waveforms?

## EC-408 - Microcontrollers Programming Lab

| | | | |
|---|---|---|---|
| Course Title | Microcontrollers Programming Lab | Course Code | EC-408 |
| Semester | IV | Course Group | Practical |
| Teaching Scheme in | 1:0:2 | Credits | 1.5 |
| Periods(L:T:P) | | | |
| Methodology | Lecture + Practical | Total Contact Hours | 45 |
| CIE | 60 Marks | SEE | 40 Marks |

**Pre requisites**

This course requires the basic skills of Handling digital circuits and computer.

**Course outcomes:**

On successful completion of the course, the students will be able to attain below Course Outcome

| | **Course Outcome** | **CL** | **Linked PO** | **Teaching Hours** |
|---|---|---|---|---|
| CO1 | Execute programs for data manipulation. | R/U/A | 1,2,3,4,10 | **9** |
| CO2 | Execute programs to perform and arithmetic and logical functions | R/U/A | 1,2,3,4,10 | **15** |
| CO3 | Write and execute programs to meet a requirement | R/U/A | 1,2,3,4,10 | **9** |
| CO4 | Implement time delays by writing programs. | R/U/A | 1,2,3,4,10 | **12** |
| | | | | **45** |

**Course Contents**

**List of Experiments**

I. **Programs related to data transfer instructions.**

1.

a) Write an assembly language program (ALP) to move the data from one register to another.

b) Write an ALP to move the data from internal RAM one location to another.

2.

a) Write an ALP to move the data from external RAM one location to another.

b) Write an ALP to move the data from external RAM internal RAM and vice versa.

3.

a) Write an ALP to exchange the data between two registers.

b) Write an ALP to exchange the data between two internal RAM locations.

**II. Programs on arithmetic instructions.**

4.

a) Write an ALP to add two binary numbers in i-RAM location.

b) Write an ALP to add two binary numbers in OFF chip-RAM location.

5.

a) Write an ALP to add two decimal numbers in OFF chip-RAM location.

b) Write an ALP to add two decimal numbers in OFF chip-RAM location and store the carry in any reg.

6.

a) Write an ALP to add two 16-bit binary numbers in i-RAM location.

b) Write an ALP to subtract two binary numbers in registers and store the diff. In i-RAM.

7. Write an ALP to multiply two binary numbers.

III. **Programs on logical instructions.**

8.

a) Write an ALP to mask the higher order nibble.

b) Write an ALP to mask the lower order nibble.

9.

a) Write an ALP to mask any one bit only of the binary number.

b) Write an ALP to rotate a number left twice with carry set.

10.

a) Write an ALP to rotate a number right twice with carry reset.

b) Write an ALP to find the a) 1’s complement b )2’s complement of a given number.

IV. **Programs to perform Data Transfer**

11.

a) Write an ALP to transfer a block of data from internal RAM overlap.to external RAM with

b) Write an ALP to transfer a block of data from external RAM to internal RAM without overlap.

12. Write an ALP to add block of decimal numbers present in internal RAM. Store the sum and carry in registers.
13. Write an ALP to test if a given number is present in the block of data.
14.
    a) Write an ALP to arrange a block of data in ascending order.
    b) Write an ALP to arrange a block of data in descending order.

**V. Counters/ &Timers**

15.
    a) Implement a HEX up/down counter - (Program should check value @R0=0X30, if 0X30=0 then up counter else down counter)
    b) Write a program in assembly language to produce required time delay a) by Using instructions only b) by using Timers

# EC-409 MATLAB

| | | | |
|---|---|---|---|
| Course Title | MATLAB | Course Code | EC-409 |
| Semester | IV | Course Group | Practical |
| Teaching Scheme in Periods(L:T:P) | 1:0:2 | Credits | 1.5 |
| Methodology | Lecture + Practicals | Total Contact Hours | 45 |
| CIE | 60 Marks | SEE | 40 Marks |

Pre requisites

This course requires the knowledge of basic understanding of Arrays, Matrices, Analog Communication and Digital Communication.

**Course Contents**

**Unit-1: Practice with MATLAB Environment**

1. To acquaint with MATLAB windows: Command window, Editor Window, Figure window, Command history window, Current directory window, Workspace window
2. Know about data types in MATLAB
3. Practice with mathematical operators
4. Write a mathematical expression in MATLAB
5. Practice with MATLAB statements
6. Practice with conditional control statements such as if-end, if-else-end, if-else if-else if-else-end
7. Practice with loop control statements such as for loop and while loop
8. Write a program to compute roots of a quadratic equation $ax2+bx+c=0$given $a$, $b$ and $c$
9. Create and print simple plots
10. To create, save & Execute a script file
11. Create and execute a function file
12. Plot simple graphs using f-plot function
13. Plot a sine wave with title and labels
14. Plot simple graphs using ez-plot function
15. Plot simple graphs using ezsurfc function
16. Know about Simulink
17. Practice with Simulink

**Unit-2: Implement programs using Arrays and Matrices**

1. Access elements of array
2. Write a program to sort an array in descending order and execute
3. Write a MATLAB program for an addition of scalar to an array and execute
4. Write MATLAB program to multiply an array by scalar and execute
5. Write a MATLAB program to add two arrays and execute
6. Write a program to create a matrix
7. Write a MATLAB program to find transpose, determinant and inverse of a matrix
8. Practice with MATLAB mathematical operators on matrices such as addition, subtraction and multiplication
9. Compute mean, median, standard deviation and variance of a set of data using formulae and verify using built-in function.

**Unit-3: Demonstrate Skills using MATLAB to simulate generation of required signal**

1. Execute the given MATLAB program to generate message signal and simulate
2. Execute the given MATLAB program to generate carrier signal and simulate it
3. Simulate the given MATLAB program to generate AM modulated signal
4. Execute the given MATLAB program to generate DSBSC modulated signal and simulate it
5. Execute the given MATLAB program generate FM modulated signal and simulate it
6. Execute the given MATLAB program to generate PAM signal and simulate

| | Course Outcome | Linked PO |
|---|---|---|
| CO1 | Practice with MATLAB Environment | 1,2,3,4,5,6,7 |
| CO2 | Implement programs using Arrays and Matrices | 1,2,3,4,10 |
| CO3 | Demonstrate Skills using MATLAB to simulate generation of required signal | 1,2,3,4,10 |

**E Learning Resources**

1. www.electronics-tutorials.ws
2. www.nptel.ac.in

**Reference Book**:


1. MATLAB programming by Y. Kirani Singh and B.B. Chaudhuri, PHI.
2. Getting started with MATLAB by RudraPratap, Oxford University Press

**HU -410 – Employability Skills Lab**

| | | | |
|---|---|---|---|
| Course Title | Employability Skills Lab | Course Code | HU-410 |
| Semester | IV | Course Group | Core |
| Teaching Scheme in Hrs (L:T:P) | 1:0:2 | Credits | 1.5 |
| Methodology | Pair Work, Group Work, Activities, Lecture, Self-Learning | Total Contact Hours | 45 (3 contact hours per week) |
| CIE | 60 Marks | SEE | 40 Marks |

**Rationale:**

The course is designed to impart employability skills to make the students of diploma get the initial employment, maintain the employment and get better employment, if they wish.

**Prerequisites:**

The course requires the basic knowledge of vocabulary, grammar, four language learning skills, viz. listening, speaking, reading and writing and life skills.

**Course Outcomes**

| | |
|---|---|
| CO1 | Comprehend the importance of employability skills and strategies to survive in a job. |
| CO2 | Converse fluently and accurately accordingly in JAM sessions. Group Discussions will enhance the willingness to take the Initiative, accept adaptability in turn developing leadership qualities and Communication Skills. |
| CO3 | Understand purpose and process of interview in turn knowing how to prepare and succeed in interview. |
| CO4 | Making effective presentation, Develop Public speaking skills and learn to make visually attractive PPTs. |
| CO5 | Learn various writing formats useful at workplace and to develop an ability to apply technical information in documentation. |
| CO6 | Build strong workplace relationships by learning workplace etiquette, professional ethics and importance of gender sensitization. |

**Course Contents**

**Module 1: Introduction to Employability Skills**

**Duration: 6 Periods ( L 2 P 4 )**

a. Filling the Curriculum gaps
   i. Attributes and values
   ii. Specific and general skills
   iii. Academic Knowledge and Aptitude Skills
   iv. Analytical skills / Data Analysis
b. How to get into a job?
   i. Good personal presentation and attitude
   ii. Core generic skills
   iii. Technical / Professional skills

iv. Good Communication skills

c. How to survive in a job?
   i. Learning skills needed for self-advocacy and networking
   ii. Adaptability to cope with the changing circumstances.
   iii. Reliability and Integrity
   iv. Continuous Learning and Consistency in performance.

**Module 2: JAM & Group Discussion**

**Duration: 9 Periods ( L 3 P- 6 )**

i. What is JAM?
ii. Significance of JAM
iii. Enhancing Speaking skills, fluency, usage, coherence, spontaneity, voice modulation, eye contact, body language, Creativity, Sense of humor, Confidence and Time management.
iv. Learn avoiding hesitation, deviation and repetition
v. Purpose of Group Discussion
vi. Types of Group Discussion
vii. Different expressions and phases and their effective usage
   a. Opinion expression agrees and disagrees, partially agree or disagree, interrupt politely, add new information and conclusion
viii. Dos and Don'ts of a Group Discussion
ix. Importance of body language, Etiquettes and awareness of group dynamics
x. Practice.

**Module 3: Interview Skills**

**Duration: 9 Periods ( L 3 P 6 )**

i. Importance of interview skills
ii. Types of interviews
   a) Face to Face / One to One, Telephonic / Video, Panel Interview.
iii. Understanding the process of interview.
   a) Before the interview
   b) On the day of the interview
   c) After the interview
iv. FAQs, Common expressions of an interviewer and interviewee
v. Acceptable and unacceptable gestures. Body language, and Attire,
vi. Do's and Don'ts of an interview
vii. Mock Interviews

**Module 4: Presentation Skills:**

**Duration: 9 Periods ( L-3 P-6 )**

**a)** Significance of presentation
**b)** Types of presentations.
   **i.** Informative, Instructional, Arousing, Persuasive and Decision-Making
**c)** . What makes a good presentation?
   **i.** Understand, Collect, Organize, Use presentational aids and Practice

**d)** Tips for an effective presentation

**i.** Good Beginning – Greeting, Confidence, Body Language, Opening Ideas (Funny Videos, Ridicule. Asking Questions, Quote someone/Proverb or telling a story/referring an historical event)

ii. Unveiling – Develop systematically, usage of appropriate linkers or discourse markers. Eye contact and Effective usage of PPTs

iii. Conclusion – Summarize - Giving time to the audience for queries and Time management

**e)** Guidelines for PPTs

**f)** Public Speaking Skills

**i.** Benefits – Personal and Professionals.

**ii.** Strategies to improve public speaking skills.

iii. Obstacles to effective public speaking.

iv. Overcoming the barriers of public speaking.

g) Prepare presentation template.

**Module 5: Writing Skills at Workplace:**

**Duration: 6 Periods ( L – 2 P – 4 )**

a) Various writing formats useful at workplace
b) Skills involved in writing at workplace
c) Different templates for different purposes
d) Useful technical information in documentation

**Module 6: Workplace Awareness**

**Duration 6 Periods ( L – 2 P – 4 )**

a) Workplace etiquette
b) Knowledge, skills and attributes useful at workplace
c) Workplace Relationships
d) Professional ethics
e) Importance of gender sensitization
f) Sense of responsibility towards the society

**Suggested Student Activities:**

- Paper Presentations
- Seminars
- Mock Interviews
- Telephonic Interviews
- Group Discussions
- Role Plays
- Creating advertisements
- Five-minute activities
- Creating a model of workplace

**Course Outcomes**

| | |
|---|---|
| **CO1** | Comprehend the importance of employability skills and strategies to survive in a job. |
| **CO2** | Converse fluently and accurately accordingly in JAM sessions. Group Discussions will enhance the willingness to take the Initiative, accept adaptability in turn developing leadership qualities and Communication Skills |
| **CO3** | Understand purpose and process of interview in turn knowing how to prepare and succeed in interview. |
| **CO4** | Making effective presentation, develop public speaking skills and learn to make visually attractive PPTs. |
| **CO5** | Learn various writing formats useful at workplace and to develop an ability to apply technical information in documentation. |
| **CO6** | Build strong workplace relationships by learning workplace etiquette, professional ethics and importance of gender sensitization. |

**CO-PO Matrix**

| CO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | Mapping POs |
|---|---|---|---|---|---|---|---|---|
| **410.1** | - | - | - | - | 3 | | 3 | 5,7 |
| **410.2** | - | - | - | - | 3 | 2 | 3 | 5,6,7 |
| **410.3** | - | - | - | - | 3 | 3 | 3 | 5,6,7 |
| **410.4** | - | - | - | - | 2 | 2 | 3 | 5,6,7 |
| **410.5** | - | - | - | - | 2 | 2 | 3 | 5,6,7 |
| **410.6** | | - | -- | -- | 2 | | 3 | 5,7 |

**Evaluation Pattern:**

**II. Continuous Internal Examination: 60 Marks**

b. **Mid Sem - I** 20 marks

Syllabus:

ii. Introduction to Employability skills

iii. JAM & Group Discussion

c. **Mid – II** 20 Marks

Syllabus:

vii. Interview Skills

viii. Presentation skills

d. **Internal assessment** 20 marks

iv. Seminars: 10 marks

v. Assignments: 5 marks

vi. Lab record submission: 5 marks

**III. Semester End Examination: 40 Marks**

b. Write an essay on a given topic or participate in an activity: 15 Marks

c. Interview or Group Discussion: 15 Marks

d. *Viva Voce* 10 marks

**References:**


Adair, John. *Effective Communication*. London: Pan Macmillan Ltd., 2003.

Ajmani, J. C. *Good English: Getting it Right*. New Delhi: Rupa Publications, 2012.

Amos, Julie-Ann. *Handling Tough Job Interviews*. Mumbai: Jaico Publishing, 2004.

Collins, Patrick. *Speak with Power and Confidence*. New York: Sterling, 2009.

Fensterheim, Herbert and Jean Baer. *Don't Say Yes When You Want To Say No*. New York: D

Raman, Meenakshi & Sangeeta Sharma. *Technical Communication: Principles and Practice*. Second Edition. New Delhi: Oxford University Press, 2011


**E-Learning Resources:**

http://www.dailywritingtips.com/

http://www.englishdaily626.com/c-errors.php

http://www.owlnet.rice.edu/~cainproj/

http://www.thehumorsource.com/

http://www.indiabix.com/group-discussion/topics-with-answers/

http://networketiquette.net/

https://public.wsu.edu/~brians/errors

http://www.bbc.co.uk/worldservice/learningenglish/radio/specials/15

| Unit No | Unit name | Periods | Questions for SEE | | | Marks weightage | %Weightage |
|---|---|---|---|---|---|---|---|
| | | | R | U | A | | |
| 1. | Introduction to Employability Skills | **6** | | | **2** | **2** | |
| 2 | JAM/ Group Discussions | **9** | | | **2** | **2** | |
| 3 | Interview Skills | **9** | | | **2** | **2** | |
| 4. | Presentation Skills | **9** | | | **2** | **2** | |
| 5. | Writing skills at work place | **6** | | | **1** | **1** | |
| 6. | Workplace awareness | **6** | | | **1** | **1** | |
| | **Total** | **45** | | | **10** | | **100** |

**BOARD DIPLOMA EXAMINATION (C-21)**
**MID SEMESTER EXAMINATION – I**
**HU-410- EMPLOYABILITY SKILLS LAB**

**Time: 1 Hour** **Total Marks: 20**

**Part – A** **10 marks**

***Instruction:*** *Answer any one of the following questions.*

1. Write a paragraph on the importance of employability skills.
2. List out the important employability skills.
3. Mention the different strategies to enhance the employability skills.

**Part – B** **10 marks**

***Instruction:*** *Answer any one of the following questions.*

4. What are the rules to be implemented in a JAM session?
5. What are the do's and don'ts of a group discussion.
6. List out the steps involved in a group discussion and mention some phrases and expressions commonly used.

**BOARD DIPLOMA EXAMINATION (C-21)**
**MID SEMESTER EXAMINATION - II**
**HU-410- EMPLOYABILITY SKILLS LAB**

**Time : 1 Hour** **Total Marks: 20**

**Part – A** **10 marks**

***Instruction:*** *Answer any one of the following questions.*

1. Write a list of frequently asked questions in an interview. Write the answers for the questions.
2. Mention the instructions to attend a telephonic interview.
3. What are the do's and don'ts for a formal interview?

**Part – B** **10 marks**

***Instruction:*** *Answer any one of the following questions.*

4. Write the various steps involved in making presentations effectively.
5. What are the do's don'ts of body language during a presentation?
6. List out a few audio-visual aids and explain their role in making an effective presentation.

**BOARD DIPLOMA EXAMINATION (C-21)**
**SEMESTER END EXAMINATION**
**HU-410- EMPLOYABILITY SKILLS LAB**

**Time: 3 Hours** **Total Marks: 40**

**Part – A** **10 marks**

***Instruction:*** *Pick any one question from the given lot.*

1. How are employability skills helpful to secure a good job?
2. Describe the steps involved in JAM and group discussion.
3. Write the guidelines involved in making a good presentation.
4. List few professional ethics useful at workplace.
5. Mention few skills involved in writing at workplace.

**Part – B** **15 marks**

6. Interview / Group Discussion

**Part – C** **15 marks**

7. *Viva Voce*

# EC-411: SKILL UPGRADATION

| | | | |
|---|---|---|---|
| Course Title | Skill Upgradation | Course Code | EC-411 |
| Semester | III | Course Group | Core |
| Teaching Scheme in periods ( L : T :P) | 0:0:8 | Credits | 2.5 |
| Methodology | Activities | Total Contact Periods | 120 |
| CIE | Rubrics | SEE | Nil |

**Rationale:** This course is introduced for all semesters with a purpose of providing outside classroom experiences that lead to overall development of the students. One whole day is allocated for activities.

**Course Objective**

To create an awareness on Engineering Ethics and Human Values.

1. To instill Moral, Social Values and Loyalty.
2. Create awareness about social responsibilities of Engineers
3. To improve Communication and Participation skills

**Course Content**

| Activity No | Activity | Periods | Frequency |
|---|---|---|---|
| 1 | Haritha Haram(plantation &Maintenance) | 9 | 3 times in a semester |
| 2 | Waste management | 12 | 3 times in a semester |
| 3 | Swatch Bharat | 28 | 4 times in a semester |
| 4 | Mini projects | 7 | 1 time in a semester |
| 5 | Video Clips | 9 | 3 times in a semester |
| 6 | Seminar/Quiz/Presentation/Group discussion | 18 | 6 times in a semester |
| 7 | Local Visits (also with in the campus) | 6 | 2 times |
| 8 | Expert Lectures<br>• Ethical issues in engineering practice<br>• Environmental ethics | 31 | 4 times in a semester |
| | Total Periods | 120 | |

Waste Disposal-Semiconductor waste

- Motor Vehicles Act
- Emerging technologies
- Indian Culture and Yoga

Note: in case Expert faculty are not available English faculty may handle the expert lectures or Video clips on the suggested lectures may be played

**Course Outcomes**

| CO | Outcome | CO/PO Mapping |
|---|---|---|
| **CO1** | Practice the moral values that ought to guide the Engineering profession | 1,2,5,6,7,8,9,10 |
| **CO2** | Develop the set of justified moral principles of obligation, ideals that ought to be endorsed by the engineers and apply them in real life situations | 8,10 |
| **CO3** | Create awareness of saving environment through activities | 3,4,5,8,9 |
| **CO4** | Create awareness of Constitution of India | 1,4,7,8,9,10 |

**COURSE CONTENT:**

**Ethical issues in engineering practice**

Ethical issues–Industrial standards-Environmental ethics –Plastic waste disposal-E-Waste Disposal-Semi conductor waste Disposal-Industrial waste disposal-Human centered environmental ethics- computer ethics –Types of issues-Computer as the Instrument and Object of Unethical Acts -Engineers as managers-Codes of ethics-Sample code of Ethics like -Institution of Engineers(India)-Institute of Electrical & Electronics engineers-Institute of Electronics & Telecommunication Engineers - Indian Institute of Materials Management.

**Evaluation:**

The student must maintain a record of all activities conducted on *skill upgradation/ Activities* day and prepare a soft copy of report and submit it to their mentor or upload to the institute website or mail.

The reports shall be evaluated by the mentors though rubrics and accordingly give the eligibility for 2.5 credits. The student must have participated in at least 75% of activities to get eligibility.

## EC-402: Microcontrollers

**Suggested student activities.**

1. Learn how to download keilsoftware.
2. Propose how to manage thee-waste.
3. Down load ed-sim simulator and know itsworking.
4. Learn the latest microcontrollers used in day to dayapplications.
5. Prepare a simple PCB to interface a switch andLED.

**Model of rubrics for assessing student activity:**

| Type of Skill/Score | Excellent(4) | Good(3) | Satisfactory(2) | Developing(1) |
|---|---|---|---|---|
| **Data/Material Collection** | All Data/Material was collected one time independently. Collects a great deals of information, all refer to the topic | All Data/Material was collected more than one time independently. Collects more information, most refer to the topic | All Data/Material was collected several times independently. Collects basic information, most refer to the topic | All Data/Material was collected several times with assistance. Collects very limited information, some relate to topic |
| **Methodology/ Procedure** | Procedures were outlined in a step-by-step fashion that could be followed by anyone without additional explanations. | Procedures were outlined in a step- by-step fashionthat could be followed by anyone without additional explanations. Expert help was needed to accomplish this. | Procedures were outlined in a step-by-step fashion, but had 1 or 2 gaps that require explanation even after expert feedback. | Procedures that were outlined were incomplete or not sequential, even after expert feedback had been given. |
| **Activity/ Development** | Quality of Skill is high. | Skill is mastered to the level of expectation. | Skill is present but with errors and omissions. | Skill needs improvement. |
| **Interpretation/ summary** | Student provided a detailed conclusion clearly. | Student provided a somewhat detailed conclusion clearly. | Student provided a conclusion withsomereference. | No conclusion was apparent. |
| **Full-fills team roles and duties** | Performs all duties of assigned team roles | Performs almost all duties | Performs nearly all duties | Performs very little duties |
| **Shares work equality** | Always does the assigned work, without needing reminding | Always does the assigned work, rarely needs reminding | Usually does the assigned work, rarely needs reminding | Rarely does the assigned work, often needs reminding. |
| **Listen to other team mates** | Listens and talks a fare amount | Listens and talks a little more than needed | Listens, but sometimes talk too much | Usually does most of the talking, rarely allows others to speak |

**EC-403: Linear Integrated Circuits & Thyristors**

**Suggested Student Activities:**

1. Student visits Library to refer to Manual of Operational amplifiers
2. Student inspects the available equipment in the Lab to test the applications of op-amp
3. Visit near by Industry to familiarize with fabrication techniques of ICs and Thyristors
4. Participate in the Quiz
5. Participate in Group discussion
6. Search internet for circuits using the operational amplifier and thyristors

**Model of rubrics for assessing student activity:**

| **Dimension** | **Scale** | | | | |
|---|---|---|---|---|---|
| | **1 Unsatisfactory** | **2 Developing** | **3 Satisfactory** | **4 Good** | **5 Exemplary** |
| 1. Information search and documentation | Does not collect information relate to topic | Collects very limited information, some relate to topic | Collects basic information, most refer to the topic | Collects more information, most refer to the topic | Collects a great deals of information, all refer to the topic |
| **Suggested E-Learning references** 2. Full-fills team roles and duties | Does not perform any duties assigned to the team role | Performs very little duties | Performs nearly all duties | Performs almost all duties | Performs all duties of assigned team roles |
| 3. Shares work equality | Always relies on others to do the work | Rarely does the assigned work, often needs reminding | Usually does the assigned work, rarely needs reminding | Always does the assigned work, rarely needs reminding. | Always does the assigned work, without needing reminding |
| 4. Listening skills | Is always talking, never allows anyone to else to speak | Usually does most of the talking, rarely allows others to speak | Listens, but sometimes talk too much, | Listens and talks a little more than needed. | Listens and talks a fare amount |

## EC-404: Microwave Communication and Television

**Suggested Student Activities:**

1. Students visits Library to refer to Manuals and related books of microwave Communication.
2. Student inspects the available equipment in the Lab.
3. Visit nearby Industry to familiarize with working of various radar satellite communication systems.
4. Prepare a report on the limitations of microwave signals for conventional low frequency devices.
5. Visit the local BSNL office and prepare a report on it.
6. Visit the local Microwave station and prepare a report on it.
7. Prepare a report on different types of antennas used in radar application.
8. Prepare a report on Historical background of Satellite.
9. Prepare a report on Indian satellites.
10. Prepare a report on activities of ISRO.

## EC-406: Linear Integrated Circuits Lab

**Suggested Student Activities**

(i) Collection of catalogues and specification sheets, preparation of a chart displaying symbols of passive components and connectors/cables.

(ii) Collection of the contributors (scientists) and contribution details to the field of Electrical and Electronics engineering

(iii) Any other such activities that can contribute to the student's knowledge in respect of this course.

(iv) Record the best practices used in the disposal of E-waste and precautions in the operation of electrical appliances.

## EC-407 - COMMUNICATION LAB

**Suggested Student Activities:**

(i) Collection of catalogues and specification sheets, preparation of a chart displaying symbols of passive components and connectors/cables.

(ii) Collection of the contributors (scientists) and contribution details to the field of Electrical and Electronics engineering

(iii) Any other such activities that can contribute to the student's knowledge in respect of this course.

(iv) Record the best practices used in the disposal of E-waste and precautions in the operation of electrical appliances.

## EC-409 MATLAB

**Suggested Student Activities:**

1. Practice with MATLAB environment
2. Write and Simulate different programs
3. Apply the MATLAB environment for developing simple programs

## HU-410

**Suggested Student Activities:**

- Paper Presentations
- Seminars
- Mock Interviews
- Telephonic Interviews
- Group Discussions
- Role Plays
- Creating advertisements
- Five-minute activities
- Creating a model of workplace

STUDENT ACTIVITY SHEET FOR SKILL UP GRADATION

The activity should be graded as

| Unsatisfactory | Developing | Satisfactory | Good | Excellent |
|---|---|---|---|---|
| 1mark | 2marks | 3marks | 4marks | 5marks |

Note:

1. Along with every activity the rubrics table should be given to the student for his information about the criterion of assessment.
2. As a record of the activity at least Rubric sheet for each student for every activity at least Rubric sheet for each student as be preserved as a document.

RUBRICS MODEL – Group activity like Mini Project

| RUBRICS FOR ACTIVITY (5 Marks) | | | | | | |
|---|---|---|---|---|---|---|
| Dimension | Unsatisfactory | Developing | Satisfactory | Good | Excellent | Student Score |
| | 1 | 2 | 3 | 4 | 5 | |
| Collection of data | Does not collect any information relating to the topic | Collects very limited information; some relate to the topic | Collect much information; but very limited relate to the topic | Collects some basic information; most refer to the topic | Collects a great deal of information; all refer to the topic | Ex: 4 |
| Fulfill team's roles & duties | Does not perform any duties assigned to the team role | Performs very little duties but Unreliable. | Performs very little duties | Performs nearly all duties | Performs all duties of assigned team roles | 5 |
| Shares work equally | Always relies on others to do the work | Rarely does the assigned work; often needs reminding | Usually does the assigned work; rarely needs reminding | Normally does the assigned work | Always does the assigned work without having to be reminded | 3 |
| Listen to other Team mates | Is always talking; never allows anyone else to speak | Usually does most of the talking; rarely allows others to speak | Talks good; but never show interest in listening others | Listens, but sometimes talk too much | Listens and speaks a fair amount | 2 |
| Average / Total marks= (4+5+3+2)/4=14/4=3.5=4 | | | | | | |
| | | | | | | |

## SKILL UPGRADATION ACTIVITIES

1. Visit the College library and prepare a list of at least 10 text books available in the library with author name and publishing company for each subject of the semester. The student should submit a handwritten report.
2. Do Market survey on List of Various Linear ICs and digital ICs available in the market and collect the information like pin diagrams, specifications, Price etc. The student should submit a handwritten report. Documents have to be maintained as a record.
3. To Study using internet about the applications of various Linear ICs which are useful to the society, design and demonstrate their working. Prepare a detailed report of their working and uses. Documents have to be maintained as a record.
4. To Study using internet about the applications of various Digital ICs which are useful to the society, design and demonstrate their working. Prepare a detailed report of their working and uses. Documents have to be maintained as a record.
5. To Study using internet about the various equipment like Analog Instruments and Digital Instruments available in the Lab and prepare a detailed report of their working and uses. Documents have to be maintained as a record.
6. To Study using internet about the various equipment like Analog Instruments and Digital Instruments available in the Lab and prepare a detailed report of their working and uses. Documents have to be maintained as a record.
7. To Study using internet about various equipment like function generators, CROs and various test instruments available in the Lab and prepare a detailed report of their working and uses. Documents have to be maintained as a record.