

**ST. Xavier's Technical Institute,  
Mahim, Mumbai 400 016**

**Revised Curriculum  
For  
Diploma Programme in  
Electronics and  
Telecommunication  
Engineering**

**From July 2023**

**A.Y.2023-24**



**ST. Xavier's Technical Institute, Mahim, Mumbai 400 016**  
**Diploma Programme in Electronics and Telecommunication Engineering**  
**Programme Structure**

**Programme Educational Objectives (PEO)**

*(What the student will continue to do even after 3-5 years of working in the industry)*

**PEO1:** To produce diploma holders who have the ability to demonstrate technical competence in the fields of Electronics and Telecommunication engineering and develop solutions to the problems.

**PEO2:** To produce diploma holders who would be able to take individual responsibility and to work as a part of a team towards the fulfillment of both individual and organizational goals.

**PEO3:** To prepare the students to engage in professional development through self-study, graduate and professional studies in engineering, management and research.

**Program Outcomes (PO) given by NBA.**

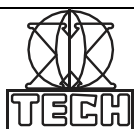
*(What the student will be able to do at the entry point of industry soon after diploma programme)*

**PROGRAM OUTCOMES (POs)**

1. **Basic and Discipline specific knowledge:** Apply knowledge of basic mathematics, science and engineering fundamentals and engineering specialization to solve the engineering problems.
2. **Problem analysis:** Identify and analyse well-defined engineering problems using codified standard methods.
3. **Design/ development of solutions:** Design solutions for well-defined technical problems and assist with the design of systems components or processes to meet specified needs.
4. **Engineering Tools, Experimentation and Testing:** Apply modern engineering tools and appropriate technique to conduct standard tests and measurements.
5. **Engineering practices for society, sustainability and environment:** Apply appropriate technology in context of society, sustainability, environment and ethical practices.
6. **Project Management:** Use engineering management principles individually, as a team member or a leader to manage projects and effectively communicate about well-defined engineering activities.
7. **Life-long learning:** Ability to analyse individual needs and engage in updating in the context of technological changes.

### **Note for All the Semesters :**

1. Every student has to pass in each head of End-Semester-Examination (ESE) i.e Theory, Practical, Term work by securing minimum of 40% marks of the maximum marks i.e. ::--
  - For Theory ( ESE ) ::--- 28 out of 70 marks
  - For Theory ( ESE ) ::--- 32 out of 80 marks
  - For Practical ( ESE ) ::--- 20 out of 50 marks
  - For Term work ::--- 10 out of 25 marks
  - For Term work ::--- 20 out of 50 marks
2. Progressive Assessment (PA) for Theory includes – average of two PTs of 20 marks each. Progressive Assessment (PA) for Practical includes lab performance , micro projects, Assignment/Quiz/Presentations & attendance as per the course. The scheme and schedule for progressive assessment should be informed to the students and discussed with them at the start of the term.
3. For developing self-directed learning skills, from each course about 15-20% of the topics/sub-topics, which are relatively simpler or descriptive in nature are to be given to the students for self-study , proper learning of these topics should be assured by Assignment/Quiz/conducting classroom presentations of students by respective faculty.



# ST. XAVIER'S TECHNICAL INSTITUTE, MAHIM, MUMBAI 400 016

## TEACHING AND EXAMINATION SCHEME

REVISED AND EFFECTIVE  
FROM JULY 2023

**Program Name ::--- Electronics & Telecommunication Engineering**

**SEMESTER ::--- FOUR**

**Duration ::--- 16 weeks**

**ACADEMIC YEAR - 2023-24**

**TEACHING SCHEME**

**EXAMINATION SCHEME**

| SR.NO | COURSE TITLE             | COURSE CODE | L  | T  | P  | CREDITS | Exam Duration in Hrs | THEORY    |           |           |           |           |           | PRACTICAL |           |           |           |           |           | GRAND TOTAL |
|-------|--------------------------|-------------|----|----|----|---------|----------------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-------------|
|       |                          |             |    |    |    |         |                      | ESE       |           | PA        |           | TOTAL     |           | ESE       |           | PA        |           | TOTAL     |           |             |
|       |                          |             |    |    |    |         |                      | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks | Max Marks | Min Marks |             |
| 1     | Microcontroller          | ETPC401     | 03 | 00 | 02 | 4       | 3                    | 70        | 28        | 30#       | 00        | 100       | 40        | 50        | 20        | 25        | 10        | 75        | 30        | 175         |
| 2     | Digital Communication    | ETPC402     | 03 | 00 | 02 | 4       | 3                    | 70        | 28        | 30#       | 00        | 100       | 40        | 50        | 20        | 25        | 10        | 75        | 30        | 175         |
| 3     | Circuit Network          | ETES403     | 03 | 00 | 02 | 4       | 3                    | 70        | 28        | 30#       | 00        | 100       | 40        | 50        | 20        | 25        | 10        | 75        | 30        | 175         |
| 4     | Power Electronics        | ETPC404     | 03 | 00 | 02 | 4       | 3                    | 70        | 28        | 30#       | 00        | 100       | 40        | 50        | 20        | 25        | 10        | 75        | 30        | 175         |
| 5     | Program Elective-1       | ETPE405     | 00 | 00 | 04 | 2       | ----                 | ----      | ----      | ----      | ----      | ----      | ----      | 50        | 20        | 50        | 20        | 100       | 40        | 100         |
| 6     | Open Elective-1 MOOC     | ETOE406     | 01 | 00 | 00 | 1       | ----                 | ----      | ----      | ----      | ----      | ----      | ----      | ----      | ----      | 25        | 10        | 25        | 10        | 25          |
| 7     | Python Programming in ML | ETES407     | 00 | 00 | 02 | 1       | ----                 | ----      | ----      | ----      | ----      | ----      | ----      | 50        | 20        | 25        | 10        | 75        | 30        | 75          |
| 8     | Social & Life Skills     | ETAU408     | 02 | 00 | 00 | 0       | ----                 | ----      | ----      | ----      | ----      | ----      | ----      | ----      | ----      | ----      | ----      | ----      | ----      | ----        |
|       | TOTAL                    |             | 15 | 00 | 14 | 20      |                      | 280       |           | 120       |           | 400       |           | 300       |           | 200       |           | 500       |           | 900         |

**Total No. of Credits = 20      Total No. of Student Contact Hours = 29 Hrs.**

**Total Marks      900**

**Theory and Practical periods of 60 minutes each.**

**Medium of Instruction ::- English**

|               |    |          |     |                        |      |                    |
|---------------|----|----------|-----|------------------------|------|--------------------|
| Abbreviations | TH | Theory   | ESE | End Semester Exam      | ---- | Not Applicable     |
|               | TU | Tutorial | PA  | Progressive Assessment | *    | Online Examination |

**Program Elective-1 ----- 1) IOT    2) Repair Maintenance of Consumer Electronic Appliances ----- ANY ONE course can be offer**

**Open Elective-1 MOOC ----- 1) Renewable Energy Technologies 2) Introduction to E-Governance 3) Web Designing and Multimedia Technology**  
MOOC course can be selected from suggested list or it can be decided by Faculty in charge by referring NPTEL, ATAL, Springboard etc.

Progressive Assessment # (PA) for Theory includes – out of 30 marks, 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. Progressive Assessment (PA) for Practical includes lab performance , micro projects, Assignment/Quiz/Presentations & attendance as per the course

| Program Title   |                                                                                                                                                                                                                                                                                                    |           |              | Diploma in Electronics & Telecommunication Engineering |     |       |           |       |        |           |       |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|--------------------------------------------------------|-----|-------|-----------|-------|--------|-----------|-------|
| Course Code     | ETPC 401                                                                                                                                                                                                                                                                                           |           | Course Title | MICROCONTROLLER                                        |     |       |           |       |        | Semester  | 4     |
| Teaching Scheme |                                                                                                                                                                                                                                                                                                    |           |              | Examination Scheme                                     |     |       |           |       |        |           |       |
| Credits         |                                                                                                                                                                                                                                                                                                    |           |              | Theory                                                 |     |       | Practical | Oral  | Online | Term work | Total |
| Lecture         | Tutorial                                                                                                                                                                                                                                                                                           | Practical | Total        | ESE                                                    | PA  | Total |           |       |        |           |       |
| 3               | -----                                                                                                                                                                                                                                                                                              | 2         | 4            | 70                                                     | 30# | 100   | 50        | ----- | -----  | 25        | 175   |
|                 |                                                                                                                                                                                                                                                                                                    |           |              |                                                        |     |       |           |       |        |           |       |
|                 | 1) Theory paper duration 3 hrs.<br>2) Theory paper assessment is Internal and External.<br>3) The assessment of practical is Internal and External.<br>4) # Progressive Assessment out of 30 marks , 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. |           |              |                                                        |     |       |           |       |        |           |       |

**RATIONALE:**

This subject which comes under the Applied Technology group will enable the students to comprehend the theory, concepts, working of microprocessors and microcontrollers, their programming and also their applications in electronic systems. The knowledge acquired by student will help them to design, test, troubleshoot and program microcontroller based systems. Knowledge of microprocessors will provide a quicker grasping and understanding of the internal working and operation of microcontroller based control systems in industry.

**COURSE OUTCOMES ::--**

Course theory content, practical skills, experience help student to understand basic electronics communication terms & devices methods, thus student should able to

|               |                                                                                           |                                              |                         |
|---------------|-------------------------------------------------------------------------------------------|----------------------------------------------|-------------------------|
| Semester      | <b>4</b>                                                                                  | Subject                                      | <b>MICROCONTROLLERS</b> |
|               |                                                                                           | <b>8<sup>th</sup> subject in Second Year</b> |                         |
| <b>C401.1</b> | <b>Analyze the architecture of 8051 Microcontrollers.</b>                                 |                                              |                         |
| <b>C401.2</b> | <b>Develop assembly language program for microcontroller applications.</b>                |                                              |                         |
| <b>C401.3</b> | <b>Illustrate the functions of SFRs in microcontroller applications.</b>                  |                                              |                         |
| <b>C401.4</b> | <b>Interface the special purpose peripherals 8255 and 0808 with 8051 microcontroller.</b> |                                              |                         |
| <b>C401.5</b> | <b>Demonstrate the designing of a microcontroller based system.</b>                       |                                              |                         |
| <b>C401.6</b> | <b>Interface External devices with microcontroller</b>                                    |                                              |                         |

## Mapping of Course outcomes (COs) to Program outcomes (POs)

| SEM III           | MICROCONTROLLER                                               |     |     |     |     |     |     |
|-------------------|---------------------------------------------------------------|-----|-----|-----|-----|-----|-----|
| CO 401            | (8 <sup>th</sup> subject in Second Year) PREPARED BY : VN,RVG |     |     |     |     |     |     |
| CO 401            | PO1                                                           | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
| CO 401.1          | 1                                                             |     | 3   |     | 1   | 1   | 1   |
| CO 401.2          | 1                                                             | 1   | 3   | 1   |     | 1   | 1   |
| CO 401.3          | 2                                                             | 2   | 3   | 1   |     | 1   | 1   |
| CO 401.4          | 1                                                             | 2   | 3   | 1   | 1   |     | 1   |
| CO 401.5          | 1                                                             | 2   | 3   | 1   | 1   |     |     |
| CO 401.6          | 1                                                             | 2   | 3   | 1   | 1   | 1   | 1   |
| CO 401 TOTAL      | 7                                                             | 09  | 18  | 05  | 04  | 04  | 05  |
| CORRELATION LEVEL | 1                                                             | 2   | 3   | 1   | 1   | 1   | 1   |

## TABLE TO DECIDE CORRELATION LEVELS

|                   |    |    |    |
|-------------------|----|----|----|
| CO SUM TOTAL      | 06 | 12 | 18 |
| CORRELATION LEVEL | 1  | 2  | 3  |

|                   |         |                  |                       |                |
|-------------------|---------|------------------|-----------------------|----------------|
| CO SUM TOTAL      | 0, 1, 2 | 3, 4, 5, 6, 7, 8 | 9, 10, 11, 12, 13, 14 | 15, 16, 17, 18 |
| CORRELATION LEVEL | 0       | 1                | 2                     | 3              |

Subject Experts

Mr. Vinaykumar S. Nagalika

Mr. R. V. Gheware

|            | Section -- 1                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |       |   |   |       |        |
|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|---|---|-------|--------|
| Chapter No | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Periods | Marks |   |   |       | COs    |
|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Hrs.    | R     | U | A | Total |        |
| <b>1</b>   | <b>INTRODUCTION TO MICROCONTROLLER 8051</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |         |       |   |   |       |        |
|            | <ul style="list-style-type: none"> <li>Simplified Block diagram of Microcontroller System, Buses &amp; Their types: Address bus, Data bus &amp; Control Bus.</li> <li>Comparison between Microprocessor &amp; Microcontroller.</li> <li>Specifications of MCS-51 Microcontrollers.</li> <li>Pin Diagram of 8051.</li> <li>Internal block diagram of 8051, memory organization.</li> <li>8051 machine cycle concept, significance of flags, ports.</li> </ul> | 08      | 4     | 3 | 8 | 15    | C401.1 |
| <b>2</b>   | <b>8051 INSTRUCTION SET</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |         |       |   |   |       |        |
|            | <ul style="list-style-type: none"> <li>Detailed study of 8051 Instructions, instruction classification, Addressing modes.</li> <li>8051 Programs for simple arithmetic and Logical problems. (find largest/smallest number, search given number in block of memory, block transfer )</li> <li>Concept of Subroutine &amp; Stack , Delay Subroutine</li> </ul>                                                                                                | 08      | 2     | 4 | 4 | 10    | C401.2 |
| <b>3</b>   | <b>TIMER &amp; (UART)SERIAL PORT PROGRAMMING</b>                                                                                                                                                                                                                                                                                                                                                                                                             |         |       |   |   |       |        |
|            | <ul style="list-style-type: none"> <li>TMOD, TCON, Programs on Delay and counters using timer.</li> <li>SCON, SBUF, Programs for serial data communication.</li> </ul>                                                                                                                                                                                                                                                                                       | 08      | 2     | 4 | 4 | 10    | C401.3 |

|             | Section -- 2                                                                                                                                                                                                                                                                                                                                   |         |       |   |   |       |               |
|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|---|---|-------|---------------|
| Chapter No. | Topics                                                                                                                                                                                                                                                                                                                                         | Periods | Marks |   |   |       | COs           |
|             |                                                                                                                                                                                                                                                                                                                                                | Hrs.    | R     | U | A | Total |               |
| <b>4</b>    | <b>INTERRUPTS &amp; INTERFACING WITH EXTERNAL MEMORY</b>                                                                                                                                                                                                                                                                                       |         |       |   |   |       |               |
|             | <ul style="list-style-type: none"> <li>Semiconductor Memory: RAM, EPROM</li> <li>Study of Peripherals PPI 8255 interfacing with UC 8051.</li> <li>Interfacing with external ROM and RAM</li> <li>Interrupt structure, concept of interrupt priorities, IE &amp; IP registers,</li> </ul>                                                       | 08      | 4     | 4 | 7 | 15    | <b>C401.4</b> |
| <b>5</b>    | <b>APPLICATIONS OF 8051</b>                                                                                                                                                                                                                                                                                                                    |         |       |   |   |       |               |
|             | <ul style="list-style-type: none"> <li>ADC 0808-interfacing with 8051. 8051 Program to read data from ADC.</li> <li>DAC 0800-interfacing with 8051. 8051 Program to read data from DAC.</li> <li>Concept of KEYBOARD and LCD Display &amp; its interfacing. 8051 program to display some numbers/characters on multiplexed display.</li> </ul> | 08      | 2     | 4 | 4 | 10    | <b>C401.5</b> |
| <b>6</b>    | <b>INTERFACING WITH RELAYS AND MOTORS</b>                                                                                                                                                                                                                                                                                                      |         |       |   |   |       |               |
|             | <ul style="list-style-type: none"> <li>Interfacing with Relay. 8051 program to control Relay.</li> <li>DC motor Interfacing and PWM. 8051 program to control DC motor.</li> <li>Stepper Motor interfacing &amp; 8051 program to control stepper motor.</li> </ul>                                                                              | 08      | 2     | 4 | 4 | 10    | <b>C401.6</b> |



**IMPLEMENTATION STRATEGY:**

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples
- 4) Group discussions and micro project
- 5) Assignments for writing skills, create awareness about selection /purchasing components

**LIST OF LABORATORY EXPERIENCES**

| EXP. NO. | TITLE                                                                                                                                                                 | COURSE OUTCOME | CHAPT. NO. |
|----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------|
| 1        | Demonstration of 8051 assembler, simulator                                                                                                                            | <b>C401.1</b>  | 1          |
| 2        | 8051 program to move a block of data to other memory locations and to compliment a block of data in successive memory locations                                       | <b>C401.2</b>  | 1          |
| 3        | 8051 program to find largest and smallest of 8 bit numbers stored in successive memory locations                                                                      | <b>C401.2</b>  | 2          |
| 4        | 8051 program to sort five 8 bit numbers in ascending as well as descending order                                                                                      | <b>C401.3</b>  | 2          |
| 5        | 8051 program to search given byte of block in external memory and to convert a 2 digit BCD number to Hex                                                              | <b>C401.4</b>  | 2          |
| 6        | To add five bytes in successive memory locations of external memory and do the same for program memory AND program to transmit and receive five bytes serially        | <b>C401.3</b>  | 3          |
| 7        | Using assembly language/ embedded C Program to flash L.E.D. interfaced to port of 8051.using (a) delay subroutine (b) using one of the timers of 8051 microcontroller | <b>C401.3</b>  | 3          |
| 8        | Using assembly language/ embedded C Program read data from an ADC interfaced to the 8051 microcontroller                                                              | <b>C401.4</b>  | 4          |
| 9        | To interface a keyboard with 8051 and read data using assembly language/ embedded C Program                                                                           | <b>C401.4</b>  | 5          |
| 10       | Using assembly language/ embedded C Program interface seven segment LED display with 8051                                                                             | <b>C401.5</b>  | 5          |
| 11       | Using assembly language/ embedded C Program interface stepper motor with 8051.                                                                                        | <b>C401.6</b>  | 6          |
| 12       | Study of Hardware Interrupts                                                                                                                                          | <b>C401.4</b>  | 6          |
| 13       | To Interface LCD's                                                                                                                                                    | <b>C401.6</b>  | 6          |
| 14       | To generate square and sawtooth waves using DAC 0832                                                                                                                  | <b>C401.5</b>  | 6          |
| 15       | Interfacing 8051 with a DC Motor                                                                                                                                      | <b>C401.6</b>  | 6          |
|          |                                                                                                                                                                       |                |            |
|          |                                                                                                                                                                       |                |            |
|          |                                                                                                                                                                       |                |            |

Fault finding practicals are demo experiments which is an extra skill imparted in the laboratory and not covered in theory.

| Chapter No. | Title                                                           | Teaching Hours | Distribution of Theory Marks |         |         |             |
|-------------|-----------------------------------------------------------------|----------------|------------------------------|---------|---------|-------------|
|             |                                                                 |                | R Level                      | U Level | A Level | Total Marks |
|             | Section I                                                       |                |                              |         |         |             |
| 1           | Introduction to Microcontroller 8051                            | 08             | 4                            | 3       | 8       | 15          |
| 2           | 8051 Instruction set                                            | 08             | 2                            | 4       | 4       | 10          |
| 3           | TIMER & (UART)SERIAL PORT PROGRAMMING,                          | 08             | 2                            | 4       | 4       | 10          |
|             |                                                                 |                |                              |         |         |             |
| 4           | Interrupts & Interfacing with external Memory.                  | 08             | 4                            | 4       | 7       | 15          |
| 5           | Applications of 8051.                                           | 08             | 2                            | 4       | 4       | 10          |
| 6           | Interfacing with Relays and Motors.                             | 08             | 2                            | 4       | 4       | 10          |
|             | Total                                                           | 48             | 16                           | 23      | 31      | 70          |
|             | Legends :: R ::- Remember , U ::- Understand , A ::-Application |                |                              |         |         |             |

This specification table provide guide line to teacher to teach & assess student also a general guideline to frame theory paper & practical theory exam paper which student have to undertake. The actual distribution of marks at different taxonomy level in the question paper may vary from above table.

## **REFERENCES**

| <b>Sr. No.</b> | <b>Author</b>       | <b>Title</b>                                            | <b>Edition</b> | <b>Year of Publication</b> | <b>Publisher &amp; Address</b>       |
|----------------|---------------------|---------------------------------------------------------|----------------|----------------------------|--------------------------------------|
| 1.             | Intel               | Intel data sheets                                       |                |                            | IntelUSA                             |
| 2.             | Muhammad Ali Mazidi | The 8051 microcontroller                                | 1st            | 2002                       | Pearson Education<br>Delhi Branch    |
| 3.             | Kenneth Ayala       | The 8051 microcontroller                                | 1st            | 1988                       | Prentice Hall Int                    |
| 4.             | Douglas V. Hal      | Microprocessors & Interfacing<br>Programming & Hardware |                |                            | McGraw Hill<br>International Edition |

## **LEARNING WEBSITES / WEB REFERENCES :**

- <https://datasheet4u.com/datasheet-pdf/Intel/8085/pdf.php?id=1462411>
- [https://datasheet4u.com/share\\_search.php?sWord=8051](https://datasheet4u.com/share_search.php?sWord=8051) www.Youtube.com
- [www.keil.com](http://www.keil.com)

| Program Title                                                                                                                                                                                                                                                                                      |          |           |              | Diploma in Electronics & Telecommunication Engineering |     |       |           |       |        |           |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|--------------|--------------------------------------------------------|-----|-------|-----------|-------|--------|-----------|-------|
| Course Code                                                                                                                                                                                                                                                                                        | ETPC 402 |           | Course Title | DIGITAL COMMUNICATION                                  |     |       |           |       |        | Semester  | IV    |
| Teaching Scheme                                                                                                                                                                                                                                                                                    |          |           |              | Examination Scheme                                     |     |       |           |       |        |           |       |
| Credits                                                                                                                                                                                                                                                                                            |          |           |              | Theory                                                 |     |       | Practical | Oral  | Online | Term work | Total |
| Lecture                                                                                                                                                                                                                                                                                            | Tutorial | Practical | Total        | ESE                                                    | PA  | Total |           |       |        |           |       |
| 3                                                                                                                                                                                                                                                                                                  | -----    | 2         | 4            | 70                                                     | 30# | 100   | 50        | ----- | -----  | 25        | 175   |
|                                                                                                                                                                                                                                                                                                    |          |           |              |                                                        |     |       |           |       |        |           |       |
| 1) Theory paper duration 3 hrs.<br>2) Theory paper assessment is Internal and External.<br>3) The assessment of practical is Internal and External.<br>4) # Progressive Assessment out of 30 marks , 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. |          |           |              |                                                        |     |       |           |       |        |           |       |

**RATIONALE:**

This subject comes under the Applied Technology category. Presently, majority of the telecommunication systems operate on the basis of digital principles. It demands that the student has a good working knowledge of fundamentals of pulse and data communication. The subject will help the student in understanding the concepts of various pulse modulation techniques and methods of generating and demodulating, in each of the pulse modulation systems and digital carrier modulation systems.

**COURSE OUTCOMES :: --**

Course theory content, practical skills, experience help student to understand basic terms , functions & uses of Digital Communication , thus student should able to

| Semester      | <b>IV</b> | Subject                                                                                                              | <b>DIGITAL COMMUNICATION</b> |
|---------------|-----------|----------------------------------------------------------------------------------------------------------------------|------------------------------|
|               |           | 9 <sup>th</sup> Subject in Second Year                                                                               |                              |
| <b>C402.1</b> |           | <b>Calculate the performance parameters of Digital Communication System using the concepts of Information theory</b> |                              |
| <b>C402.2</b> |           | <b>Encode the analog information using analog pulse modulation techniques.</b>                                       |                              |
| <b>C402.3</b> |           | <b>Convert analog signal into digital using different digital pulse modulation systems.</b>                          |                              |
| <b>C402.4</b> |           | <b>Categorize the various multiplexing techniques in modern digital communications.</b>                              |                              |
| <b>C402.5</b> |           | <b>Select appropriate digital modulation technique as per the system requirement</b>                                 |                              |
| <b>C402.6</b> |           | <b>Recover the original information through suitable digital demodulation technique.</b>                             |                              |

**Mapping of Course outcomes (COs) to Program outcomes (POs)**

| SEM IV            | <b>DIGITAL COMMUNICATION</b>                                           |     |     |     |     |     |     |
|-------------------|------------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|
|                   | (9 <sup>th</sup> Subject in Second Year ) <b>PREPARED BY : KHK, JN</b> |     |     |     |     |     |     |
| CO                | PO1                                                                    | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 |
| 1                 | 2                                                                      | 3   | 3   |     | 1   | 1   | 3   |
| 2                 | 2                                                                      | 3   | 3   |     |     | 2   | 1   |
| 3                 | 3                                                                      | 3   | 3   |     |     | 2   | 1   |
| 4                 | 3                                                                      | 3   | 3   | 3   | 3   | 2   | 2   |
| 5                 | 3                                                                      | 3   | 3   |     |     | 2   | 2   |
| 6                 | 2                                                                      | 3   | 3   | 2   | 2   | 2   | 2   |
| Total             | 15                                                                     | 18  | 18  | 05  | 06  | 11  | 11  |
| CORRELATION LEVEL | 3                                                                      | 3   | 3   | 1   | 1   | 2   | 2   |

**TABLE TO DECIDE CORRELATION LEVELS**

|                   |    |    |    |
|-------------------|----|----|----|
| CO SUM TOTAL      | 06 | 12 | 18 |
| CORRELATION LEVEL | 1  | 2  | 3  |

|                   |         |                  |                       |                |
|-------------------|---------|------------------|-----------------------|----------------|
| CO SUM TOTAL      | 0, 1, 2 | 3, 4, 5, 6, 7, 8 | 9, 10, 11, 12, 13, 14 | 15, 16, 17, 18 |
| CORRELATION LEVEL | 0       | 1                | 2                     | 3              |

**Subject Expert****Mr. K. H. Kamath****Dr. Janani Natarajan**

|            | Section - 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |           |           |           |           |                          |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|--------------------------|
| Chapter No | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Periods   | Marks     |           |           |           | COs                      |
|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Hrs.      | R         | U         | A         | Total     |                          |
| <b>1</b>   | <b>INFORMATION THEORY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |           |           |           |           |           |                          |
|            | 1.1 Introduction to digital communication.<br>1.2 Block diagram of basic digital communication system.<br>1.3 Definition and Expression for Measure of information Amount of information Average information (Entropy) Information rate, Channel capacity<br>1.4 Hartley's laws related to channel capacity<br>1.5 Shannon & Hartley theorem<br>1.6 Problems on above topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>10</b> | <b>04</b> | <b>05</b> | <b>05</b> | <b>14</b> | <b>C402.1</b>            |
| <b>2</b>   | <b>PULSE COMMUNICATIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |           |           |           |           |           |                          |
|            | 2.1 Pulse modulation – Definition, Types, Comparison with CW modulation<br>2.2 Analog Pulse modulation: PAM, PWM & PPM<br>2.2.1 Pulse Amplitude modulation (PAM) – Definition, Waveforms<br>2.2.2 Types - Single and Double Polarity type, Flat top and natural PAM<br>2.2.3 Generation of PAM<br>2.2.4 Pulse Width modulation (PWM) - Definition, waveforms<br>2.2.5 Types-Symmetrical, leading edge and trailing edge PWM<br>2.2.6 Generation of PWM<br>2.2.7 Pulse Position Modulation (PPM) Definition, waveforms<br>2.2.8 Generation of PPM from PWM; Block diagram of PPM transmitter<br>2.2.9 Comparison of PAM,PWM & PPM.<br>2.3 Digital Pulse Modulation<br>2.3.1 Pulse Code Modulation (PCM) – Definition, Waveforms<br>2.3.2 Principles of PCM generation.<br>2.3.3 Block diagram of PCM transmitter Companding<br>2.3.4 Block diagram of PCM receiver<br>2.3.5 Delta Modulation - working principle | <b>14</b> | <b>06</b> | <b>10</b> | <b>05</b> | <b>21</b> | <b>C402.2<br/>C402.3</b> |

| Section - 2 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |           |           |           |           |                                |
|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-----------|-----------|-----------|-----------|--------------------------------|
| Chapter No  | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Periods   | Marks     |           |           |           | COs                            |
|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Hrs.      | R         | U         | A         | Total     |                                |
| <b>3</b>    | <b>CHANNEL MULTIPLEXING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |           |           |           |           |           |                                |
|             | 3.1 Time Division Multiplexing (TDM)<br>Definition, Block diagram of a typical PAM TDM system, Waveforms, 5channel and 10channel PCM TDM Transmitter.<br>3.2 Frequency Division Multiplexing (FDM)<br>3.2.1 Definition ,Group formation<br>3.2.2 Block diagram of 12 channel Basic group<br>3.2.3 Block diagram of Super group<br>3.2.4 Standard frequency allocations and bandwidth, Pilot carrier frequencies<br>3.2.5 General block diagram of FDM Transmitter & Receiver<br>Comparison of TDM & FDM systems.                                                                                                                                                            | <b>10</b> | <b>04</b> | <b>05</b> | <b>05</b> | <b>14</b> | <b>C402.4</b>                  |
| <b>4</b>    | <b>BINARY MODULATION TECHNIQUES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |           |           |           |           |                                |
|             | 4.1 Amplitude Shift Keying (ASK) :<br>4.1.1 Definition, description, waveforms.<br>4.1.2 ASK modulator<br>4.1.3 ASK receiver<br>4.1.4 Advantages, disadvantages and applications<br>4.2 Frequency Shift Keying (FSK) :<br>4.2.1 Definition, description, waveforms<br>4.2.2 FSK modulator using Timer IC 555<br>4.2.3 FSK receiver (PLL type)<br>4.2.4 Advantages, disadvantages and applications<br>4.3 Phase-Shift Keying (PSK):<br>4.3.1 Definition, description, waveforms of BPSK signal<br>4.3.2 BPSK transmitter - Circuit diagram using Ring modulator<br>4.3.3 BPSK receiver<br>4.3.4 QAM – definition, constellation diagram, types, QAM transmitter(16 QAM only) | <b>14</b> | <b>06</b> | <b>10</b> | <b>05</b> | <b>21</b> | <b>C402.5</b><br><b>C402.6</b> |

**IMPLEMENTATION STRATEGY:**

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples
- 4) Group discussions and micro project
- 5) Assignments for writing skills, create awareness about selection /purchasing components

**LIST OF LABORATORY EXPERIENCES**

| EXP. NO. | TITLE                                                      | COURSE OUTCOME MAPPING |
|----------|------------------------------------------------------------|------------------------|
| 1        | Pulse Amplitude Modulation using op-amp(ADTRON KIT)        | C209.2                 |
| 2        | Pulse Amplitude Modulation using Transistor Circuit        | C209.2                 |
| 3        | Pulse Width Modulation using op-amp(ADTRON KIT)            | C209.2                 |
| 4        | Pulse Width Modulation using single op-amp                 | C209.2                 |
| 5        | Pulse Position Modulation using op-amp(ADTRON KIT)         | C209.2                 |
| 6        | Pulse Position Modulation using single op-amp              | C209.2                 |
| 7        | Frequency Shift Keyed Modulation                           | C209.5                 |
| 8        | Pulse Code Modulation                                      | C209.3                 |
| 9        | Time Division Multiplexing                                 | C209.4                 |
| 10       | Time Division De-Multiplexing                              | C209.4                 |
| 11       | Pulse Code Demodulation                                    | C209.3                 |
| 12       | Frequency Shift Keyed Demodulation                         | C209.6                 |
| 13       | ASK Modulation/ Demodulation (Anshuman CM6 Kit)            | C209.6                 |
| 14       | Frequency Division Multiplexing(Anshuman CM6 and P19 Kits) | C209.4                 |
| 15       | Quadrature Amplitude Modulation(Anshuman CM6 Kit)          | C209.5                 |

**SUGGESTED LIST OF MICROPROJECTS**

1. Applications of PWM: Brightness control in smart lighting systems, Speed control of motors.
2. Delta modulation based voice encoder-Decoder
3. Demonstration of applications of PSK in wireless LANs, RFID and Bluetooth communication.
4. Build and test simple FSK MODEM.
5. Demonstrate a simple BPSK modulator-Demodulator



**SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN**

| Chapte<br>rNo. | Title                           | Teachin<br>gHours | Distribution of Theory Marks |            |            |                |
|----------------|---------------------------------|-------------------|------------------------------|------------|------------|----------------|
|                |                                 |                   | R<br>Level                   | U<br>Level | A<br>Level | Total<br>Marks |
| Section I      |                                 |                   |                              |            |            |                |
| 1              | INFORMATION THEORY              | 10                | 04                           | 05         | 05         | 14             |
| 2              | PULSE COMMUNICATIONS            | 14                | 06                           | 10         | 05         | 21             |
| Section II     |                                 |                   |                              |            |            |                |
| 4              | CHANNEL MULTIPLEXING            | 10                | 04                           | 05         | 05         | 14             |
| 5              | BINARY MODULATION<br>TECHNIQUES | 14                | 06                           | 10         | 05         | 21             |
| Total          |                                 | 48                | 20                           | 30         | 20         | 70             |

**REFERENCES**

| Sr. No. | Author               | Title                                                   | Edition         | Year of Publication | Publisher & Address                 |
|---------|----------------------|---------------------------------------------------------|-----------------|---------------------|-------------------------------------|
| 1.      | George Kennedy       | Electronic Communication Systems                        | 4 <sup>th</sup> | 1999                | Tata McGraw-Hill New Delhi.         |
| 2.      | Roddy Coolen         | Electronic Communication                                | 3 <sup>rd</sup> | 2000                | Prentice Hall of India, New Delhi   |
| 3.      | Taub Schilling       | Principles of communication Systems                     | 3 <sup>rd</sup> | 1986                | McGraw-Hill International, New York |
| 4.      | Robert J. Schoenbeck | Electronic Communications - Modulation and Transmission | 2nd Edition     | 1999                | Prentice Hall of India              |
| 5.      | K. Sam Shanmugam     | Digital and Analog Communication Systems                | 1st             | 2012                | Wiley India                         |

**E- REFERENCES :**

- <https://www.allsyllabus.com/aj/note/ECE/Digital%20Communication/unit5/index.php#.WRFIBdKGPIU>
- <https://www.slideshare.net/lineking/digital-communication- system>
- <http://www.managementstudyguide.com/digital-communication- system.htm>
- <http://www.uotechnology.edu.iq/depeee/lectures/4th/Electrical/Communication%20engineering%20part1.pdf>

| Program Title   |                                                                                                                                                                                                                                                                                                    |              |       | Diploma in Electronics & Telecommunication Engineering |     |       |           |       |        |           |       |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------|--------------------------------------------------------|-----|-------|-----------|-------|--------|-----------|-------|
| Course Code     | ETES 403                                                                                                                                                                                                                                                                                           | Course Title |       | CIRCUITS NETWORKS                                      |     |       |           |       |        | Semester  | 4     |
| Teaching Scheme |                                                                                                                                                                                                                                                                                                    |              |       | Examination Scheme                                     |     |       |           |       |        |           |       |
| Credits         |                                                                                                                                                                                                                                                                                                    |              |       | Theory                                                 |     |       | Practical | Oral  | Online | Term work | Total |
| Lecture         | Tutorial                                                                                                                                                                                                                                                                                           | Practical    | Total | ESE                                                    | PA  | Total |           |       |        |           |       |
| 3               | -----                                                                                                                                                                                                                                                                                              | 2            | 4     | 70                                                     | 30# | 100   | 50        | ----- | -----  | 25        | 175   |
|                 |                                                                                                                                                                                                                                                                                                    |              |       |                                                        |     |       |           |       |        |           |       |
|                 | 1) Theory paper duration 3 hrs.<br>2) Theory paper assessment is Internal and External.<br>3) The assessment of practical is Internal and External.<br>4) # Progressive Assessment out of 30 marks , 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. |              |       |                                                        |     |       |           |       |        |           |       |

**RATIONALE:**

This subject comes under the Basic Technology group and intended to teach students the concepts and methods of analysis of different types of Electronic Circuits and Networks, network theorems and their applications in electrical and electronic circuits. The prerequisite for this subject is knowledge of basic electronics which is taught in the preceding semesters. It is important to note that a good knowledge of mathematics is necessary for a better understanding of this subject due to the depth of coverage, and hence the practice of the contents covered in the mathematics subjects of the first three semesters is also essential.

**COURSE OUTCOMES: --**

Course theory content, practical skills, experience help student to understand basic electronics circuit terms & network methods, thus student should able to

| Semester | 4 | Subject                                                                                         | CIRCUITS & NETWORKS |
|----------|---|-------------------------------------------------------------------------------------------------|---------------------|
| C0403    |   | 10 <sup>th</sup> Course in Second Year                                                          |                     |
| CO 403.1 |   | Analyze the importance of circuits and networks and its applications in Electronics engineering |                     |
| CO 403.2 |   | Sketch phasors diagram and calculate power factor, Quality factor in AC circuits.               |                     |
| CO 403.3 |   | Interpret the concept of time constant in DC circuit..                                          |                     |
| CO 403.4 |   | Understand the resonance condition in electrical circuits                                       |                     |
| CO 403.5 |   | Calculate different parameters of two port Networks.                                            |                     |
| CO 403.6 |   | Design different types of passive filters                                                       |                     |

**Mapping of Course outcomes (COs) to Program outcomes (POs)**

| SEM IV            | <b>CIRCUITS &amp; NETWORKS</b>                                  |     |     |     |     |     |     |  |
|-------------------|-----------------------------------------------------------------|-----|-----|-----|-----|-----|-----|--|
| CO                | <b>(10<sup>th</sup> Course in Second Year) PREPARED BY : SG</b> |     |     |     |     |     |     |  |
| CO 403.1          | P01                                                             | P02 | P03 | P04 | P05 | P06 | P07 |  |
| CO 403.2          | 3                                                               | 3   | 3   | 2   | 2   | 1   | 2   |  |
| CO 403.3          | 3                                                               | 3   | 2   | 1   | 2   | 1   | 2   |  |
| CO 403.4          | 3                                                               | 3   | 3   | 2   | 1   | 2   | 2   |  |
| CO 403.5          | 3                                                               | 3   | 3   | 2   | 1   | 1   | 2   |  |
| CO 403.6          | 3                                                               | 3   | 3   | 2   | 1   | 1   | 2   |  |
| CO TOTAL          | 15                                                              | 15  | 14  | 09  | 07  | 06  | 10  |  |
| CORRELATION LEVEL | 3                                                               | 3   | 2   | 2   | 1   | 1   | 2   |  |

**TABLE TO DECIDE CORRELATION LEVELS**

| CO SUM TOTAL      | 06 | 12 | 18 |
|-------------------|----|----|----|
| CORRELATION LEVEL | 1  | 2  | 3  |

| CO SUM TOTAL      | 0, 1, 2 | 3, 4, 5, 6, 7, 8 | 9, 10, 11, 12, 13, 14 | 15, 16, 17, 18 |
|-------------------|---------|------------------|-----------------------|----------------|
| CORRELATION LEVEL | 0       | 1                | 2                     | 3              |

**Subject Experts****Mrs. Surbhi G.**

|            | Section -- 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |         |       |    |    |       |                      |
|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|----|----|-------|----------------------|
| Chapter No | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Periods | Marks |    |    |       | COs                  |
|            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Hrs.    | R     | U  | A  | Total |                      |
| <b>1</b>   | <b>SINGLE PHASE AC CIRCUITS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |         |       |    |    |       |                      |
|            | 1.1 Series A.C. circuits: R-L, R-C and R-L-C circuits ---- Voltage and current equations, waveforms, reactance, impedance, phasor diagram, active(Real) power, Apparent power, Reactive power, power factor<br>1.2 Numerical practice on above topics                                                                                                                                                                                                                                                    | 06      | 02    | 6  | 02 | 10    | CO<br>403.1<br>403.2 |
| <b>2</b>   | <b>TRANSIENT BEHAVIOR AND INITIAL CONDITIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |       |    |    |       |                      |
|            | 2.1 Initial conditions in basic Passive elements<br>2.2 Transient response of series R-L circuit for D.C. Excitation<br>2.2.1 Transient response of Driven series R-L circuit<br>2.2.2 Transient response of source free or Undriven series R-L circuit<br>2.3 Transient response of series R-C circuit for D.C. Excitation<br>2.3.1 Transient response of Driven series R-C circuit<br>2.3.2 Transient response of source free or Undriven series R-C circuit<br>2.4 Numerical practice on above topics | 10      | 03    | 06 | 03 | 12    | CO<br>403.3          |
| <b>3</b>   | <b>RESONANT CIRCUITS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |         |       |    |    |       |                      |
|            | 3.1 Resonant Circuits-Definition<br>3.2 Q factor-Definition, Expression<br>3.3 Series Resonance- derivation of resonance frequency<br>3.4 Reactance curves, Q factor of series resonant circuit, voltage across L and C under resonance<br>3.5 Bandwidth and selectivity of series resonant circuit<br>3.6 Numerical practice on above topics                                                                                                                                                            | 08      | 04    | 06 | 03 | 13    | CO<br>403.4          |

|             | Section -- 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |       |    |    |       |             |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|----|----|-------|-------------|
| Chapter No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Periods | Marks |    |    |       | COs         |
|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Hrs.    | R     | U  | A  | Total |             |
| <b>4</b>    | <b>TWO PORT NETWORKS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |       |    |    |       |             |
|             | 4.1 Symmetrical Networks :<br>4.1.1 Characteristic impedance<br>4.1.2 Propagation Constant<br>4.2 Asymmetrical Networks<br>4.2.1 Image impedences<br>4.2.2 Iterative impedences<br>4.2.3 Image transfer constant<br>4.3 T and Pi network-Characteristics impedance and propagation constant formulas (no derivation )<br>4.4 Voltage dividers-Definition<br>4.5 Attenuators- Definition, Design of T and Pi attenuator(only resistive)<br>4.6 Numerical practice on above topics | 12      | 04    | 08 | 03 | 15    | CO<br>403.5 |
| <b>5</b>    | <b>PASSIVE FILTERS (LC filters)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |       |    |    |       |             |
|             | Design of<br>6.1 Constant 'K' Filters – Low pass, High pass, Band pass & Band stop filter<br>6.2 M-derived filters- Low pass, High pass filter<br>6.3 Comparison between Prototype and m-derived filters<br>6.4 Block Diagram of Composite Filter.                                                                                                                                                                                                                               | 12      | 04    | 08 | 08 | 20    | CO<br>403.6 |

**IMPLEMENTATION STRATEGY:**

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples
- 4) Group discussions and micro project
- 5) Assignments for writing skills, create awareness about selection /purchasing components

**LIST OF LABORATORY EXPERIENCES**

| EXP. NO. | TITLE                                                                                                       | COURSE OUTCOME | CHAPT. NO. |
|----------|-------------------------------------------------------------------------------------------------------------|----------------|------------|
| 1        | Variation of inductive reactance with frequency                                                             | C              | 1          |
| 2        | Variation of capacitive reactance with frequency                                                            | C              | 1          |
| 3        | Determine initial and final voltage across the inductor at $t=0^-$ and $t=0^+$                              | C              | 2          |
| 4        | Determine initial and final voltage across the capacitor at $t=0^-$ and $t=0^+$                             | C              | 2          |
| 5        | Determine Active, Reactive and Apparent power consumed in given R-L series circuit and draw phasor diagram  | C              | 3          |
| 6        | Determine Active, Reactive and Apparent power consumed in given R-C series circuit and draw phasor diagram  | C              | 6          |
| 7        | Determine Active Reactive and Apparent power consumed in given R-L-C series circuit and draw phasor diagram | C              | 6          |
| 8        | Create resonance in given R-L-C circuit by varying L and C or by using variable frequency supply.           | C              | 5          |
| 9        | Design a constant k low pass filter                                                                         | C              | 1          |
| 10       | Design a constant k high pass filter                                                                        | C              | 1          |

Fault finding practicals are demo experiments which is an extra skill imparted in the laboratory and not covered in theory.

**IMPLEMENTATION STRATEGY**

- Teaching plan
- Minimum 10 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of "out of 25") of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9, ....and so on.....)

| LAB EXPERIENCE |                 | 1                | 2                | 3                | 4                | 5                | 6                |
|----------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|
|                | COURSE OUTCOMES | C<br>(out of 25) | C<br>(out of 25) | C<br>(out of 25) | C<br>(out of 25) | C<br>(out of 25) | C<br>(out of 25) |
| STUDENT SPNO   |                 |                  |                  |                  |                  |                  |                  |
| 1303001        |                 |                  |                  |                  |                  |                  |                  |
| 1303002        |                 |                  |                  |                  |                  |                  |                  |
| 1303004        |                 |                  |                  |                  |                  |                  |                  |

\* The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

**SUGGESTED LIST OF MICROPROJECTS**

Micro project could be group based. A suggestive list is given here, similar micro projects could be added by concerned faculty. Each student will maintain dated work diary with details of individual contribution. Assessment is done by project guide based on their performance and presentation of submission.

| SR. NO. | TITLE                                                                                                                                                                                                                                                                      |
|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | <b>Single Phase A.C. series and parallel Circuits:</b> Prepare series circuit using variable R, L and C combination on the bread board. Measure the response and draw vector diagram. Also calculate power factor for the circuit. Write report on the                     |
| 2       | <b>Resonance in series</b> Circuits: Prepare series RLC circuit using variable R, L and C combination on the bread board. Tune the circuit for resonance condition. Measure the responses and calculate band width and Q-factor for the circuit. Write report on the same. |

### SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN

| Chapter No. | Title                                                                                                                                                                                                                                                                                                        | Teaching Hours | Distribution of Theory Marks |         |         |             |
|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|------------------------------|---------|---------|-------------|
|             |                                                                                                                                                                                                                                                                                                              |                | R Level                      | U Level | A Level | Total Marks |
|             | Section I                                                                                                                                                                                                                                                                                                    |                |                              |         |         |             |
| 1           | SINGLE PHASE AC CIRCUITS                                                                                                                                                                                                                                                                                     | 06             | 02                           | 06      | 02      | 10          |
| 2           | TRANSIENT BEHAVIOR AND INITIAL CONDITIONS                                                                                                                                                                                                                                                                    | 10             | 03                           | 06      | 03      | 12          |
| 3           | RESONANT CIRCUITS                                                                                                                                                                                                                                                                                            | 08             | 04                           | 06      | 03      | 13          |
|             | Section II                                                                                                                                                                                                                                                                                                   |                |                              |         |         |             |
| 4           | TWO PORT NETWORKS                                                                                                                                                                                                                                                                                            | 12             | 04                           | 08      | 03      | 15          |
| 5           | PASSIVE FILTERS                                                                                                                                                                                                                                                                                              | 12             | 04                           | 08      | 08      | 20          |
|             | Total                                                                                                                                                                                                                                                                                                        | 48             | 19                           | 33      | 18      | 70          |
|             | Legends :: R ::- Remember , U ::- Understand , A ::-Application                                                                                                                                                                                                                                              |                |                              |         |         |             |
|             | This specification table provide guide line to teacher to teach & assess student also a general guideline to frame theory paper & practical theory exam paper which student have to undertake. The actual distribution of marks at different taxonomy level in the question paper may vary from above table. |                |                              |         |         |             |

### REFERENCES

| Sr. No. | Author      | Title                              | Edition | Year of Publication | Publisher & Address             |
|---------|-------------|------------------------------------|---------|---------------------|---------------------------------|
| 1.      | Mittle V.N. | Basic electrical engineering       | 4th     | 2005                | McGraw Hill, New Delhi.         |
| 2.      | Sudhakar A  | Circuit and networks               | 4th     | 2006                | McGraw Hill, New Delhi          |
| 3.      | Gupta B. R. | Fundamental of Electrical networks | 2nd     | 2005                | S. Chand & Company<br>New Delhi |

### LEARNING WEBSITES / WEB REFERENCES :

- <https://www.griet.ac.in/nodes/BEEE.pdf>
- <https://sctevtodisha.nic.in/wp-content/plugins/LectureNote>
- <https://www.youtube.com/electrc circuits>

| Program Title                                                                                                                                                                                                                                                                                      |          |           |              | Diploma in Electronics & Telecommunication Engineering |     |       |           |       |        |           |       |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-----------|--------------|--------------------------------------------------------|-----|-------|-----------|-------|--------|-----------|-------|
| Course Code                                                                                                                                                                                                                                                                                        | ETPC 404 |           | Course Title | Power Electronics                                      |     |       |           |       |        | Semester  | IV    |
| Teaching Scheme                                                                                                                                                                                                                                                                                    |          |           |              | Examination Scheme                                     |     |       |           |       |        |           |       |
| Credits                                                                                                                                                                                                                                                                                            |          |           |              | Theory                                                 |     |       | Practical | Oral  | Online | Term work | Total |
| Lecture                                                                                                                                                                                                                                                                                            | Tutorial | Practical | Total        | ESE                                                    | PA  | Total |           |       |        |           |       |
| 3                                                                                                                                                                                                                                                                                                  | -----    | 2         | 4            | 70                                                     | 30# | 100   | 50        | ----- | -----  | 25        | 175   |
| 1) Theory paper duration 3 hrs.<br>2) Theory paper assessment is Internal and External.<br>3) The assessment of practical is Internal and External.<br>4) # Progressive Assessment out of 30 marks , 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. |          |           |              |                                                        |     |       |           |       |        |           |       |

### RATIONALE:

This subject comes under the Core Technology group and will enable the students to comprehend the theory, concepts, characteristics and working principles of basic electronic communication techniques and their applications in communication circuits. Concepts such as modulation, side band transmission, radiation and propagation, reception and demodulation which are widely used in the field of analog communication are dealt with in this subject. Knowledge of basic electronic devices and circuits is a prerequisite for the learning of this subject..

### COURSE OUTCOMES:: --

Course theory content, practical skills, experience help student to understand basics of power electronics terms & devices & their applications thus student should able to

| Semester                               | IV                                                                                                          | Subject | Power Electronics |
|----------------------------------------|-------------------------------------------------------------------------------------------------------------|---------|-------------------|
| 11 <sup>th</sup> Course in Second Year |                                                                                                             |         |                   |
| C404.1                                 | Illustrate the turn on & turn off mechanism of SCR                                                          |         |                   |
| C404.2                                 | Demonstrate the need, function and operation of Inverter                                                    |         |                   |
| C404.3                                 | Select appropriate Chopper for DC control drives                                                            |         |                   |
| C404.4                                 | Compare the principles of AC, DC & Microprocessor, MC based drive                                           |         |                   |
| C404.5                                 | Enumerate the operation of Power electronics applications                                                   |         |                   |
| C404.6                                 | Implement safety measures for over-voltage & over-current fault conditions in power electronics application |         |                   |



**Mapping of Course outcomes (COs) to Program outcomes (POs)**

| <b>SEM IV</b>            | <b>Power Electronics</b>                                         |            |            |            |            |            |            |  |
|--------------------------|------------------------------------------------------------------|------------|------------|------------|------------|------------|------------|--|
|                          | (11 <sup>th</sup> Course in Second Year) <b>PREPARED BY : VR</b> |            |            |            |            |            |            |  |
| <b>CO</b>                | <b>P01</b>                                                       | <b>P02</b> | <b>P03</b> | <b>P04</b> | <b>P05</b> | <b>P06</b> | <b>P07</b> |  |
| <b>1</b>                 | <b>2</b>                                                         | <b>3</b>   | <b>3</b>   |            | <b>1</b>   | <b>1</b>   | <b>3</b>   |  |
| <b>2</b>                 | <b>2</b>                                                         | <b>3</b>   | <b>3</b>   |            |            | <b>2</b>   | <b>1</b>   |  |
| <b>3</b>                 | <b>3</b>                                                         | <b>3</b>   | <b>3</b>   |            |            | <b>2</b>   | <b>1</b>   |  |
| <b>4</b>                 | <b>3</b>                                                         | <b>3</b>   | <b>3</b>   | <b>3</b>   | <b>3</b>   | <b>2</b>   | <b>2</b>   |  |
| <b>5</b>                 | <b>3</b>                                                         | <b>3</b>   | <b>3</b>   |            |            | <b>2</b>   | <b>2</b>   |  |
| <b>6</b>                 | <b>2</b>                                                         | <b>3</b>   | <b>3</b>   | <b>2</b>   | <b>2</b>   | <b>2</b>   | <b>2</b>   |  |
| <b>Total</b>             | <b>15</b>                                                        | <b>18</b>  | <b>18</b>  | <b>05</b>  | <b>06</b>  | <b>11</b>  | <b>11</b>  |  |
| <b>CORRELATION LEVEL</b> | <b>3</b>                                                         | <b>3</b>   | <b>3</b>   | <b>1</b>   | <b>1</b>   | <b>2</b>   | <b>2</b>   |  |

**TABLE TO DECIDE CORRELATION LEVELS**

|                          |           |           |           |
|--------------------------|-----------|-----------|-----------|
| <b>CO SUM TOTAL</b>      | <b>06</b> | <b>12</b> | <b>18</b> |
| <b>CORRELATION LEVEL</b> | <b>1</b>  | <b>2</b>  | <b>3</b>  |

|                          |                |                         |                              |                       |
|--------------------------|----------------|-------------------------|------------------------------|-----------------------|
| <b>CO SUM TOTAL</b>      | <b>0, 1, 2</b> | <b>3, 4, 5, 6, 7, 8</b> | <b>9, 10, 11, 12, 13, 14</b> | <b>15, 16, 17, 18</b> |
| <b>CORRELATION LEVEL</b> | <b>0</b>       | <b>1</b>                | <b>2</b>                     | <b>3</b>              |

**Subject Expert****Dr. Vijay R Rathod**

|            | Section -- 1                                                                                                                                                                                                                                                                                                                                                                      |         |       |    |    |       |               |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|----|----|-------|---------------|
| Chapter No | Topics                                                                                                                                                                                                                                                                                                                                                                            | Periods | Marks |    |    |       | COs           |
|            |                                                                                                                                                                                                                                                                                                                                                                                   | Hrs.    | R     | U  | A  | Total |               |
| <b>1</b>   | <b>INTRODUCTION TO SCR</b>                                                                                                                                                                                                                                                                                                                                                        |         |       |    |    |       |               |
|            | 1.1 Introduction<br>1.2 Basic construction, Principle, operation and characteristics of SCR<br>1.3 Turn on method of SCR<br>1.4 Dynamic Turn on switching characteristics<br>1.5 Turn off mechanism<br>1.6 Turn off methods (commutations)<br>1.7 Types of commutation Natural and Forced                                                                                         | 10      | 03    | 05 | 03 | 11    | <b>C404.1</b> |
| <b>2</b>   | <b>INVERTERS</b>                                                                                                                                                                                                                                                                                                                                                                  |         |       |    |    |       |               |
|            | 2.1 Introduction<br>2.2 Working Principle of Inverters<br>2.3 SCR Inverters Classification<br>a) Method of Commutation<br>b) According to Connections<br>2.4 Series Inverter<br>2.5 Parallel Inverter<br>2.6 Bridge Inverters<br>2.6.1 Half bridge<br>2.6.2 Full bridge                                                                                                           | 10      | 04    | 05 | 02 | 11    |               |
| <b>3</b>   | <b>CHOPPERS</b>                                                                                                                                                                                                                                                                                                                                                                   |         |       |    |    |       |               |
|            | 3.1 Introduction<br>3.2 Methods available for obtaining D.C. voltage from a Fixed DC Voltage.<br>3.2.1 Line Commutated convertors<br>3.2.2 AC link Chopper (Inverter Rectifier)<br>3.2.3 DC Chopper (DC-DC Power Convertor)<br>3.3 Basic Chopper Classification<br>3.3.1 According to the input / output voltage loads.<br>3.3.1.1 Step Down 3.3.1.2 Step Up 3.3.1.3 Step Up-Down | 09      | 03    | 06 | 04 | 13    |               |

| Section -- 2 |                                                                                                                                                                                                                                        |         |       |    |    |       |     |
|--------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|----|----|-------|-----|
| Chapter No   | Topics                                                                                                                                                                                                                                 | Periods | Marks |    |    |       | COs |
|              |                                                                                                                                                                                                                                        | Hrs.    | R     | U  | A  | Total |     |
| <b>4</b>     | <b>SOLID STATE CONTROL OF D.C. &amp; A.C. CONTROL DRIVES</b>                                                                                                                                                                           |         |       |    |    |       |     |
|              | 4.1 Block schematic of DC Control Drive.<br>4.2 Block schematic of AC Control Drive.<br>4.3 Block schematic of microprocessor & microcontroller-based Control Drives<br>4.4 Advantages, Disadvantages and Applications of Motor drives | 08      | 05    | 06 | 04 | 15    |     |
| <b>5</b>     | <b>POWER ELECTRONICS APPLICATIONS</b>                                                                                                                                                                                                  |         |       |    |    |       |     |
|              | 5.1 LDR Application in a light activated turn off circuit<br>5.2 Illumination control using SCR<br>5.3 Applications of SCR and DIAC<br>5.3 Applications of SCR and TRIAC<br>5.3 UPS online and offline load                            | 10      | 08    | 06 | 06 | 20    |     |

**IMPLEMENTATION STRATEGY:**

- 1) Use of PowerPoint presentations and Videos
- 2) References from the internet **(for teachers as well as students)**
- 3) Extensive use of examples
- 4) Group discussions and micro project
- 5) Assignments for writing skills, create awareness about selection /purchasing components

**LIST OF LABORATORY EXPERIENCES**

| <b>Exp. No.</b> | <b>Title</b>                     | <b>CO Mapping</b> |
|-----------------|----------------------------------|-------------------|
| 1.              | SCR Characteristics              |                   |
| 2.              | TRIAC'S Characteristics          |                   |
| 3.              | DIAC'S Characteristics           |                   |
| 4.              | Turn on method of SCR            |                   |
| 5.              | Commutation of SCR (part-1)      |                   |
| 6.              | Commutation of SCR (part-2)      |                   |
| 7.              | Series Inverter                  |                   |
| 8.              | Parallel Inverter                |                   |
| 9.              | Chopper circuits                 |                   |
| 10.             | DC motor speed control using SCR |                   |
| 11.             | SCR firing circuit               |                   |
| 12.             | H.W.R using SCR                  |                   |
| 13.             | FWR using SCR                    |                   |
| 14.             | SCR circuit breaker              |                   |
| 15.             | Dv/ Dt limitation of SCR         |                   |
| 16.             | Illumination control using SCR   |                   |

**SUGGESTED LIST OF MICROPROJECTS**

- RC time delay circuit employing Diac & SCR fan temperature control
- Fan Regulator using SCR & Triac
- SCR & Diac for Motor Control
- LDR for Traffic Controller
- UPS

Fault finding practicals are demo experiments which is an extra skill imparted in the laboratory and not covered in theory.

**IMPLEMENTATION STRATEGY**

1. Teaching plan
2. Minimum 10 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9, ....and so on.....)

\* The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

**SUGGESTED SPECIFICATION TABLE FOR QUESTION PAPER DESIGN**

| Chapte<br>rNo. | Title                                             | Teachin<br>gHours | Distribution of Theory Marks |            |            |                |
|----------------|---------------------------------------------------|-------------------|------------------------------|------------|------------|----------------|
|                |                                                   |                   | R<br>Level                   | U<br>Level | A<br>Level | Total<br>Marks |
| Section I      |                                                   |                   |                              |            |            |                |
| 1              | INTRODUCTION TO SCR                               | 10                | 03                           | 05         | 03         | 11             |
| 2              | INVERTERS                                         | 10                | 04                           | 05         | 02         | 11             |
| 3              | CHOPPERS                                          | 09                | 03                           | 06         | 04         | 13             |
| Section II     |                                                   |                   |                              |            |            |                |
| 4              | SOLID STATE CONTROL OF D.C. & A.C. CONTROL DRIVES | 09                | 05                           | 06         | 04         | 15             |
| 5              | POWER ELECTRONICS APPLICATIONS                    | 10                | 08                           | 06         | 06         | 20             |
| Total          |                                                   | 48                | 20                           | 30         | 20         | 70             |

**REFERENCES**

| S. No. | Author                        | Title                           | Edition | Year of Publication | Publisher & Address |
|--------|-------------------------------|---------------------------------|---------|---------------------|---------------------|
| 1.     | S K Bhattacharaya             | Industrial Electronics& control |         | 2000                | Tata Mcgraw Hill    |
| 3.     | P.C. Sen                      | Power Electronics               | 1st     | 1987                | Tata Mcgraw Hill    |
| 4.     | M. D Singh & K B Khanchandani | Power Electronics               | 1st     | 2007                | Tata Mcgraw Hill    |
| 5      | M.H .Rashid                   | Power Electronics               | 1st     | 2000                | Tata Mcgraw Hill    |

**E-REFERENCES**

[www.nptel.ac.in/courses/108101038](http://www.nptel.ac.in/courses/108101038)  
[www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007](http://www.ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-334-power-electronics-spring-2007)  
[www.nptelvideos.in/2012/11/power-electronics.html](http://www.nptelvideos.in/2012/11/power-electronics.html)  
[www.coursera.org/learn/power-electronics](http://www.coursera.org/learn/power-electronics)  
[www.powerguru.org/power-electronics-videos/](http://www.powerguru.org/power-electronics-videos/)

|                 |                                                                                                                                                                                                                                                                                                    |           |              |                                                        |                    |     |       |           |       |          |           |       |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|--------------------------------------------------------|--------------------|-----|-------|-----------|-------|----------|-----------|-------|
| Program Title   |                                                                                                                                                                                                                                                                                                    |           |              | Diploma in Electronics & Telecommunication Engineering |                    |     |       |           |       |          |           |       |
| Course Code     | ETPC 405                                                                                                                                                                                                                                                                                           |           | Course Title | Internet of Things - IOT                               |                    |     |       |           |       | Semester | IV        |       |
| Teaching Scheme |                                                                                                                                                                                                                                                                                                    |           |              |                                                        | Examination Scheme |     |       |           |       |          |           |       |
| Credits         |                                                                                                                                                                                                                                                                                                    |           |              |                                                        | Theory             |     |       | Practical | Oral  | Online   | Term work | Total |
| Lecture         | Tutorial                                                                                                                                                                                                                                                                                           | Practical | Total        |                                                        | ESE                | PA  | Total |           |       |          |           |       |
| 3               | -----                                                                                                                                                                                                                                                                                              | 2         | 4            |                                                        | 70                 | 30# | 100   | 50        | ----- | -----    | 25        | 175   |
|                 | 1) Theory paper duration 3 hrs.<br>2) Theory paper assessment is Internal and External.<br>3) The assessment of practical is Internal and External.<br>4) # Progressive Assessment out of 30 marks , 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. |           |              |                                                        |                    |     |       |           |       |          |           |       |

**RATIONALE:**

On completion of the course, student will be able to Understand the various concepts, terminologies and architecture of IoT systems. Use sensors and actuators for design of IoT. Apply various protocols for design of IoT systems Use various techniques of data storage and analytics in IoT . Understand various applications of IoT

**COURSE OUTCOMES:: --**

Course theory content, practical skills, experience help student to understand basics of electronic sensors & devices & their applications with advance technology of Internet thus student should able to

| Semester | IV                                                                                           | Subject | Internet of Things - IOT                |
|----------|----------------------------------------------------------------------------------------------|---------|-----------------------------------------|
|          |                                                                                              |         | 12 <sup>th</sup> Subject in Second Year |
| C405.1   | To study fundamental concepts of IoT                                                         |         |                                         |
| C405.2   | To understand roles of sensors in IoT                                                        |         |                                         |
| C405.3   | To Learn different protocols used for IoT design                                             |         |                                         |
| C405.4   | To be familiar with data handling and analytics tools in IoT                                 |         |                                         |
| C405.5   | Appreciate the role of big data, cloud computing and data analytics in a typical IoT system. |         |                                         |
| C405.6   | Understand the role of IoT in various domains of Industry.                                   |         |                                         |

**Mapping of Course outcomes (COs) to Program outcomes (POs)**

| SEM IV            | <b>Internet of Things - IOT</b>                                      |     |     |     |     |     |     |  |
|-------------------|----------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|--|
|                   | 12 <sup>th</sup> Subject in Second Year <b>PREPARED BY : RVG, AG</b> |     |     |     |     |     |     |  |
| CO                | P01                                                                  | P02 | P03 | P04 | P05 | P06 | P07 |  |
| 1                 | 2                                                                    | 3   | 3   |     | 1   | 1   | 3   |  |
| 2                 | 2                                                                    | 3   | 3   |     |     | 2   | 1   |  |
| 3                 | 3                                                                    | 3   | 3   |     |     | 2   | 1   |  |
| 4                 | 3                                                                    | 3   | 3   | 3   | 3   | 2   | 2   |  |
| 5                 | 3                                                                    | 3   | 3   |     |     | 2   | 2   |  |
| 6                 | 2                                                                    | 3   | 3   | 2   | 2   | 2   | 2   |  |
| Total             | 15                                                                   | 18  | 18  | 05  | 06  | 11  | 11  |  |
| CORRELATION LEVEL | 3                                                                    | 3   | 3   | 1   | 1   | 2   | 2   |  |

**TABLE TO DECIDE CORRELATION LEVELS**

|                   |    |    |    |
|-------------------|----|----|----|
| CO SUM TOTAL      | 06 | 12 | 18 |
| CORRELATION LEVEL | 1  | 2  | 3  |

|                   |         |                  |                       |                |
|-------------------|---------|------------------|-----------------------|----------------|
| CO SUM TOTAL      | 0, 1, 2 | 3, 4, 5, 6, 7, 8 | 9, 10, 11, 12, 13, 14 | 15, 16, 17, 18 |
| CORRELATION LEVEL | 0       | 1                | 2                     | 3              |

**Subject Expert****Mr. R. V. Gheware****Mr. Anil Gurav**



**LIST OF LABORATORY EXPERIENCES**

| EXP. NO. | TITLE                                                                    | COURSE OUTCOME MAPPING |
|----------|--------------------------------------------------------------------------|------------------------|
| 1        | Understanding Arduino UNO Board and Components                           | C209.2                 |
| 2        | Installing and work with Arduino IDE                                     | C209.2                 |
| 3        | Blinking LED sketch with Arduino                                         | C209.2                 |
| 4        | Simulation of 4-Way Traffic Light with Arduino                           | C209.2                 |
| 5        | Using Pulse Width Modulation                                             | C209.2                 |
| 6        | Digital Read Serial Sketch (Working with DHT/IR/Gas or Any other Sensor) | C209.2                 |
| 7        | Working with Adafruit Libraries in Arduino                               | C209.5                 |
| 8        | Spinning a DC Motor and Motor Speed Control Sketch                       | C209.3                 |
| 9        | Controlling Servo Motor.                                                 | C209.4                 |
| 10       | Interfacing Arduino with Cloud (Thingspeak API)                          | C209.4                 |
| 11       | Installing Linux in Raspberry pi                                         | C209.3                 |
| 12       | Installing Python in Raspberry pi, interfacing sensors to it.            | C209.6                 |

Fault finding practicals are demo experiments which is an extra skill imparted in the laboratory and not covered in theory.

**IMPLEMENTATION STRATEGY**

1. Teaching plan
2. Minimum 10 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

(Note:.....the table should progress to the right for Lab Experience 7, 8, 9, ....and so on.....)

\* The final % attainment level for TERM WORK of each course outcome may then be computed and the overall % attainment level for the course, for term work may then be calculated.

**REFERENCES**

| Sr. No. | Author           | Title                                   | Edition         | Year of Publication | Publisher                           |
|---------|------------------|-----------------------------------------|-----------------|---------------------|-------------------------------------|
| 1.      | Samuel Greengard | The Internet of Things                  | 4 <sup>th</sup> | 1999                | Tata McGraw-Hill New Delhi.         |
| 2.      | Cuno Pfister     | Getting started with Internet of Things | 3 <sup>rd</sup> | 2000                | Prentice Hall of India, New Delhi   |
| 3.      | Peter Waher      | Learning Internet of Things             | 3 <sup>rd</sup> | 1986                | McGraw-Hill International, New York |

**E- REFERENCES :**

- <https://www.allsyllabus.com/notes/ECE/IOT> <https://www.slideshare.net/lineking/IOT>

|                 |                                                                                                                                                                                                                                                                                                    |           |              |                                                        |                    |      |       |           |       |          |           |       |
|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|--------------------------------------------------------|--------------------|------|-------|-----------|-------|----------|-----------|-------|
| Program Title   |                                                                                                                                                                                                                                                                                                    |           |              | Diploma in Electronics & Telecommunication Engineering |                    |      |       |           |       |          |           |       |
| Course Code     | ETES 407                                                                                                                                                                                                                                                                                           |           | Course Title | Python Programming for ML                              |                    |      |       |           |       | Semester | IV        |       |
| Teaching Scheme |                                                                                                                                                                                                                                                                                                    |           |              |                                                        | Examination Scheme |      |       |           |       |          |           |       |
| Credits         |                                                                                                                                                                                                                                                                                                    |           |              |                                                        | Theory             |      |       | Practical | Oral  | Online   | Term work | Total |
| Lecture         | Tutorial                                                                                                                                                                                                                                                                                           | Practical | Total        |                                                        | ESE                | PA   | Total |           |       |          |           |       |
| ----            | -----                                                                                                                                                                                                                                                                                              | 2         | 1            |                                                        | ---                | ---- | ----  | 50        | ----- | -----    | 25        | 75    |
|                 | 1) Theory paper duration 3 hrs.<br>2) Theory paper assessment is Internal and External.<br>3) The assessment of practical is Internal and External.<br>4) # Progressive Assessment out of 30 marks , 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. |           |              |                                                        |                    |      |       |           |       |          |           |       |

**RATIONALE:**

This subject is classified under the Applied Technology group and intended to teach the students basics, concepts, principles of Machine Learning. Machine Learning uses algorithms to imitate the way in which humans learn. It uses statistical methods to train models and make predictions without explicit programming them to do so. These algorithms make use of historical data to predict output values and these insights and predictions enable businesses to make smart decisions.

**COURSE OUTCOMES:: --**

| Semester                                | IV                                                          | Subject | Python Programming for ML |
|-----------------------------------------|-------------------------------------------------------------|---------|---------------------------|
| 11 <sup>th</sup> Subject in Second Year |                                                             |         |                           |
| C404.1                                  | Handle arrays , pandas data frame and files(csv,json)       |         |                           |
| C404.2                                  | Data Preprocessing i.e cleaning and handling missing values |         |                           |
| C404.3                                  | Implementation of Linear Regression                         |         |                           |
| C404.4                                  | Implementation of Logistic Regression                       |         |                           |
| C404.5                                  | Implementation of K-Nearest Neighbors, SVM                  |         |                           |
| C404.6                                  | Implementation of K mean Clustering                         |         |                           |

**Mapping of Course outcomes (COs) to Program outcomes (POs)**

| SEM IV            | <b>Python Programming for ML</b>                                 |     |     |     |     |     |     |  |
|-------------------|------------------------------------------------------------------|-----|-----|-----|-----|-----|-----|--|
|                   | 11 <sup>th</sup> Subject in Second Year <b>PREPARED BY : RVG</b> |     |     |     |     |     |     |  |
| CO                | P01                                                              | P02 | P03 | P04 | P05 | P06 | P07 |  |
| 1                 | 2                                                                | 3   | 3   |     | 1   | 1   | 3   |  |
| 2                 | 2                                                                | 3   | 3   |     |     | 2   | 1   |  |
| 3                 | 3                                                                | 3   | 3   |     |     | 2   | 1   |  |
| 4                 | 3                                                                | 3   | 3   | 3   | 3   | 2   | 2   |  |
| 5                 | 3                                                                | 3   | 3   |     |     | 2   | 2   |  |
| 6                 | 2                                                                | 3   | 3   | 2   | 2   | 2   | 2   |  |
| Total             | 15                                                               | 18  | 18  | 05  | 06  | 11  | 11  |  |
| CORRELATION LEVEL | 3                                                                | 3   | 3   | 1   | 1   | 2   | 2   |  |

**TABLE TO DECIDE CORRELATION LEVELS**

|                   |    |    |    |
|-------------------|----|----|----|
| CO SUM TOTAL      | 06 | 12 | 18 |
| CORRELATION LEVEL | 1  | 2  | 3  |

|                   |         |                  |                       |                |
|-------------------|---------|------------------|-----------------------|----------------|
| CO SUM TOTAL      | 0, 1, 2 | 3, 4, 5, 6, 7, 8 | 9, 10, 11, 12, 13, 14 | 15, 16, 17, 18 |
| CORRELATION LEVEL | 0       | 1                | 2                     | 3              |

**Subject Expert****Mr. R.V.Gheware**

**Theory to be covered at the time of practical's**

- Data Preprocessing: Data cleaning handling missing values
- Data scaling and normalization
- Exploring data with Pandas and Matplotlib/Seaborn
- Introduction to machine learning : Supervised and unsupervised learning,
- Linear Regression , Logistic Regression
- Implementation of machine learning algorithms using Python

**LIST OF LABORATORY EXPERIENCES**

| EXP. NO. | TITLE                                                                                                                          | COURSE OUTCOME MAPPING |
|----------|--------------------------------------------------------------------------------------------------------------------------------|------------------------|
| 1        | Python program to Handle pandas data frame and files(csv,json)                                                                 | C209.2                 |
| 2        | Python program for data preprocessing i.e. data cleaning and handling missing values Part 1                                    | C209.2                 |
| 3        | Python program for data preprocessing 1.LabelEncoding<br>2. One Hot Encoder                                                    | C209.2                 |
| 4        | Python program to implement Linear Regression using dataset 1<br>Python program to implement Linear Regression using dataset 2 | C209.2                 |
| 5        | Python program to implement Logistic Regression (Binary Classification)                                                        | C209.2                 |
| 6        | Python program to implement Logistic Regression (Multiclass Classification)                                                    | C209.2                 |
| 7        | Python program to implement Decision Tree for Classification using suitable dataset.                                           | C209.5                 |
| 8        | Python program to implement Random Forest Algorithm using suitable dataset.                                                    | C209.3                 |
| 9        | Implementation of K-Nearest Neighbors                                                                                          | C209.4                 |
| 10       | Implementation of support vector machine Algorithm                                                                             | C209.4                 |
| 11       | Implementation of K mean clustering Algorithm                                                                                  | C209.3                 |

Fault finding practicals are demo experiments which is an extra skill imparted in the laboratory and not covered in theory.

**IMPLEMENTATION STRATEGY**

1. Teaching plan
2. Minimum 10 practicals

The table to measure the attainment levels for TERM WORK (on a rating scale of “out of 25”) of the defined expected course outcomes is as shown in the format given below:

**REFERENCES**

| Sr. No. | Author            | Title                                           | Edition         | Year of Publication | Publisher & Address               |
|---------|-------------------|-------------------------------------------------|-----------------|---------------------|-----------------------------------|
| 1.      | Sebastian Raschka | Machine Learning and Deep Learning with Python, | 2 <sup>nd</sup> | 2001                | Prentice Hall of India, New Delhi |

| Program Title   |                                                                                                                                                                                                                                                                                                   |           |              | Diploma in Electronics & Telecommunication Engineering |       |       |           |       |        |           |       |
|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--------------|--------------------------------------------------------|-------|-------|-----------|-------|--------|-----------|-------|
| Course Code     | ETAU 408                                                                                                                                                                                                                                                                                          |           | Course Title | SOCIAL & LIFE SKILLS                                   |       |       |           |       |        | Semester  | 4     |
| Teaching Scheme |                                                                                                                                                                                                                                                                                                   |           |              | Examination Scheme                                     |       |       |           |       |        |           |       |
| Credits         |                                                                                                                                                                                                                                                                                                   |           |              | Theory                                                 |       |       | Practical | Oral  | Online | Term work | Total |
| Lecture         | Tutorial                                                                                                                                                                                                                                                                                          | Practical | Total        | ESE                                                    | PA    | Total |           |       |        |           |       |
| 2               | -----                                                                                                                                                                                                                                                                                             | -----     | 2            | -----                                                  | ----- | ----- | -----     | ----- | -----  | -----     | ----- |
|                 |                                                                                                                                                                                                                                                                                                   |           |              |                                                        |       |       |           |       |        |           |       |
|                 | 1) Theory paper duration 3 hrs.<br>2) Theory paper assessment is Internal and External.<br>3) The assessment of practical is Internal and External.<br>4) #Progressive Assessment out of 30 marks , 20 marks is average of 2 periodical tests (PT) and 10 marks are for micro project assessment. |           |              |                                                        |       |       |           |       |        |           |       |

**RATIONALE:**

Life skills can be defined as abilities that enable humans to deal effectively with the demands and challenges of life. Social skills are a subset of life skills that are needed for successful, healthy relationships to easily adapt when moving from one social situation to the next. They help regulate our emotions effectively and develop enduring, supportive relationships, we're happier and healthier. This is why developing life skills and eventually social skills is key not only to being successful in life, it's key for our health and well-being. Thus, Teaching of Social and life skills provide students with essentials of knowing , understanding attitudes, values, morals ,social skills and better equip them to handle stress and build their self efficacy, self esteem and self confidence.

**COURSE OUTCOMES ::--**

Course theory content, practical skills, experience help student to understand basic human values social responsibility , thus student should able to

| Semester | 4 | Subject                                 | Social & Life Skills |
|----------|---|-----------------------------------------|----------------------|
|          |   | 15 <sup>th</sup> subject in Second Year |                      |
| C408.1   |   | Unnat Maharashtra Abhiyan (Uma).        |                      |
| C408.2   |   | National Service Scheme (Nss)           |                      |
| C408.3   |   | To Develop Universal Human Values       |                      |
| C408.4   |   | Value Education (Unnati Foundation)     |                      |
| C408.5   |   | Financial Literacy                      |                      |

## Mapping of Course outcomes (COs) to Program outcomes (POs)

| SEM IV            | Social & Life Skills                                       |     |     |     |     |     |     |
|-------------------|------------------------------------------------------------|-----|-----|-----|-----|-----|-----|
| CO 408            | (15 <sup>th</sup> Course in Second Year) PREPARED BY : SBG |     |     |     |     |     |     |
| CO 408            | P01                                                        | P02 | P03 | P04 | P05 | P06 | P07 |
| CO 408.1          | 1                                                          |     | 3   |     | 1   | 1   | 1   |
| CO 408.2          | 1                                                          | 1   | 3   | 1   |     | 1   | 1   |
| CO 408.3          | 2                                                          | 2   | 3   | 1   |     | 1   | 1   |
| CO 408.4          | 1                                                          | 2   | 3   | 1   | 1   |     | 1   |
| CO 408.5          | 1                                                          | 2   | 3   | 1   | 1   |     |     |
| CO 408.6          | 1                                                          | 2   | 3   | 1   | 1   | 1   | 1   |
| CO 408 TOTAL      | 7                                                          | 09  | 18  | 05  | 04  | 04  | 05  |
| CORRELATION LEVEL | 1                                                          | 2   | 3   | 1   | 1   | 1   | 1   |

TABLE TO DECIDE CORRELATION LEVELS

|                   |    |    |    |
|-------------------|----|----|----|
| CO SUM TOTAL      | 06 | 12 | 18 |
| CORRELATION LEVEL | 1  | 2  | 3  |

|                   |         |                  |                       |                |
|-------------------|---------|------------------|-----------------------|----------------|
| CO SUM TOTAL      | 0, 1, 2 | 3, 4, 5, 6, 7, 8 | 9, 10, 11, 12, 13, 14 | 15, 16, 17, 18 |
| CORRELATION LEVEL | 0       | 1                | 2                     | 3              |

Subject Experts  
Dr. Shivaji Ghungrad

| Section -- 1 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |         |       |   |   |       |        |
|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|---|---|-------|--------|
| Chapter No   | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Periods | Marks |   |   |       | COs    |
|              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Hrs.    | R     | U | A | Total |        |
| <b>1</b>     | <b>Activities Under Unnat Maharashtra Abhiyan (UMA)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |         |       |   |   |       |        |
|              | <ul style="list-style-type: none"> <li>• Introduction to Societal Needs and respective stakeholders :<br/>Regional societal issues that need engineering intervention</li> <li>• Multidisciplinary approach- linkages of academia, society and technology</li> <li>• Stakeholders' involvement</li> <li>• Introduction to Important secondary data sets available such as census, district economic surveys, cropping pattern, rainfall data, road network data etc</li> <li>• Problem Outline and stakeholders :<br/>Importance of activity and connection with Mapping of system components and stakeholders (engineering / societal)</li> <li>• Key attributes of measurement</li> <li>• Various instruments used for data collection - survey templates, simple measuring equipments</li> <li>• Format for measurement of identified attributes/ survey form and piloting of the same</li> <li>• Fieldwork :<br/>Measurement and quantifications of local systems such as agriculture produce, rainfall, Road network, production in local industries, Produce /service which moves from A to B</li> <li>• Analysis and Report writing<br/>Report writing containing-<br/>1 Introduction of the topic<br/>2 Data collected in various formats such as table, pie chart, bar graph etc<br/>3. Observations of field visits and data collected.</li> </ul> | 04      |       |   |   |       | C408.1 |

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |           |  |  |  |  |               |
|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|--|--|--|--|---------------|
| <b>2</b> | <b>National Service Scheme (NSS)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |           |  |  |  |  |               |
|          | <ul style="list-style-type: none"> <li>• Contacting Village/Area Leaders</li> <li>• Primary socio economic survey of few villages in the vicinity of the institute.</li> <li>• Selection of the village for adoption - conduct of activities</li> <li>• Comprehensive Socio Economic Survey of the Village/Area</li> <li>• Identification of Problem(s)</li> <li>• Dissemination of information about the latest developments in agriculture, watershed management, wastelands development, non- conventional energy, low-cost housing, sanitation, nutrition and personal hygiene, schemes for skill development, income generation, government schemes, legal aid, consumer protection and allied fields.</li> <li>• A liaison between government and other development agencies for the implementation of various development schemes in the selected village/slum</li> </ul> | <b>08</b> |  |  |  |  | <b>C408.2</b> |
| <b>3</b> | <b>To Develop Universal Human Values</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |  |  |  |  |               |
|          | <ul style="list-style-type: none"> <li>• Love and Compassion (Prem and Karuna): Introduction, Practicing Love and Compassion (Prem and Karuna)</li> <li>• Truth (Satya) : Introduction, Practicing Truth (Satya)</li> <li>• Non-Violence (Ahimsa) : Introduction, Practicing Non-Violence (Ahimsa)</li> <li>• Righteousness (Dharma) : Introduction, Practicing Righteousness (Dharma)</li> <li>• Peace (Shanti) : Introduction, Practicing Peace (Shanti)</li> <li>• Service (Seva) : Introduction, Practicing Service (Seva)</li> <li>• Renunciation (Sacrifice) Tyaga : Introduction, Practicing Renunciation (Sacrifice) Tyaga</li> <li>• Gender Equality and Sensitivity: Introduction, Practicing Gender Equality and Sensitivity.</li> </ul>                                                                                                                              | <b>04</b> |  |  |  |  | <b>C408.3</b> |



|             | Section -- 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |         |       |                     |       |       |               |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-------|---------------------|-------|-------|---------------|
| Chapter No. | Topics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Periods | Marks |                     |       |       | COs           |
|             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Hrs.    | R     | U                   | A     | Total |               |
| <b>4</b>    | <b>Value Education (Unnati Foundation)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |         |       |                     |       |       |               |
|             | <ul style="list-style-type: none"> <li>• Punctuality, Icebreaker and Simple Greeting, Understanding &amp; Managing Emotions, Introducing Self, The power of a Positive Attitude, Talking about one's Family, Talking about one's Family, Making a Positive Impression, Give word list for a Word based</li> <li>• Cleanliness , Hygiene and Orderliness , Likes and Dislikes, Developing Confidence in Self and Others, Strengths and Weaknesses, Listening Skills , Greeting gestures, Gender Equality and Sensitivity</li> <li>• Responsibility, OCSEM- Visual Comprehension and Word Based Learning, Goal Setting – Make it happen, Follow, Like &amp; Share Unnati Social Media</li> <li>- Facebook / Instagram/ Twitter Introducing Others, Time Management, Talking about the daily routine, Money Management</li> <li>• Gratitude and Appreciation , Asking Simple Questions &amp; Asking for the price , Stress Management, Student Referral process</li> <li>,Comprehending &amp; Paraphrasing Information, A Plate of Rice and Dignity of Labour, Topics for Public Speaking, Placement Process , OCSEM-E- Newspaper, Critical Thinking to overcome challenges</li> <li>• Determination and Persistence, Guiding and Giving Directions, Language Etiquette &amp; Mannerism, . Unnati Philosophy , b. Unnati Branding - Follow, Like &amp; Share Unnati Social Media - Facebook / Instagram/ Twitter, Simple instructions to follow procedures, Assertiveness, Give topics for Debate, Describing a person/Objects, Refusal Skills, Word List for Word based Learning</li> <li>Respect, Comparing , OCSEM - Public Speaking, Student referral process, Attending a phone call, Being a Good Team</li> </ul> | 08      | ----- | -----<br>-----<br>- | ----- | ---   | <b>C408.4</b> |

|          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |           |       |            |       |     |                    |
|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|-------|------------|-------|-----|--------------------|
|          | <p>Player , Placement Process, At a Restaurant, Workplace ethics</p> <p>Team Spirit, Inviting someone, OCSEM - Picture Reading &amp; Word, a. Unnati Philosophy &amp; b. Unnati Branding - Follow, Like &amp; Share Unnati Social Media - Facebook / Instagram/ Twitter, Apologizing, Apologizing, Dealing effectively with Criticism, Introduce Importance of Self Learning and upskilling</p> <p>Caring and Sharing , Handling Customer queries, Flexibility &amp; Adaptability, Student referral process, Writing a Resume, OCSEM-Public Speaking, Placement Process, Meditation/ Affirmation &amp; OCSEM-Debate, Introduce Certif- ID, how to create Certif-ID Project ,</p> <p>Honesty, Email etiquette &amp; Official Email communication, Alcohol &amp; Substance use &amp; abuse, Describing a known place , Leadership Skills, Describing an event, OSCEM-Picture Reading &amp; Visual Comprehension</p> <p>Forgive and Forget, Facing and Interview, OSCEM-Public Speaking , Attending a telephonic/Video interview &amp; Mock Interview , Affirmation , Pat-a-Back &amp; Closure (Valediction , Unnati Branding, Student Testimonials), Meditation/ Affirmation &amp; Sponsor connect (Speak to UNXT HO)</p> |           |       |            |       |     |                    |
| <b>5</b> | <b>FINANCIAL LITERACY</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |           |       |            |       |     |                    |
|          | <ul style="list-style-type: none"> <li>• Introduction - Life Goals and financial goals</li> <li>• Savings and Investments - Three pillars of investments, Popular asset classes, Government schemes, Mutual Funds, Securities markets (Shares and bonds), Gold, Real Estate, Do's and Don'ts of investments</li> <li>• Retirement planning</li> <li>• Cashless transactions</li> <li>• Income, expenditure and budgeting – Concepts and Importance</li> <li>• Inflation- Concept, effect on financial planning of an individual</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>08</b> | ----- | -----<br>- | ----- | --- | <b>C408<br/>.5</b> |

|  |                                                                                                                                                                                                                              |  |  |  |  |  |  |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
|  | <ul style="list-style-type: none"> <li>Loans – Types, Management of loans,</li> <li>Tax benefits</li> <li>Insurance – Types, Advantages, selection</li> <li>Dos and Don'ts in Financial planning and Transactions</li> </ul> |  |  |  |  |  |  |
|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|

**VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES : NOT APPLICABLE.**

**VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)**

**Suggestive list of activities during Regular as well as Special Camping (NSS Activities)**

- Following list is only an illustrative list of the type of activities that can be undertaken. Under the programme it would be open to each NSS Unit to undertake one of these programmes or any other activity which may seem desirable to them according to local needs. The NSS Unit should aim at the integrated development of the area selected for its operation which could be a village or a slum. It has also to be ensured that at least a part of the programme does involve manual work.
- (a) Environment Enrichment and Conservation:
- The activities under this sub-theme would inter-alia, include:
- plantation of trees, their preservation and upkeep Water conservation- Jaldindi, Essay competition, Drawing Competition.
  - Construction & maintenance of village streets, drains
  - Cleaning of village ponds and wells;
  - Popularization and construction of Gobar Gas Plants, use of non-conventional energy;
  - Disposal of garbage & composting;