



KANNUR UNIVERSITY

## **Four Year Undergraduate Programme ELECTRONICS**

**(OBE – Outcome Based Education)**

**2024 Admission onwards**

**(Semester III & IV Only)**

**List of Courses (Category wise)**

**Discipline Specific Core Courses (DSC) - Major pathway**

| Sl. No. | Semester | Course Code  | Course Title                               | MARKS |     |       | Credit |   |   |       | Hours/Week |    |    |       |
|---------|----------|--------------|--------------------------------------------|-------|-----|-------|--------|---|---|-------|------------|----|----|-------|
|         |          |              |                                            |       |     |       | L      | T | P | Total | L*         | T* | P* | Total |
|         |          |              |                                            | CE    | ESE | Total |        |   |   |       |            |    |    |       |
| 1       | 1        | KU1DSCELE101 | Fundamentals of Electrical and Electronics | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 2       | 2        | KU2DSCELE105 | Fundamentals of Digital Circuits           | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 3       | 3        | KU3DSCELE201 | Analog Electronics                         | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 4       | 3        | KU3DSCELE205 | Microprocessor and microcontroller         | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 5       | 4        | KU4DSCELE206 | Analog Integrated Circuits                 | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 6       | 4        | KU4DSCELE207 | Electronic Communication                   | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 7       | 4        | KU4DSCELE208 | Electronic Instrumentation                 | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 8       | 5        | KU5DSCELE301 | Fibre optic communication                  | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 9       | 5        | KU5DSCELE302 | Digital System Design                      | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 10      | 5        | KU5DSCELE303 | Embedded Systems                           | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 11      | 5        |              | Elective1                                  |       |     |       |        |   |   |       |            |    |    |       |
| 12      | 5        |              | Elective2                                  |       |     |       |        |   |   |       |            |    |    |       |
| 13      | 6        | KU6DSCELE304 | Python Programming                         | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |

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|                                 |   |              |                               |    |    |     |   |   |   |    |   |   |   |   |
|---------------------------------|---|--------------|-------------------------------|----|----|-----|---|---|---|----|---|---|---|---|
| 14                              | 6 | KU6DSCELE305 | VLSI                          | 30 | 70 | 100 | 4 | 0 | 0 | 4  | 4 | 0 | 0 | 4 |
| 15                              | 6 | KU6DSCELE306 | ARM Processor                 | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 16                              | 6 | KU6INTELE200 | <b>Internship</b>             |    |    |     |   |   |   | 2  |   |   |   |   |
| 17                              | 6 |              | Elective3                     |    |    |     |   |   |   |    |   |   |   |   |
| 18                              | 6 |              | Elective4                     |    |    |     |   |   |   |    |   |   |   |   |
| 19                              | 7 | KU7DSCELE401 | Low power VLSI                | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 20                              | 7 | KU7DSCELE402 | Information Theory and coding | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 21                              | 7 | KU7DSCELE403 | Machine Learning              | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 22                              | 7 | KU7DSCELE404 | Printed Antennas              | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 23                              | 7 | KU7DSCELE405 | Digital Image processing      | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| <b>Honours with Research</b>    |   |              |                               |    |    |     |   |   |   |    |   |   |   |   |
| 24                              | 8 | KU8RPHELE400 | PROJECT                       |    |    |     |   |   |   | 12 |   |   |   |   |
| 25                              | 8 |              | Elective5*                    |    |    |     |   |   |   |    |   |   |   |   |
| 26                              | 8 |              | Elective6*                    |    |    |     |   |   |   |    |   |   |   |   |
| 27                              | 8 |              | Elective7*                    |    |    |     |   |   |   |    |   |   |   |   |
| <b>Honours without research</b> |   |              |                               |    |    |     |   |   |   |    |   |   |   |   |
| 28                              | 8 | KU8DSCELE406 | Embedded OS and RTOS          | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 29                              | 8 | KU8DSCELE407 | Advanced Python Programming   | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 30                              | 8 | KU8DSCELE408 | Deep learning                 | 35 | 65 | 100 | 3 | 0 | 1 | 4  | 3 | 0 | 2 | 5 |
| 31                              | 8 |              | Elective5                     |    |    |     |   |   |   |    |   |   |   |   |
| 32                              | 8 |              | Elective6                     |    |    |     |   |   |   |    |   |   |   |   |
| 33                              | 8 |              | Elective7                     |    |    |     |   |   |   |    |   |   |   |   |

**\* These electives can be done as online courses. BoS will decide the title of the online courses upon request from the insitution.**

**Discipline Specific Core Courses (DSC) - Minor Pathway**

| Sl. No. | Sem ester | Course Code  | Course Title                              | MARKS |     |       | Credit |   |   |       | Hours/Week |    |    |       |
|---------|-----------|--------------|-------------------------------------------|-------|-----|-------|--------|---|---|-------|------------|----|----|-------|
|         |           |              |                                           | CE    | ESE | Total | L      | T | P | Total | L*         | T* | P* | Total |
|         |           |              |                                           |       |     |       |        |   |   |       |            |    |    |       |
| 1       | 1         | KU1DSCELE102 | Fundamentals of Digital Electronics       | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 2       | 1         | KU1DSCELE103 | Basic Electronics                         | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 3       | 1         | KU1DSCELE104 | Foundations of Electrical and Electronics | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 4       | 2         | KU2DSCELE106 | Introduction to 8051 Microcontroller      | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 5       | 2         | KU2DSCELE107 | Electronic Devices and Circuits           | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 6       | 2         | KU2DSCELE108 | Digital Electronics                       | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 7       | 3         | KU3DSCELE202 | Embedded C and Arduino programming        | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 8       | 3         | KU3DSCELE203 | Linear Integrated Circuits                | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |
| 9       | 3         | KU3DSCELE204 | Analog Circuits                           | 35    | 65  | 100   | 3      | 0 | 1 | 4     | 3          | 0  | 2  | 5     |

**Discipline Specific Elective Courses (DSE) – Major Pathway**

| Sl. No. | Sem ester | Course Code  | Course Title                   | Marks |     |       | Credit |   |   |       | Hours/Week |    |    |       |
|---------|-----------|--------------|--------------------------------|-------|-----|-------|--------|---|---|-------|------------|----|----|-------|
|         |           |              |                                | CE    | ESE | Total | L      | T | P | Total | L*         | T* | P* | Total |
| 1       | 5         | KU5DSEELE307 | Programming with C             | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 2       | 5         | KU5DSEELE308 | Signals and Systems            | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 3       | 5         | KU5DSEELE309 | PIC microcontrollers           | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 4       | 5         | KU5DSEELE310 | Electromagnetics               | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 5       | 5         | KU5DSEELE311 | Power Electronics              | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 6       | 5         | KU5DSEELE312 | Control System                 | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 7       | 5         | KU5DSEELE313 | Wireless sensor Networks       | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 8       | 6         | KU6DSEELE314 | Fundamentals of IOT            | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 9       | 6         | KU6DSEELE315 | Robotics and Automation        | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 10      | 6         | KU6DSEELE316 | Wireless Communications        | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 11      | 6         | KU6DSEELE317 | Digital Signal Processing      | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 12      | 6         | KU6DSEELE318 | Advanced Power electronics     | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 13      | 6         | KU6DSEELE319 | Antennas and Microwave Devices | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 14      | 6         | KU6DSEELE320 | MEMS                           | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 15      | 6         | KU6DSEELE321 | Cryptography                   | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 16      | 8         | KU8DSEELE409 | Research Methodology           | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |
| 17      | 8         | KU8DSEELE410 | Computer                       | 30    | 70  | 100   | 4      | 0 | 0 | 4     | 4          | 0  | 0  | 4     |

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|    |   |              |                                      |    |    |     |   |   |   |   |   |   |   |   |
|----|---|--------------|--------------------------------------|----|----|-----|---|---|---|---|---|---|---|---|
|    |   |              | networks                             |    |    |     |   |   |   |   |   |   |   |   |
| 18 | 8 | KU8DSEELE411 | Microwave Integrated Circuits        | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 19 | 8 | KU8DSEELE412 | Radar and navigation                 | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 20 | 8 | KU8DSEELE413 | Industrial Automation                | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 21 | 8 | KU8DSEELE414 | Optical sensing                      | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 22 | 8 | KU8DSEELE415 | Mixed Signal Circuit Design          | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 23 | 8 | KU8DSEELE416 | Secure Communication                 | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 24 | 8 | KU8DSCELE417 | Basic Tools of Microwave Engineering | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
|    |   |              |                                      |    |    |     |   |   |   |   |   |   |   |   |

**Discipline Specific Elective Courses (DSE) – Minor Pathway**

|   |   |              |                             |    |    |     |   |   |   |   |   |   |   |   |
|---|---|--------------|-----------------------------|----|----|-----|---|---|---|---|---|---|---|---|
| 1 | 8 | KU8DSEELE322 | Embedded OS and RTOS        | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 2 | 8 | KU8DSEELE323 | Advanced Python Programming | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 3 | 8 | KU8DSEELE324 | VLSI                        | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |
| 4 | 8 | KU8DSEELE325 | Fundamentals of IOT         | 30 | 70 | 100 | 4 | 0 | 0 | 4 | 4 | 0 | 0 | 4 |

**Skill Enhancement Courses (SEC)**

| Sl. No. | Semester | Course Code   | Course Title                  | Marks |     |       | Credit |   |   |       | Hours/Week |    |    |       |
|---------|----------|---------------|-------------------------------|-------|-----|-------|--------|---|---|-------|------------|----|----|-------|
|         |          |               |                               | CE    | ESE | Total | L      | T | P | Total | L*         | T* | P* | Total |
| 1       | 4        | KU4SECEL E109 | Embedded product design       | 25    | 50  | 75    | 2      | 0 | 1 | 3     | 2          | 0  | 2  | 4     |
| 2       | 5        | KU5SECEL E110 | Computer Aided Circuit design | 25    | 50  | 75    | 3      | 0 | 0 | 3     | 3          | 0  | 0  | 3     |
| 3       | 6        | KU6SECEL E111 | PCB Design and Fabrication    | 25    | 50  | 75    | 3      | 0 | 0 | 3     | 3          | 0  | 0  | 3     |

**Value Added Courses (VAC)**

| Sl. No . | Se mes ter | Course Code   | Course Title                    | Marks |      |        | Credit |   |   |        | Hours/Week |    |    |        |
|----------|------------|---------------|---------------------------------|-------|------|--------|--------|---|---|--------|------------|----|----|--------|
|          |            |               |                                 |       |      |        | L      | T | P | Tot al |            |    |    |        |
|          |            |               |                                 | CE    | ES E | To tal |        |   |   |        | L*         | T* | P* | Tota l |
| 1        | 3          | KU3VACE LE112 | Web Application Development     | 25    | 50   | 75     | 3      | 0 | 0 | 3      | 3          | 0  | 0  | 3      |
| 2        | 4          | KU4VACE LE113 | Mobile Application development  | 25    | 50   | 75     | 3      | 0 | 0 | 3      | 3          | 0  | 0  | 3      |
| 3        | 4          | KU4VACE LE114 | Artificial Intelligence for You | 25    | 50   | 75     | 3      | 0 | 0 | 3      | 3          | 0  | 0  | 3      |

**Multi Disciplinary Courses (MDC)**

| Sl.No. | Semester | Course Code  | Course Title                      | Marks |     |       | Credit |   |   |       | Hours/Week |    |    |       |
|--------|----------|--------------|-----------------------------------|-------|-----|-------|--------|---|---|-------|------------|----|----|-------|
|        |          |              |                                   | CE    | ESE | Total | L      | T | P | Total | L*         | T* | P* | Total |
| 1      | 1        | KU1MDCELE115 | Computer Hardware                 | 25    | 50  | 75    | 2      | 0 | 1 | 3     | 2          | 0  | 2  | 4     |
| 2      |          | KU1MDCELE116 | Electronics for You               | 25    | 50  | 75    | 2      | 0 | 1 | 3     | 2          | 0  | 2  | 4     |
| 3      | 2        | KU2MDCELE117 | R and Python for Data Analysis    | 25    | 50  | 75    | 2      | 0 | 1 | 3     | 2          | 0  | 2  | 4     |
| 4      | 3        | KU3MDCELE118 | Fundamentals of Electric Vehicles | 25    | 50  | 75    | 3      | 0 | 0 | 3     | 3          | 0  | 0  | 3     |

\* L=Lecture, T=Tutorial, P=Practical

**Internship & Project**

| Sl.No. | Semester | Course Code  | Course Title | Credit |
|--------|----------|--------------|--------------|--------|
| 1      | 6        | KU6INTELE200 | INTERNSHIP   | 2      |
| 2      | 8        | KU8RPHELE400 | PROJECT      | 12     |

# SYLLABUS

## Semester -III

| Sl.No. | Course Type              | Course Title                       | Course Code  | Credit |
|--------|--------------------------|------------------------------------|--------------|--------|
| 1      | Major                    | Analog Electronics                 | KU3DSCELE201 | 4      |
|        |                          | Microprocessor and microcontroller | KU3DSCELE205 | 4      |
| 2      | Minor                    | Embedded C and Arduino programming | KU3DSCELE202 | 4      |
|        |                          | Linear Integrated Circuits         | KU3DSCELE203 | 4      |
|        |                          | Analog Circuits                    | KU3DSCELE204 | 4      |
| 3      | Value Added Course (VAC) | Web ApplicationDevelopment         | KU3VACELE112 | 3      |

**KU3DSCELE201: Analog Electronics**

| Semester                        | Course Type | Course Level | Course Code        | Credits<br>(L+T+P) | Total Hours<br>(L+T+P)     |
|---------------------------------|-------------|--------------|--------------------|--------------------|----------------------------|
| 3                               | Major       | 200          | KU3DSCELE201       | 3+0+1              | 45+0+30                    |
|                                 |             |              |                    |                    |                            |
| Learning Approach (Hours/ Week) |             |              | Marks Distribution |                    |                            |
| Lecture                         | Practical   | Tutorial     | CE                 | ESE                | Total                      |
| 3                               | 2           | 0            | 35                 | 65                 | 100                        |
|                                 |             |              |                    |                    | Duration of<br>ESE (Hours) |
|                                 |             |              |                    |                    | 2                          |

**Course Description:**

*This course aims to develop skills in designing circuits based on BJTs, FETs, MOSFETs, amplifiers, and oscillators. The working principle of BJTs is explained in Unit I. Unit II explains the design of CE amplifiers and power amplifiers. The working principle of oscillators and their types is also explained in detail. After the successful completion of this course, the student will be able to design circuits based on the above devices. Practical sessions are also included.*

**Course Prerequisite:** Understanding of fundamental electronic components, knowledge of circuit analysis techniques, and familiarity with semiconductor devices.

**Course Outcomes:**

| CO No. | Expected Outcome                                              | Learning Domains |
|--------|---------------------------------------------------------------|------------------|
| 1      | Explain the working of BJTs, FETs, Amplifiers and oscillators | U                |
| 2      | Design biasing circuits for BJT                               | C                |
| 3      | Design single stage BJT amplifier and Power amplifier         | C                |
| 4      | Comparison of positive feedback and negative feedback         | U                |
| 5      | Design and develop oscillator circuits                        | C                |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create ©**

| Mapping of Course Outcomes to PSOs |       |       |       |       |       |       |       |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                                    | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
| CO 1                               | 3     |       |       |       |       |       |       |
| CO 2                               |       | 3     |       | 3     |       |       |       |
| CO 3                               |       | 3     |       | 3     |       |       |       |
| CO 4                               | 3     |       |       |       |       |       |       |
| CO 5                               |       | 3     |       | 3     |       |       | 3     |

## COURSE CONTENTS

## Contents for Classroom Transaction:

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                                                                                                | HOURS     |
|----------------------------|------------------|------------------------------------------------------------------------------------------------------------|-----------|
| 1                          | <b>Module I</b>  |                                                                                                            | <b>10</b> |
|                            | 1.1              | Bipolar Junction Transistor (BJT) symbol, types (NPN and PNP), construction, working principle, parameters |           |
|                            | 1.2              | BJT amplification, BJT switching, Transistor configurations- CB, CE and CC, characteristics                |           |
|                            | 1.3              | DC load line (CE), Q point, factors affecting the stability                                                |           |
|                            | 1.4              | Biasing circuits-fixed bias, emitter feedback bias, voltage divider, thermal stability                     |           |
| 2                          | <b>Module II</b> |                                                                                                            | <b>10</b> |
|                            | 2.1              | AC analysis, Coupling and bypass capacitors, AC load line and equivalent circuits                          |           |
|                            | 2.2              | Transistor models – RE model Hybrid equivalent circuits                                                    |           |
|                            | 2.3              | CE circuit analysis, - Small signal amplifier, Design of single stage RC Coupled amplifier                 |           |
|                            | 2.4              | Classification of power amplifiers on basis of conduction: class A, class B, class AB, Class C amplifiers  |           |
|                            |                  |                                                                                                            |           |

|          |                                                                                                                 |                                                                                                                                               |           |
|----------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          |                                                                                                                 |                                                                                                                                               |           |
|          | <b>Module III</b>                                                                                               |                                                                                                                                               | <b>10</b> |
| <b>3</b> | 3.1                                                                                                             | Construction, working principle, Symbol, types, V-I characteristics, Specifications and parameters of Junction Field Effect Transistor (JFET) |           |
|          | 3.2                                                                                                             | Construction, working principle, Symbol, types, V-I characteristics, Specifications and parameters of Metal Oxide Semiconductor FET (MOSFET)  |           |
|          | 3.3                                                                                                             | MOSFET Based practical switching circuits                                                                                                     |           |
|          | 3.4                                                                                                             | Comparison of JFET, MOSFET and BJT, Applications                                                                                              |           |
|          |                                                                                                                 |                                                                                                                                               |           |
|          | <b>Module IV</b>                                                                                                |                                                                                                                                               | <b>10</b> |
| <b>4</b> | 4.1                                                                                                             | Concept of negative and positive feedback. Types of feedbacks circuits: current shunt, current series, voltage shunt and voltage series       |           |
|          | 4.2                                                                                                             | Comparison and applications                                                                                                                   |           |
|          | 4.3                                                                                                             | Effect of negative feedback: on amplifier performance, stability of an amplifier.                                                             |           |
|          | 4.4                                                                                                             | Positive feedback: oscillator circuits -Wien bridge , Phase Shift , Hartley , Colpitts and Crystal                                            |           |
|          |                                                                                                                 |                                                                                                                                               |           |
|          | <b>Teacher Specific Module</b>                                                                                  |                                                                                                                                               | <b>5</b>  |
| <b>5</b> | <i>Directions: Teacher can design this module based on their expertise and demonstrate it from the students</i> |                                                                                                                                               |           |
|          |                                                                                                                 |                                                                                                                                               |           |

**Essential Readings:**

1. Electronic Devices and Circuits: David A Bell, Oxford University Press 5<sup>th</sup> edition
2. A text book of Applied Electronics : R. S. Sedha, S Chand Company Ltd

**Suggested Readings:**

- Basic Electronics Solid state : B. L. Theraja, S Chand Company Ltd, 5 th edition

- A text book of Electrical Technology: B.L.Theraja, S.Chand and Co.
- Basic Electronics and Linear Circuits: Bhargava N.N., Kulshreshtha D.C., TMH
- Electronic Devices and Circuits: Bolyestad, TataMcGraw Hill.
- Electronic Principles: Albert Malvino, David J Bates, McGraw Hill 7th Edition.

**Laboratory Sessions :** Practical sessions to reinforce theoretical concepts

**1 : V-I Characteristics of the CE configuration of BJT**

**2 : Design Transistor Biasing circuits (Fixed and voltage divider bias) for a given specification**

**3: Design a single stage CE amplifier for a given gain**

**4: Design BJT as switch**

**5: Design current series feedback amplifier**

**6 : Design phase shift oscillator**

**7: Design Wein bridge oscillator**

**8: Design current shunt feedback amplifier**

**9: Design Hartley oscillator**

**10: Design Colpitts oscillator**

*Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, program listings, and expected outcomes.*

**Assessment Rubrics:**

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |
| Continuous Evaluation   | 35    |

**KU3DSCELE205: Microprocessor & Microcontroller**

| Semester | Course type | Course level | Course code   | Credits (L+T+P) | Total hours(L+T+P) |
|----------|-------------|--------------|---------------|-----------------|--------------------|
| 3        | Major       | 200          | KU3DSCELE 205 | 3+0+1           | 45+0+30            |

| Learning Approach (Hours\week) |           |          | Mark Distribution |     |       | Duration of ESE(Hours) |
|--------------------------------|-----------|----------|-------------------|-----|-------|------------------------|
| Lecture                        | Practical | Tutorial | CE                | ESE | Total |                        |
| 3                              | 2         | 0        | 35                | 65  | 100   | 2                      |

**Course Description:**

This is a complete introductory course designed to provide a solid understanding of the basic and programming concepts underlying microprocessor and microcontroller 8051. Topics covered include basic processor instructions sets, programming concepts in processors and 8051 microcontroller basics, memory, i/o ports, serial communication and interfacing techniques.

Course Prerequisite; Basic understanding of Digital electronics

**Course Outcomes**

| CO No. | Expected Outcomes                                                        | Learning Domains |
|--------|--------------------------------------------------------------------------|------------------|
| 1      | Understand Introduction to microprocessors, types, descriptions          | U                |
| 2      | Explain Microcontroller concepts and instructions formats                | E                |
| 3      | Understand Microcontroller 8051 programming techniques                   | U                |
| 4      | Develop interfacing concepts and sample programs                         | C                |
| 5      | Develop practical experience through laboratory experiments and projects | C                |

Remember(R) Understand (U) Apply (A) Analyse (An) Evaluate (E) Create(C)

**Mapping of Course Outcomes to PSOs**

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 | 2    |      | 2    |      |      |      |      |

|     |  |  |   |  |   |   |   |
|-----|--|--|---|--|---|---|---|
| CO2 |  |  | 2 |  | 3 |   |   |
| CO3 |  |  |   |  | 3 |   |   |
| CO4 |  |  | 3 |  | 3 | 3 |   |
| CO5 |  |  |   |  | 3 | 3 | 3 |

### COURSE CONTENTS

#### Contents for Classroom Transaction

|   |     | Description                                                                                                                                                              | Hours |
|---|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| 1 |     | <b>Module 1</b>                                                                                                                                                          | 10    |
|   | 1.1 | Evolution of microprocessor-introduction to 8085-Functional block-diagram-8085 registers-bus organization - microprocessor initiated operations&internal data operations |       |
|   | 1.2 | Externally initiated operations-memory organisation-mapping and types<br><br>Types of I/O addressing -instruction format. Instructions and timing (programming not)-     |       |
|   | 1.3 | Instruction classification .concepts of RISC &CISC - MMX-Pentium processors (instructions only).Simple programs in examples                                              |       |
| 2 |     | <b>Module 2</b>                                                                                                                                                          | 10    |
|   | 2.1 | Microcontroller 8051Architecture:Comparison between microprocessor and microcontroller                                                                                   |       |
|   | 2.2 | microcontroller 8051 Hardware (oscillator&clock,program counter,Data pointer,A and B registers,Flag and PSW,internal memory ,memory RAM/ROM,Stack and stack memory&SFRs) |       |
|   | 2.3 | I/O Ports,external memory,counters and timers                                                                                                                            |       |
|   | 2.4 | Serial I/O interrupts.types define only                                                                                                                                  |       |
|   |     | <b>Module3</b>                                                                                                                                                           | 10    |
|   | 3.1 | Addressing modes,Different groups of instructions-Data transfer instructions,Logical operations, simple programs                                                         |       |
|   | 3.2 | Arithmetic operations, jump and call instructions,some                                                                                                                   |       |

|   |                                                                                                  |                                                                                                                                              |    |
|---|--------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|----|
|   |                                                                                                  | simple programs                                                                                                                              |    |
|   | 3.3                                                                                              | Code conversion,Block data transfer ,timer programming                                                                                       |    |
|   | 3.4                                                                                              | All types of instruction based 8051 microcontroller simple programs for solved examples                                                      |    |
| 4 |                                                                                                  | Module4                                                                                                                                      | 10 |
|   | 4.1                                                                                              | Peripherals timer,counter,interrupts-serial data -i/p and serial data o/p                                                                    |    |
|   | 4.2                                                                                              | Serial data interrupts,timer flag interrupts,serial port interrupt,external interrupts,reset,interrupt priority-software generated interrupt |    |
|   | 4.3                                                                                              | Data transmission and reception -serial data transmission mode.Keyboard interfacing,display interfacing,seven segment and LCD Display        |    |
|   | 4.4                                                                                              | D/A and A/D interface,simple programmes for solved examples                                                                                  |    |
| 5 |                                                                                                  | Teacher Specific Module                                                                                                                      | 5  |
|   | Directions: Teacher can design this module based on their expertise and demand from the students |                                                                                                                                              |    |
|   |                                                                                                  |                                                                                                                                              |    |

**Essential Readings:**

- 1.8085 -Architecture programming & technique-Ramesh Goanker
- 2.The 8051 microcontroller Architecture programming & Applications(II Edition)-Kenneth .J.Ayala
3. The 8051 microcontroller and Embedded systems-Muhammad Ali Mazidi

**Suggested Readings:**

1. Kenneth .J.Ayala- The 8051 microcontroller& embedded system using assembly and C
2. The 8051 microcontroller -Phinillos Gimenez

3. The 8051 microcontroller- Scott MacKenzie
4. The 8051 microcontroller MCS 51 Family and its variants-Satish Shah
5. The 8051 microcontroller.Fundamental cocepts,Hardware,software and applications in Electronics-Salvador Pinillos Gimenez

**Laboratory Sessions:Practical sessions to include programming and interfacing programmms based on theoretical concepts using microcontroller 8051 trainer kit**

- 1.Addition ,Subtraction,Multiplication and Division( 8-bit numbers)
- 2.Addition and subtraction (16 bit numbers)
- 3.Logical operation -AND,OR and NOT
- 4.Programme to transfer a block of data
- 5.Array addition (8-bit number array)
- 6.Decimal to Hex and Hex to Decimal
- 7.Decimal to ASCII and ASCII to Decimal
- 8.Sort numbers in Ascending order/Descending order
- 9.UP/DOWN counter
10. Dancing LED
11. Square wave generator
12. Serial communicationbased programmms
13. Seven segment LED interface
14. LCD interface

**Lab rules to be followed**

*Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, program listings, and expected outcomes.*

**Assessment Rubrics:**

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |

|                       |    |
|-----------------------|----|
| Continuous Evaluation | 35 |
|-----------------------|----|

### KU3DSCELE202 Embedded C and Arduino programming

| Semester | Course Type | Course Level | Course Code  | Credits<br>(L+T+P) | Total Hours<br>(L+T+P) |
|----------|-------------|--------------|--------------|--------------------|------------------------|
| 3        | Minor       | 200          | KU3DSCELE202 | 3+0+1              | 45+0+30                |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of<br>ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|----------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                            |
| 3                               | 2         | 0        | 35                 | 65  | 100   | 2                          |

#### Course Description:

*This is a comprehensive introductory course designed to provide a solid understanding of the basic principles and concepts underlying Embedded C and Arduino programming. Topics covered include the fundamentals of C and Embedded C programming, microcontroller basics using Arduino hardware, interfacing sensors and actuators using Arduino and applications of embedded systems in real-world projects. Throughout the course, emphasis is placed on practical applications to reinforce theoretical concepts. By the end of the course, students should have a solid foundation in embedded systems in real-world projects, preparing them for more advanced coursework or practical applications in the field.*

**Course Prerequisite:** Basic understanding of Embedded C and Arduino Hardware. To develop programming skills for interfacing sensors and actuators using Arduino.

#### Course Outcomes:

| CO No. | Expected Outcome | Learning Domains |
|--------|------------------|------------------|
|--------|------------------|------------------|

*FYUGP “ELECTRONICS”*

|   |                                                                                                                     |   |
|---|---------------------------------------------------------------------------------------------------------------------|---|
| 1 | To introduce the fundamentals of C and Embedded C programming.                                                      | U |
| 2 | To provide knowledge on microcontroller basics using Arduino hardware.                                              | U |
| 3 | To develop programming skills for interfacing sensors and actuators using Arduino.                                  | A |
| 4 | To enable practical applications of embedded systems in real-world projects.                                        | E |
| 5 | Develop Mini Projects: ( Line follower, Smart Light, Temperature Logger). Debugging and troubleshooting techniques. | C |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

**Mapping of Course Outcomes to PSOs**

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 | 3     |       |       |       |       |       |       |
| CO 2 |       |       |       |       |       |       |       |
| CO 3 |       |       |       |       |       |       |       |
| CO 4 | 3     | 3     |       |       |       |       |       |
| CO 5 |       | 3     |       |       |       |       | 3     |

**COURSE CONTENTS**

**Contents for Classroom Transaction:**

| <b>M<br/>O<br/>D<br/>U<br/>L<br/>E</b> | <b>U<br/>N<br/>I<br/>T</b> | <b>DESCRIPTION</b>                                                 | <b>HOURS</b> |
|----------------------------------------|----------------------------|--------------------------------------------------------------------|--------------|
| <b>1</b>                               | <b>Module I</b>            |                                                                    | <b>10</b>    |
|                                        | 1.1                        | Introduction to programming and structure of C programs            |              |
|                                        | 1.2                        | Data types, variables, constants, operators.                       |              |
|                                        | 1.3                        | Control statements: if, else, switch, loops (for, while, do-while) |              |

|   |                  |                                                                                      |           |
|---|------------------|--------------------------------------------------------------------------------------|-----------|
|   | 1.4              | Functions, arrays, strings, pointers. Structure and file handling basics (overview). |           |
|   | <b>Module II</b> |                                                                                      | <b>10</b> |
| 2 | 2.1              | Differences between C and Embedded C. Microcontroller architecture overview.         |           |
|   | 2.2              | Registers, memory types (RAM, ROM, EEPROM                                            |           |
|   | 2.3              | Bit manipulation, I/O port programming. Delay functions and embedded C libraries.    |           |
|   | 2.4              | Introduction to Interrupts.                                                          |           |
|   |                  |                                                                                      |           |

|   |                   |                                                                                          |           |
|---|-------------------|------------------------------------------------------------------------------------------|-----------|
|   | <b>Module III</b> |                                                                                          | <b>10</b> |
| 3 | 3.1               | Overview of Arduino platform and IDE.                                                    |           |
|   | 3.2               | Arduino UNO: pin configuration, power supply, memory.                                    |           |
|   | 3.3               | Sensors and Actuators: Types and working (temperature, motion, IR, relay, motors, etc.). |           |
|   | 3.4               | Communication protocols: UART, SPI, I2C (basics).                                        |           |

|   |                                                                                                         |                                                                                          |           |
|---|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|-----------|
|   | <b>Module IV</b>                                                                                        |                                                                                          | <b>10</b> |
| 4 | 4.1                                                                                                     | Basic Arduino programs (Blink, Serial Print, DigitalRead/Write.                          |           |
|   | 4.2                                                                                                     | AnalogRead/Write and PWM. Interfacing LEDs, switches, buzzers, sensors (IR, ultrasonic). |           |
|   | 4.3                                                                                                     | Mini Projects: ( Line follower, Smart Light, Temperature Logger)..                       |           |
|   | 4.4                                                                                                     | Debugging and troubleshooting techniques.                                                |           |
| 5 | <b>Teacher Specific Module</b>                                                                          |                                                                                          | <b>5</b>  |
|   | <i>Directions: Teacher can design this module based on their expertise and demand from the students</i> |                                                                                          |           |
|   | Space to fill the selected                                                                              |                                                                                          |           |

|  |                |  |
|--|----------------|--|
|  | area/ activity |  |
|--|----------------|--|

**Essential Readings:**

- 1) Let Us C – Yashavant Kanetkar
- 2) Embedded C Programming and the Atmel AVR – Barnett, Cox, O’Cull
- 3) Arduino Cookbook – Michael Margolis
- 4) Getting Started with Arduino – Massimo Banz

**Suggested Readings:**

- 1) C Programming Absolute Beginner's Guide-Greg Perry, Dean Miller
- 2) C Programming in easy steps (5th Edition)- Mike McGrath
- 3) "Embedded C" by Michael J. Pont
- 4) "First Steps with Embedded Systems" by Phaedrus Systems:
- 5) Programming Arduino-Simon monk

**Laboratory Sessions :** Practical sessions to reinforce theoretical concepts

**1) Familiarization with Arduino IDE and Basic C Programming (Blink LED)**

**Objective:** To introduce students to Arduino development environment and write a basic program to blink an LED.

**Tasks:** - Install and configure Arduino IDE.

- Identify Arduino UNO board and its components.
- Write a simple program to blink an LED connected to a digital pin.
- Upload the program to the Arduino board and observe output.

**2) Digital Input Reading: Interface a Push Button**

**Objective:** To understand digital input reading using Arduino.

**Tasks:**

- Connect a push button to an Arduino digital pin.

- Write a program to read button state.
- Display button status on Serial Monitor.

### **3) Analog Input Reading: Read Values from a Potentiometer**

Objective: To measure analog voltages using Arduino ADC.

Tasks:

- Connect a potentiometer to an analog pin.
- Write a program to read and display analog values.
- Observe changes in Serial Monitor.

### **4) PWM Output: Control LED Brightness**

Objective: To generate PWM signals using Arduino.

Tasks:

- Connect an LED to a PWM capable pin.
- Write a program to vary LED brightness.
- Use analogWrite() function.

### **5) Temperature Monitoring: Interfacing LM35 Sensor**

Objective: To measure ambient temperature using LM35 and Arduino.

Tasks:

- Interface LM35 sensor to analog input.
- Write a program to calculate and display temperature.

### **6) Motion Detection: Interfacing PIR Sensor**

Objective: To detect motion using PIR sensor and trigger an output device.

Tasks:

- Connect a PIR sensor to Arduino.

- Write a program to detect motion.
- Activate LED/Buzzer upon detection.

### **7) Motor Control: Interface and Control DC Motor Using PWM**

Objective: To control the speed of a DC motor using PWM.

Tasks:

- Connect motor driver circuit to Arduino.
- Write a program to vary motor speed.
- Test different speed levels.

### **8) Serial Communication: UART Communication with PC**

Objective: To perform serial communication using Arduino UART.

Tasks:

- Write a program to send sensor data to PC.
- Display the data using Serial Monitor.

### **9) Mini Project 1: Smart Automatic Lighting System**

Objective: To automate lighting using LDR and Motion Sensor.

Tasks:

- Interface LDR and PIR sensor.
- Write program logic to turn on light in dark when motion detected.

### **10) Mini Project 2: Obstacle Detection and Alert System**

Objective: To detect obstacles using Ultrasonic Sensor and generate alert.

Tasks:

- Interface Ultrasonic sensor (HC-SR04) with Arduino.
- Write program to measure distance.

- Activate buzzer/LED if obstacle detected within threshold.

*Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, algorithm/flow chart, program listings, and expected outcomes.*

**Assessment Rubrics:**

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |
| Continuous Evaluation   | 35    |

**KU3DSCELE203: Linear integrated circuits**

| Semester                        | Course Type | Course Level | Course Code        |     | Credits<br>(L+T+P) | Total Hours<br>(L+T+P)     |
|---------------------------------|-------------|--------------|--------------------|-----|--------------------|----------------------------|
| 3                               | Minor       | 200          | KU3DSCELE203       |     | 3+0+1              | 45+0+30                    |
|                                 |             |              |                    |     |                    |                            |
| Learning Approach (Hours/ Week) |             |              | Marks Distribution |     |                    | Duration of<br>ESE (Hours) |
| Lecture                         | Practical   | Tutorial     | CE                 | ESE | Total              |                            |
| 3                               | 2           | 0            | 35                 | 65  | 100                | 2                          |

**Course Description:**

This course aims to develop the skill to design circuits using operational amplifiers and other linear ICs for various applications. It includes the study of OP-AMP characteristics, basic amplifier circuits, filters, waveform generators, voltage regulators and various OP-AMP applications. Practical sessions include hands-on experience with OP-AMP circuits such as amplifiers, oscillators, and multivibrators using IC 741 and 555 Timer. Students will gain a comprehensive understanding of OP-AMP theory and practical applications, preparing them for real-world electronic circuit design and analysis.

**Course Prerequisite:** Understanding of fundamental electronic components and concepts, familiarity with circuit analysis techniques.

**Course Outcomes:**

| CO No. | Expected Outcome                                               | Learning Domains |
|--------|----------------------------------------------------------------|------------------|
| 1      | Analyse the differential amplifier configuration               | A n              |
| 2      | Design operational amplifier circuits for various applications | A                |
| 3      | Understand the working of oscillators                          | U                |
| 4      | To develop the circuit using 555 timer                         | C                |
| 5      | Evaluate the performance of voltage regulator IC's and data    | E                |

|  |            |  |
|--|------------|--|
|  | converters |  |
|--|------------|--|

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

| Mapping of Course Outcomes to PSOs |       |       |       |       |       |       |       |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                                    | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
| CO 1                               | 3     | 3     | 1     | 2     |       |       |       |
| CO 2                               | 3     | 3     | 2     | 2     | 2     |       |       |
| CO 3                               | 3     | 3     | 2     | 2     | 2     |       |       |
| CO 4                               | 3     | 3     | 1     | 2     | 2     |       |       |
| CO 5                               | 3     | 3     | 2     | 2     | 2     |       |       |

### COURSE CONTENTS

#### Contents for Classroom Transaction

| MODULE   | UNIT             | DESCRIPTION                                                                                                                | HOURS     |
|----------|------------------|----------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>1</b> | <b>Module I</b>  |                                                                                                                            | <b>10</b> |
|          | 1.1              | Basic Differential amplifier configurations.                                                                               |           |
|          | 1.2              | The 741 Op Amp, Block diagram, Equivalent circuit,                                                                         |           |
|          | 1.3              | Ideal op-amp parameters, typical parameter values for 741                                                                  |           |
|          | 1.4              | Open loop configurations, Voltage transfer curve, Frequency response curve                                                 |           |
| <b>2</b> | <b>Module II</b> |                                                                                                                            | <b>10</b> |
|          | 2.1              | Analysis of practical inverting and non-inverting amplifiers for Closed loop gain, Input resistance and output resistance. |           |
|          | 2.2              | Summer, Voltage Follower, Differential and Instrumentation Amplifiers                                                      |           |
|          | 2.3              | Voltage to current and Current to voltage converters                                                                       |           |
|          | 2.4              | Integrator, Differentiator, Comparators, Schmitt Triggers.                                                                 |           |

|   |                                                                                                         |                                                                                                |           |
|---|---------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|-----------|
|   |                                                                                                         |                                                                                                |           |
|   |                                                                                                         |                                                                                                |           |
| 3 | <b>Module III</b>                                                                                       |                                                                                                | <b>10</b> |
|   | 3.1                                                                                                     | Phase Shift and Wien-bridge Oscillator.                                                        |           |
|   | 3.2                                                                                                     | Astable and monostable multivibrators                                                          |           |
|   | 3.3                                                                                                     | Timer IC 555- Functional diagram.                                                              |           |
|   | 3.4                                                                                                     | Astable and monostable operations.                                                             |           |
|   |                                                                                                         |                                                                                                |           |
| 4 | <b>Module IV</b>                                                                                        |                                                                                                | <b>10</b> |
|   | 4.1                                                                                                     | Fixed and Adjustable voltage regulators, IC 723 – Low voltage and high voltage configurations, |           |
|   | 4.2                                                                                                     | Digital to Analog converters, Specifications                                                   |           |
|   | 4.3                                                                                                     | Weighted resistor type and R-2R Ladder type                                                    |           |
|   | 4.4                                                                                                     | Analog to Digital Converters: Specifications, Flash type and Successive approximation type.    |           |
| 5 | <b>Teacher Specific Module</b>                                                                          |                                                                                                | <b>5</b>  |
|   | <i>Directions: Teacher can design this module based on their expertise and demand from the students</i> |                                                                                                |           |
|   | Space to fill the selected area/ activity                                                               |                                                                                                |           |

**Essential Readings:**

1. Gayakwad , Op-Amps and Linear Integrated Circuits , PHI,4/e.2013.
2. Roy Chowdhary, Linear Integrated Circuits, New Age International, 2/e, 2010.

3. Botkar, Integrated Circuits, Khanna Publishers, 9/e, 2003.

**Suggested Readings:**

- Salivahanan S. and V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008.
- David A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition, 2010
- Franco, Design with Operational Amplifiers and Analog Integrated Circuits, TMH, 3/e, 2008 .

**Laboratory Sessions :** Practical sessions to reinforce theoretical concepts

1. OPAMP – Non inverting & inverting Amplifier using IC 741
2. Adder & subtractor using IC 741
3. RC phase shift oscillator using IC 741 - design, output waveform
4. Astable Multivibrator using IC 741 - design, output waveform.
5. Mono stable Multivibrator using IC 741 - design, output waveform.
6. Schmitt trigger using IC 741 - design, output waveform.
7. Timer IC 555 – Astable Multivibrator - design, output waveform.
8. Integrators & Differentiators using IC 741- design, waveforms.
9. voltage regulator using IC 723.

*Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, program listings, and expected outcomes.*

**Assessment Rubrics:**

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |
| Continuous Evaluation   | 35    |

**KU3DSCELE204: Analog Circuits**

| Semester                        | Course Type | Course Level | Course Code        |     | Credits<br>(L+T+P) | Total Hours<br>(L+T+P)     |
|---------------------------------|-------------|--------------|--------------------|-----|--------------------|----------------------------|
| 3                               | Minor       | 200          | KU3DSCELE204       |     | 3+0+1              | 45+0+30                    |
|                                 |             |              |                    |     |                    |                            |
| Learning Approach (Hours/ Week) |             |              | Marks Distribution |     |                    | Duration of<br>ESE (Hours) |
| Lecture                         | Practical   | Tutorial     | CE                 | ESE | Total              |                            |
| 3                               | 2           | 0            | 35                 | 65  | 100                | 2                          |

**Course Description:**

*This course aims to develop knowledge about analog circuits. The course covers BJTs, FETs, MOSFETs, amplifiers, and oscillators. Practical sessions are also included in this course.*

**Course Prerequisite:** Understanding of fundamental electronic components and concepts, familiarity with circuit analysis techniques.

**Course Outcomes:**

| CO No. | Expected Outcome                                              | Learning Domains |
|--------|---------------------------------------------------------------|------------------|
| 1      | Explain the working of BJTs, FETs, Amplifiers and oscillators | U                |
| 2      | Design biasing circuits for BJT                               | C                |
| 3      | Design single stage BJT amplifier                             | C                |
| 4      | Comparison of positive feedback and negative feedback         | U                |
| 5      | Design and develop oscillator circuits                        | C                |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create ©**

| Mapping of Course Outcomes to PSOs |       |       |       |       |       |       |       |
|------------------------------------|-------|-------|-------|-------|-------|-------|-------|
|                                    | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
| CO 1                               | 3     |       |       |       |       |       |       |
| CO 2                               |       | 3     |       | 3     |       |       |       |
| CO 3                               |       | 3     |       | 3     |       |       |       |
| CO 4                               | 3     |       |       |       |       |       |       |
| CO 5                               |       | 3     |       | 3     |       |       | 3     |

### COURSE CONTENTS

#### Contents for Classroom Transaction:

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                                                                                                | HOURS     |
|----------------------------|------------------|------------------------------------------------------------------------------------------------------------|-----------|
| 1                          | <b>Module I</b>  |                                                                                                            | <b>10</b> |
|                            | 1.1              | Bipolar Junction Transistor (BJT) symbol, types (NPN and PNP), construction, working principle, parameters |           |
|                            | 1.2              | BJT amplification, BJT switching, Transistor configurations- CB, CE and CC, characteristics                |           |
|                            | 1.3              | DC load line (CE), Q point, factors affecting the stability                                                |           |
|                            | 1.4              | Biasing circuits-fixed bias, emitter feedback bias, voltage divider, thermal stability                     |           |
| 2                          | <b>Module II</b> |                                                                                                            | <b>10</b> |
|                            | 2.1              | AC analysis, Coupling and bypass capacitors, AC load line and equivalent circuits                          |           |
|                            | 2.2              | Transistor models – RE model Hybrid equivalent circuits                                                    |           |
|                            | 2.3              | CE circuit analysis, - Small signal amplifier, Design of single stage RC Coupled amplifier                 |           |
|                            | 2.4              | Comparison of small signal and large signal amplifiers                                                     |           |

|          |                                                                                                                 |                                                                                                                                               |           |
|----------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          |                                                                                                                 |                                                                                                                                               |           |
|          |                                                                                                                 |                                                                                                                                               |           |
|          | <b>Module III</b>                                                                                               |                                                                                                                                               | <b>10</b> |
| <b>3</b> | 3.1                                                                                                             | Construction, working principle, Symbol, types, V-I characteristics, Specifications and parameters of Junction Field Effect Transistor (JFET) |           |
|          | 3.2                                                                                                             | Construction, working principle, Symbol, types, V-I characteristics, Specifications and parameters of Metal Oxide Semiconductor FET (MOSFET)  |           |
|          | 3.3                                                                                                             | MOSFET Based practical switching circuits                                                                                                     |           |
|          | 3.4                                                                                                             | Comparison of JFET, MOSFET and BJT, Applications                                                                                              |           |
|          |                                                                                                                 |                                                                                                                                               |           |
|          | <b>Module IV</b>                                                                                                |                                                                                                                                               | <b>10</b> |
| <b>4</b> | 4.1                                                                                                             | Concept of negative and positive feedback                                                                                                     |           |
|          | 4.2                                                                                                             | Comparison and applications                                                                                                                   |           |
|          | 4.3                                                                                                             | Effect of negative feedback: on amplifier performance                                                                                         |           |
|          | 4.4                                                                                                             | Positive feedback: oscillator circuits -Wien bridge , Phase Shift                                                                             |           |
|          |                                                                                                                 |                                                                                                                                               |           |
|          | <b>Teacher Specific Module</b>                                                                                  |                                                                                                                                               | <b>5</b>  |
| <b>5</b> | <i>Directions: Teacher can design this module based on their expertise and demonstrate it from the students</i> |                                                                                                                                               |           |
|          |                                                                                                                 |                                                                                                                                               |           |

**Essential Readings:**

1. Electronic Devices and Circuits: David A Bell, Oxford University Press 5<sup>th</sup> edition
2. A text book of Applied Electronics : R. S. Sedha, S Chand Company Ltd

**Suggested Readings:**

- Basic Electronics Solid state : B. L. Theraja, S Chand Company Ltd, 5 th edition

- A text book of Electrical Technology: B.L.Theraja, S.Chand and Co.
- Basic Electronics and Linear Circuits: Bhargava N.N., Kulshreshtha D.C., TMH
- Electronic Devices and Circuits: Bolyestad, TataMcGraw Hill.
- Electronic Principles: Albert Malvino, David J Bates, McGraw Hill 7th Edition.

**Laboratory Sessions :** Practical sessions to reinforce theoretical concepts

**1 : V-I Characteristics of the CE configuration of BJT**

**2 : Design Transistor Biasing circuits (Fixed and voltage divider bias) for a given specification**

**3: Design a single stage CE amplifier for a given gain**

**4: Design BJT as switch**

**5: Design a FET based switching circuit**

**6 : Design phase shift oscillator**

**7: Design Wein bridge oscillator**

*Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, program listings, and expected outcomes.*

**Assessment Rubrics:**

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |
| Continuous Evaluation   | 35    |

**KU3VACELE112: Web Application Development**

| Semester | Course Type | Course Level | Course Code         | Credits (L+T+P) | Total Hours (L+T+P) |
|----------|-------------|--------------|---------------------|-----------------|---------------------|
| 3        | VAC         | 100          | <b>KU3VACELE112</b> | 3+0+0           | 45                  |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|-------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                         |
| 3                               | 0         | 0        | 25                 | 50  | 75    | 1.5Hr                   |

**Course Description:**


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*The course aims to provide the basics of web applications development from theoretical point of view. Students explore various aspects of web, web technologies and possible approaches to development. Emphasis is given on understanding the basic concepts of web applications development tools such as HTML, JavaScript, CSS etc.*

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**Course Prerequisite:** No prior knowledge of web application development is required.

**Course Outcomes:**

| CO No. | Expected Outcome                | Learning Domains |
|--------|---------------------------------|------------------|
| 1      | Knowledge about Websites        | U                |
| 2      | Knowledge about Web Application | U                |

|   |                                                 |   |
|---|-------------------------------------------------|---|
| 3 | Distinguish between Static and Dynamic Webpages | U |
| 4 | Basics of HTML, CSS, JavaScript and DHTML       | U |
| 5 | Knowledge about Web Application Development     | U |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

### Mapping of Course Outcomes to PSOs

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 |       |       |       |       | 2     | 3     | 3     |
| CO 2 |       |       |       |       | 2     | 3     | 3     |
| CO 3 |       |       |       |       | 2     | 3     | 3     |
| CO 4 |       |       |       |       | 2     | 3     | 3     |
| CO 5 |       |       |       |       | 2     | 3     | 3     |

### COURSE CONTENTS

#### Contents for Classroom Transaction:

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                                                                                  | HOURS     |
|----------------------------|------------------|----------------------------------------------------------------------------------------------|-----------|
| 1                          |                  | <b>Introduction to Websites.</b>                                                             | <b>10</b> |
|                            | 1.1              | Web Basics and Overview: Introduction to Internet, World Wide Web, Web Browsers, URL , HTTP. |           |
|                            | 1.2              | Introduction to Webpages (Static and Dynamic)                                                |           |
|                            | 1.3              | Basics of HTML                                                                               |           |
| 2                          |                  | <b>Dynamics Webpages</b>                                                                     | <b>10</b> |
|                            | 2.1              | What is DHTML?                                                                               |           |
|                            | 2.2              | Applications of DHTML                                                                        |           |

|  |     |                                                       |  |
|--|-----|-------------------------------------------------------|--|
|  | 2.3 | Components of DHTML                                   |  |
|  | 2.4 | Introduction to Cascading Style Sheets (CSS)          |  |
|  | 2.5 | Ways of specifying style – inline, internal, external |  |

|          |                     |                                                                           |           |
|----------|---------------------|---------------------------------------------------------------------------|-----------|
|          | <b>Advanced CSS</b> |                                                                           | <b>10</b> |
| <b>3</b> | 3.1                 | Font, color, background, text, border, margin and list related attributes |           |
|          | 3.2                 | Use of classes, spans, divs                                               |           |
|          | 3.3                 | Working with layers                                                       |           |
|          | 3.4                 | Simple Webpage creation                                                   |           |

|          |                                                                                                         |                                                                                                 |           |
|----------|---------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------|
|          | <b>Basics of JavaScript</b>                                                                             |                                                                                                 | <b>10</b> |
| <b>4</b> | 4.1                                                                                                     | JavaScript basics – syntax, data types and literals, type casting, variables, operators, arrays |           |
|          | 4.2                                                                                                     | Applications and advantages of JavaScript                                                       |           |
|          | 4.3                                                                                                     | Using JavaScript on a webpage                                                                   |           |
|          | 4.4                                                                                                     | Simple dynamic webpage creation                                                                 |           |
|          | <b>Teacher Specific Module</b>                                                                          |                                                                                                 | <b>5</b>  |
|          | <i>Directions: Teacher can design this module based on their expertise and demand from the students</i> |                                                                                                 |           |
| <b>5</b> | Space to fill the selected area/ activity                                                               |                                                                                                 |           |

**Essential Readings:**

- Ivan Bayross, “Web Enabled Commercial Applications Development using HTML, DHTML, Javascript, Perl CGI”

7. Wilton P. : Beginning JavaScript, 2nd Edition, Wiley DreamTech, 2004

**Suggested Reading:**

- Danny Goodman, Machael Morrison , “JavaScript Bible”, 3rd edition

**TEACHING LEARNING STRATEGIES**

**Lectures:** Theory sessions covering fundamental concepts and principles.

**ASSESSMENT RUBRICS**

|                                | <b>Marks</b> |
|--------------------------------|--------------|
| <b>End Semester Evaluation</b> | <b>50</b>    |
| <b>Continuous Evaluation</b>   | <b>25</b>    |

# SYLLABUS

## Semester -IV

| Sl.No. | Course Type                | Course Title                    | Course Code  | Credit |
|--------|----------------------------|---------------------------------|--------------|--------|
| 1      | Major                      | Analog Integrated Circuits      | KU4DSCELE206 | 4      |
| 2      |                            | Electronic Communication        | KU4DSCELE207 | 4      |
| 3      |                            | Electronic Instrumentation      | KU4DSCELE208 | 4      |
| 4      | Value Added Course (VAC)   | Mobile Application development  | KU4VACELE113 | 3      |
| 5      |                            | Artificial Intelligence for You | KU4VACELE114 | 3      |
| 6      | Skill Enhance Course (SEC) | Embedded product design         | KU4SECELE109 | 3      |

**KU4DSCELE206: ANALOG INTEGRATED CIRCUITS**

| Semester | Course Type | Course Level | Course Code  | Credits<br>(L+T+P) | Total Hours<br>(L+T+P) |
|----------|-------------|--------------|--------------|--------------------|------------------------|
| 4        | Major       | 200          | KU4DSCELE206 | 3+0+1              | 45+0+30                |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of<br>ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|----------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                            |
| 3                               | 2         | 0        | 35                 | 65  | 100   | 2                          |

**Course Description:**

This course aims to develop the skill to design circuits using operational amplifiers and other linear ICs for various applications. It includes the study of OP-AMP characteristics, basic amplifier circuits, filters, waveform generators, voltage regulators, and various OP-AMP applications. Practical sessions include hands-on experience with OP-AMP circuits such as amplifiers, oscillators, and multivibrators using IC 741 and 555 Timer. Students will gain a comprehensive understanding of OP-AMP theory and practical applications, preparing them for real-world electronic circuit design and analysis.

**Course Outcomes:**

| CO No. | Expected Outcome                                               | Learning Domains |
|--------|----------------------------------------------------------------|------------------|
| 1      | Analyse the differential amplifier configuration               | A n              |
| 2      | Design operational amplifier circuits for various applications | A                |
| 3      | Understand the working of oscillators and filters              | U                |
| 4      | To develop the circuit using 555 timer, VCO and PLL            | C                |
| 5      | Evaluate the performance of voltage regulator IC's and data    | E                |

|  |            |  |
|--|------------|--|
|  | converters |  |
|--|------------|--|

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

### Mapping of Course Outcomes to PSOs

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 | 3     | 3     | 1     | 2     |       |       |       |
| CO 2 | 3     | 3     | 2     | 2     | 2     |       |       |
| CO 3 | 3     | 3     | 2     | 2     | 2     |       |       |
| CO 4 | 3     | 3     | 1     | 2     | 2     |       |       |
| CO 5 | 3     | 3     | 2     | 2     | 2     |       |       |

### COURSE CONTENTS

#### Contents for Classroom Transaction:

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                                                                                                                | HOURS     |
|----------------------------|------------------|----------------------------------------------------------------------------------------------------------------------------|-----------|
| <b>1</b>                   | <b>Module I</b>  |                                                                                                                            | <b>10</b> |
|                            | 1.1              | Basic Differential amplifier configurations.                                                                               |           |
|                            | 1.2              | DC and AC analysis                                                                                                         |           |
|                            | 1.3              | The 741 Op Amp, Block diagram, Ideal op-amp parameters, typical parameter values for 741                                   |           |
|                            | 1.4              | . Equivalent circuit, Open loop configurations, Voltage transfer curve, Frequency response curve                           |           |
| <b>2</b>                   | <b>Module II</b> |                                                                                                                            | <b>10</b> |
|                            | 2.1              | General concept of Voltage Series, Voltage Shunt, current series and current shunt negative feedback                       |           |
|                            | 2.2              | Analysis of practical inverting and non-inverting amplifiers for Closed loop gain, Input resistance and output resistance. |           |

|  |     |                                                                                                                                                                |  |
|--|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | 2.3 | Summer, Voltage Follower, Differential and Instrumentation Amplifiers                                                                                          |  |
|  | 2.4 | Voltage to current and Current to voltage converters, Integrator, Differentiator, Precision rectifiers-half wave and full wave, Comparators, Schmitt Triggers. |  |
|  |     |                                                                                                                                                                |  |

|          |                   |                                                                                       |           |
|----------|-------------------|---------------------------------------------------------------------------------------|-----------|
|          | <b>Module III</b> |                                                                                       | <b>10</b> |
| <b>3</b> | 3.1               | Phase Shift and Wien-bridge Oscillators, Triangular and Sawtooth waveform generators. |           |
|          | 3.2               | Astable and monostable multivibrators                                                 |           |
|          | 3.3               | Comparison, design of First and second order low pass and High pass active filters    |           |
|          | 3.4               | Timer IC 555- Functional diagram, Astable and monostable operations.                  |           |

|          |                                                                                                         |                                                                                                                                                                                        |           |
|----------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          | <b>Module IV</b>                                                                                        |                                                                                                                                                                                        | <b>10</b> |
| <b>4</b> | 4.1                                                                                                     | Basic concepts of Voltage Controlled Oscillator, Application of VCO IC LM566                                                                                                           |           |
|          | 4.2                                                                                                     | PLL Operation, Closed loop analysis Lock and capture range. Basic building blocks, PLL IC 565, Applications of PLL                                                                     |           |
|          | 4.3                                                                                                     | Fixed and Adjustable voltage regulators, IC 723 – Low voltage and high voltage configurations,                                                                                         |           |
|          | 4.4                                                                                                     | Digital to Analog converters, Specifications, Weighted resistor type and R-2R Ladder type. Analog to Digital Converters: Specifications, Flash type and Successive approximation type. |           |
|          | <b>Teacher Specific Module</b>                                                                          |                                                                                                                                                                                        | <b>5</b>  |
| <b>5</b> | <i>Directions: Teacher can design this module based on their expertise and demand from the students</i> |                                                                                                                                                                                        |           |
|          | <p>Space to fill the selected<br/>area/ activity</p>                                                    |                                                                                                                                                                                        |           |

**Essential Readings:**

1. Gayakwad , Op-Amps and Linear Integrated Circuits , PHI,4/e.2013.
2. Roy Chowdhary, Linear Integrated Circuits, New Age International, 2/e, 2010.
3. Botkar, Integrated Circuits, Khanna Publishers,9/e,2003.

**Suggested Readings:**

8. Salivahanan S. and V. S. K. Bhaaskaran, Linear Integrated Circuits, Tata McGraw Hill, 2008.
9. David A. Bell, Operational Amplifiers & Linear ICs, Oxford University Press, 2nd edition,2010
10. Franco, Design with Operational Amplifiers and Analog Integrated Circuits, TMH, 3/e, 2008 .

**Laboratory Sessions :** Practical sessions to reinforce theoretical concepts

**1 : Fundamentals of operational amplifier**

Objective: To familiarize operational amplifier

Tasks:

Implement voltage follower.

Implement inverting and noninverting amplifier and plot the frequency response

**2 :Basic circuits using op amp**

Objective: To create basic circuits using op amp

Tasks:

Construct summing and difference amplifier.

Implement integrator and differentiator circuit.

### 3: Oscillators using op amp

Objective: To generate sine and square wave forms

Tasks:

Design and set up RC phase shift and wein bridge oscillator using IC 741.

Design and set up Astable and monostable multivibrator using IC 741.

### 4: Applications of 741 IC.

Objective: To understand the operation of 741 in different circuits

Tasks:

Schmitt trigger using IC 741 - design, output waveform

Timer IC 555 – Astable Multivibrator - design, output waveform

Construct VCO using 565

Construct dc power supply using IC 723.

### 5: Simulation experiments using Spice

Objective: simulate basic op amp circuit using spice

Task:

Simulation of basic op amp circuits

*Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, program listings, and expected outcomes.*

Assessment Rubrics:

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |
| Continuous Evaluation   | 35    |

**KU4DSCELE207: Electronic Communication**

| Semester | Course Type | Course Level | Course Code         | Credits<br>(L+T+P) | Total Hours<br>(L+T+P) |
|----------|-------------|--------------|---------------------|--------------------|------------------------|
| 4        | Major       | 200          | <b>KU4DSCELE207</b> | 3+0+1              | 45+0+30                |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of<br>ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|----------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                            |
| 3                               | 2         | 0        | 35                 | 65  | 100   | 2                          |

**Course Description:**

*This course is designed to provide a solid understanding of the basic principles and concepts underlying in Electronic communication. This course cover AM,FM, SSB generation and detection. Pulse communication techniques and digital modulations are also covered. By the end of the course, students should have a solid foundation in Analog and digital modulation techniques.*

**Course Prerequisite:** Basic understanding of mathematics and Electronic circuits

**Course Outcomes:**

| CO No. | Expected Outcome                                                | Learning Domains |
|--------|-----------------------------------------------------------------|------------------|
| 1      | Understand operation of a basic communication system            | U                |
| 2      | Explain the operation of AM FM & SSB transmitters and receivers | E                |
| 3      | Solve problems related to Analog modulations                    | A                |

|   |                                                                          |   |
|---|--------------------------------------------------------------------------|---|
| 4 | Understand concept of Pulse communication and digital modulations        | U |
| 5 | Develop practical experience through laboratory experiments and projects | C |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

### Mapping of Course Outcomes to PSOs

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 |       |       |       |       |       |       |       |
| CO 2 |       |       |       |       |       |       |       |
| CO 3 | 2     |       | 3     |       |       |       |       |
| CO 4 |       |       |       |       |       |       |       |
| CO 5 | 3     |       | 3     |       |       |       | 3     |

### COURSE CONTENTS

#### Contents for Classroom Transaction:

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                                                                                                              | HOURS     |
|----------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------|-----------|
|                            | <b>Module I</b>  |                                                                                                                          | <b>10</b> |
| <b>1</b>                   | 1.1              | Block diagram of an electronic communication system, electromagnetic spectrum- band designations and applications.       |           |
|                            | 1.2              | Types of Electronic Communication systems: Simplex & Duplex                                                              |           |
|                            | 1.3              | Noise in communication: External noise- Atmospheric, space noise, man-made noise, Internal noise- Thermal and Shot noise |           |
|                            | 1.4              | Definitions and relationship between Bit rate, Baud rate, Bandwidth and signal to noise ratio                            |           |

|   |                  |                                                                                                         |           |
|---|------------------|---------------------------------------------------------------------------------------------------------|-----------|
| 2 | <b>Module II</b> |                                                                                                         | <b>10</b> |
|   | 2.1              | Modulation – Need for modulation- Amplitude modulation –Side band- AM signals & spectra, power relation |           |
|   | 2.2              | AM generation – High level & low level AM transmitters                                                  |           |
|   | 2.3              | AM receivers - Super heterodyne receivers                                                               |           |
|   | 2.4              | SSB generator balanced modulator -SSB transmitters –SSB receivers.                                      |           |

|   |                   |                                                                                           |           |
|---|-------------------|-------------------------------------------------------------------------------------------|-----------|
| 3 | <b>Module III</b> |                                                                                           | <b>10</b> |
|   | 3.1               | Frequency modulation -FM & PM signals – spectra – Band with                               |           |
|   | 3.2               | Narrow band & wide band FM – generation – direct FM – VCO – phase modulator – indirect FM |           |
|   | 3.3               | Demodulation of FM- balanced discriminator, de- emphasis & pre-emphasis                   |           |
|   | 3.4               | FM transmitter & receivers – FM stereo transmission & reception.                          |           |

|   |                  |                                                                                 |           |
|---|------------------|---------------------------------------------------------------------------------|-----------|
| 4 | <b>Module IV</b> |                                                                                 | <b>10</b> |
|   | 4.1              | Sampling – Aliasing - PAM, PWM, PPM                                             |           |
|   | 4.2              | Concept of FDM & TDM,                                                           |           |
|   | 4.3              | Pulse code modulation – quantization – generation & reconstruction – companding |           |
|   | 4.4              | Concept of ASK, FSK,PSK & QPSK                                                  |           |

|   |                                                                                                         |  |          |
|---|---------------------------------------------------------------------------------------------------------|--|----------|
| 5 | <b>Teacher Specific Module</b>                                                                          |  | <b>5</b> |
|   | <i>Directions: Teacher can design this module based on their expertise and demand from the students</i> |  |          |
|   | Space to fill the selected                                                                              |  |          |

|  |                |  |
|--|----------------|--|
|  | area/ activity |  |
|--|----------------|--|

**Essential Readings:**

1. G. Kennedy, Electronic Communication, 2nd edition TMH

**Suggested Readings:**

11. Frenzel, Communication Electronics, 3rd edition TMH

12. Dennis Roddy, John Coolen Electronic Communication System PHI

**Laboratory Sessions :** Practical sessions to reinforce theoretical concepts

- AM generation
- Frequency response of IF amplifier
- Study of Pulse Amplitude Modulation and Demodulation
- Study of Pulse Width Modulation and Demodulation
- Study of Pulse Position Modulation Demodulation
- Assemble and test a low power AM Transmitter circuit (Antenna- Random length wire)
- Assemble and test a low power FM Transmitter circuit (Antenna- Random length wire)
- Design a Quarter wave monopole antenna and connect at the output of the FM transmitter and observe the range enhancement

***Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, program listings, and expected outcomes.***

**Assessment Rubrics:**

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |
| Continuous Evaluation   | 35    |

**KU4DSCELE208: Electronic Instrumentation**

| Semester | Course Type | Course Level | Course Code         | Credits<br>(L+T+P) | Total Hours<br>(L+T+P) |
|----------|-------------|--------------|---------------------|--------------------|------------------------|
| 4        | Major       | 200          | <b>KU4DSCELE208</b> | 3+0+1              | 45+0+30                |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of<br>ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|----------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                            |
| 3                               | 2         | 0        | 35                 | 65  | 100   | 2                          |

**Course Description:**


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*This course is designed to provide basic understanding of Electronic instrumentation. This course cover introduction to instrumentation, laboratory instruments such as signal generators and CRO. Various sensors used in Electronic instruments are also included. By the end of the course, students should have a solid understanding of Electronic instrumentation.*

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**Course Prerequisite:** Basic understanding of fundamentals of Electronic devices and circuits

**Course Outcomes:**

| CO No. | Expected Outcome                                                         | Learning Domains |
|--------|--------------------------------------------------------------------------|------------------|
| 1      | Understand the operation of digital voltage and current meters           | U                |
| 2      | Explain the operation of various signal generators                       | E                |
| 3      | Explain the operation of CRO                                             | E                |
| 4      | Understand operation of various transducers                              | U                |
| 5      | Develop practical experience through laboratory experiments and projects | C                |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

#### Mapping of Course Outcomes to PSOs

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 | 2     |       | 2     |       |       |       |       |
| CO 2 |       |       | 2     |       |       |       |       |
| CO 3 | 2     |       | 2     |       |       |       |       |
| CO 4 | 2     |       | 2     |       |       |       |       |
| CO 5 |       | 3     | 2     | 3     |       |       | 3     |

#### COURSE CONTENTS

##### Contents for Classroom Transaction:

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                                                                        | HOURS |
|----------------------------|------------------|------------------------------------------------------------------------------------|-------|
| 1                          | Module I         |                                                                                    | 10    |
|                            | 1.1              | Basic Measurement Instruments: DC measurement: dc voltmeter, ohm meter and ammeter |       |
|                            | 1.2              | Digital type voltmeter and ammeter                                                 |       |

|          |                  |                                                                                                                   |           |
|----------|------------------|-------------------------------------------------------------------------------------------------------------------|-----------|
|          | 1.3              | Digital Multimeter                                                                                                |           |
|          | 1.4              | AC measurement , volt meter and ammeter                                                                           |           |
|          | <b>Module II</b> |                                                                                                                   | <b>10</b> |
| <b>2</b> | 2.1              | Pulse generators, RF generators and Random noise generator                                                        |           |
|          | 2.2              | Function generators                                                                                               |           |
|          | 2.3              | Probes and Connectors: Test leads,<br>Shielded cables, connectors, low capacitance probes and high voltage probes |           |
|          | 2.4              | RF demodulator probes, special probes for ICs                                                                     |           |
|          |                  |                                                                                                                   |           |

|          |                   |                                                                          |           |
|----------|-------------------|--------------------------------------------------------------------------|-----------|
|          | <b>Module III</b> |                                                                          | <b>10</b> |
| <b>3</b> | 3.1               | Block diagram of a General Purpose Oscilloscope and its basic operation  |           |
|          | 3.2               | Electrostatic focussing, deflection and screen for CRT                   |           |
|          | 3.3               | CRO Probes                                                               |           |
|          | 3.4               | Types of CRO's: dual trace oscilloscope and digital storage oscilloscope |           |

|          |                                                                                |                                                                                                                        |           |
|----------|--------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-----------|
|          | <b>Module IV</b>                                                               |                                                                                                                        | <b>10</b> |
| <b>4</b> | 4.1                                                                            | Classification and selection of transducers                                                                            |           |
|          | 4.2                                                                            | Strain Gages: bonded and un-bonded strain gages, strain gage transducer sensitivity.                                   |           |
|          | 4.3                                                                            | Position Transducer: capacitive, inductive, linear variable differential transformer (LVDT), Piezoelectric Transducer. |           |
|          | 4.4                                                                            | Temperature transducers: Resistance, thermocouples, thermistor and semiconductor p-n junction transducer.              |           |
| <b>5</b> | <b>Teacher Specific Module</b>                                                 |                                                                                                                        | <b>5</b>  |
|          | <i>Directions: Teacher can design this module based on their expertise and</i> |                                                                                                                        |           |

|  |                                              |  |
|--|----------------------------------------------|--|
|  | <i>demand from the students</i>              |  |
|  | Space to fill the selected<br>area/ activity |  |

### Essential Readings:

- H. S. Kalsi, Electronic Instrumentation, Tata McGraw Hill (2006)
- Joseph J Carr, Elements of electronic instrumentation and measurement, Pearson Education (2005)
- C. S. Rangan, G. R. Sarma and V. S. Mani, Instrumentation Devices and Systems, Tata McGraw Hill (1998)

### Suggested Readings:

- H. Cooper, Modern electronic instrumentation and measurement techniques, Pearson Education (2005)
- R. A. Witte, Electronic test instruments: analog and digital measurements, Tata McGraw Hill (2004)
- S. Wolf and R. F. M. Smith, Student Reference Manual for Electronic Instrumentation Laboratories, Pearson Education (2004)

### Laboratory Sessions : Practical sessions to reinforce theoretical concepts

1. Study the characteristics of a PT 100 transducer
2. Plot Temperature Vs output voltage of a thermocouple transducer
3. Design a Wheatstone's bridge to detect temperature
4. Using PN junction diode convert Temperature into Voltage value
5. Using ADC convert Analog voltage to digital Value
6. Setup a humidity sensor and evaluate the performance
7. Measuring displacement using LVDT

8. Design a Digital thermo meter
9. Design a temperature controller to control the temperature of a soldering iron
10. Design a function generator (Square and triangular wave)

*Each laboratory experiment should be accompanied by a detailed lab note containing theoretical background, experimental procedures, circuit diagrams, program listings, and expected outcomes.*

**Assessment Rubrics:**

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 65    |
| Continuous Evaluation   | 35    |

**KU4VACELE113: Mobile Application Development**

| Semester | Course Type | Course Level | Course Code  | Credits<br>(L+T+P) | Total Hours<br>(L+T+P) |
|----------|-------------|--------------|--------------|--------------------|------------------------|
| 4        | VAC         | 100          | KU4VACELE113 | 3+0+0              | 45+0+0                 |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of<br>ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|----------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                            |
| 3                               | 0         | 0        | 25                 | 50  | 75    | 1.5Hr                      |

**Course Description:**


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*This course provides a comprehensive introduction to the fundamental components and concepts of Mobile application development. Through a theoretical approach, students will gain a solid understanding of fundamental mobile generations, smartphone architecture and especially the Android platform.*

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**Course Prerequisite:** No prior knowledge of computer hardware or software is required

**Course Outcomes:**

| CO No. | Expected Outcome                       | Learning Domains |
|--------|----------------------------------------|------------------|
| 1      | Understand Smart phone architecture    | U                |
| 2      | Understand Mobile OS Architecture      | U                |
| 3      | Understand Android terminologies       | U                |
| 4      | Explain fundamentals of Android studio | E                |
| 5      | Build a small android application      | C                |

*\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)*

**Mapping of Course Outcomes to PSOs**

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 | 2     |       |       |       |       |       |       |
| CO 2 | 2     |       |       |       |       |       |       |
| CO 3 | 2     |       |       |       |       |       |       |
| CO 4 | 2     |       |       |       |       | 3     |       |
| CO 5 | 3     |       |       | 3     | 3     | 3     |       |

**COURSE CONTENTS****Contents for Classroom Transaction:**

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                                                        | HOUR<br>S |
|----------------------------|------------------|--------------------------------------------------------------------|-----------|
| 1                          |                  | <b>Overview of MOBILE PLATFORMS</b>                                | <b>10</b> |
|                            | 1.1              | Introduction to mobile phone generations – 1G to 5G, , Application |           |

|          |     |                                                                                                                                             |           |
|----------|-----|---------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|          |     | deployment.                                                                                                                                 |           |
|          | 1.2 | Smart phone architecture-ARM and Intel architectures                                                                                        |           |
|          | 1.3 | Power Management, Screen resolution, Touch interfaces, Memory-Sensors, I/O interfaces, GPS,                                                 |           |
|          | 1.4 | Mobile OS Architectures-Kernel structure-Comparing and Contrasting architectures of Android, iOS, and Windows, Darwin vs. Linux vs. Windows |           |
| <b>2</b> |     | <b>Introduction to Android</b>                                                                                                              | <b>10</b> |
|          | 2.1 | Introduction to Android                                                                                                                     |           |
|          | 2.2 | Android Operating System                                                                                                                    |           |
|          | 2.3 | Android versions, Features of Android                                                                                                       |           |
|          | 2.4 | Android Architecture , Android Devices, History of Android                                                                                  |           |
|          |     |                                                                                                                                             |           |

|          |     |                                                                                  |           |
|----------|-----|----------------------------------------------------------------------------------|-----------|
|          |     | <b>Android Termonologies</b>                                                     | <b>10</b> |
| <b>3</b> | 3.1 | Introduction to Android terminologies, Application Context                       |           |
|          | 3.2 | Activities, Services, Intents, Receiving and Broadcasting Intents,               |           |
|          | 3.3 | Android Manifest File and its common settings, Using Intent Filter, Permissions. |           |
|          | 3.4 | USB ports and their prevalence in modern systems                                 |           |

|          |     |                                       |           |
|----------|-----|---------------------------------------|-----------|
| <b>4</b> |     | <b>Fundamentals of Android Studio</b> | <b>10</b> |
|          | 4.1 | Android SDK                           |           |

|   |                                                                                                         |                                                                      |          |
|---|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|----------|
|   | 4.2                                                                                                     | Eclipse Installation, Android Installation,                          |          |
|   | 4.3                                                                                                     | Building your First Android application                              |          |
|   | 4.4                                                                                                     | Understanding Anatomy of Android Application, Android Manifest file. |          |
| 5 | <b>Teacher Specific Module</b>                                                                          |                                                                      | <b>5</b> |
|   | <i>Directions: Teacher can design this module based on their expertise and demand from the students</i> |                                                                      |          |
|   | Space to fill the selected area/ activity                                                               |                                                                      |          |

**Essential Readings:**

13. Lauren Darcey and Shane Conder, “Android Wireless Application Development”, Pearson Education, 2nd ed. (2011)
14. Google Developer Training, "Android Developer Fundamentals Course – Concept Reference”, Google Developer Training Team, 2017.
15. Prasanth Kumar Pattnaik, Rajib Mall, “Fundamentals of Mobile Computing”, PHI Learning Pvt.Ltd, New Delhi-2012
16. Reto Meier, “Professional Android 2 Application Development”, Wiley India Pvt Ltd, 2010
17. Mark L Murphy, “Beginning Android”, Wiley India Pvt Ltd, 2009

**Suggested Readings:**

1. Dawn Griffiths and David Griffiths, “Head First Android Development”, 1st Edition, O’Reilly SPD Publishers, 2015. ISBN-13: 978-9352131341
2. Erik Hellman, “Android Programming – Pushing the Limits”, 1st Edition, Wiley India Pvt Ltd, 2014. ISBN-13: 978-8126547197
3. Bill Phillips, Chris Stewart and Kristin Marsicano, “Android Programming: The Big Nerd Ranch Guide”, 4th Edition, Big Nerd Ranch Guides, 2019. ISBN-13: 978-0134706054

**TEACHING LEARNING STRATEGIES**

**Lectures:** Theory sessions covering fundamental concepts and principles.

**ASSESSMENT RUBRICS**

|                                | Marks     |
|--------------------------------|-----------|
| <b>End Semester Evaluation</b> | <b>50</b> |
| <b>Continuous Evaluation</b>   | <b>25</b> |

**KU4VACELE114: ARTIFICIAL INTELLIGENCE FOR YOU**

| Semester | Course Type | Course Level | Course Code   | Credits (L+T+P) | Total Hours (L+T+P) |
|----------|-------------|--------------|---------------|-----------------|---------------------|
| 4        | VAC         | 100          | KU4VACE LE114 | 3+0+0           | 45+0+0              |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|-------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                         |
| 3                               | 0         | 0        | 25                 | 50  | 75    | 1.5Hr                   |

**Course Description:**


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*This course provides a strong foundation in modern AI principles, tools, and applications. The course covers core AI concepts, data preparation techniques, fundamental machine learning algorithms, and practical applications in vision and language processing. By the end of this course, students will be equipped with a working knowledge of AI technologies and their relevance in various fields like healthcare, education, agriculture etc.,*

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**Course Prerequisite:** No prior knowledge of computer hardware is required

**Course Outcomes:**

| CO No. | Expected Outcome                                                                                                                               | Learning Domains |
|--------|------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 1      | Understand the basics and scope of Artificial Intelligence.                                                                                    | U                |
| 2      | Describe key AI technologies                                                                                                                   | U                |
| 3      | Define basic concepts and terminology in machine learning, including supervised, unsupervised, and reinforcement learning.                     | R                |
| 4      | Identify and analyse common machine learning models such as decision trees, k-nearest neighbours and linear regression                         | A,An             |
| 5      | Undertake the identification of simple real-life problems from various domains which requires data driven solutions using AI and ML techniques | A                |

**\*Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

**Mapping of Course Outcomes to PSOs**

|      | PSO 1 | PSO 2 | PSO 3 | PSO 4 | PSO 5 | PSO 6 | PSO 7 |
|------|-------|-------|-------|-------|-------|-------|-------|
| CO 1 | 2     |       |       |       |       |       |       |
| CO 2 |       |       |       |       |       |       |       |
| CO 3 | 3     |       |       |       |       |       |       |
| CO 4 |       |       |       |       |       |       |       |
| CO 5 | 5     |       | 3     |       |       |       | 3     |

**COURSE CONTENTS****Contents for Classroom Transaction:**

| M<br>O<br>D<br>U<br>L<br>E | U<br>N<br>I<br>T | DESCRIPTION                             | HOUR<br>S |
|----------------------------|------------------|-----------------------------------------|-----------|
| 1                          |                  | INTRODUCTION TO ARTIFICIAL INTELLIGENCE | 10        |

|   |                              |                                                                                                                                                                       |           |
|---|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
|   | 1.1                          | What is Artificial Intelligence? : Definition and scope, Intelligence, AI vs Machine Learning vs Deep Learning.                                                       |           |
|   | 1.2                          | History and Evolution                                                                                                                                                 |           |
|   | 1.3                          | Types of AI: Reactive Machines, Limited Memory, Theory of Mind, and Self-aware AI;<br>Narrow AI vs General AI vs Super AI;<br>Examples of each type in today's world. |           |
|   | 1.4                          | Key concepts in AI: Problem-solving, Reasoning, Learning, Perception, and Language Processing; Role of data in AI; Introduction to intelligent agents                 |           |
| 2 | <b>TECHNIQUES USED IN AI</b> |                                                                                                                                                                       | <b>10</b> |
|   | 2.1                          | Intelligent agents and Environment: Concept of agents, Types of Agents, Environment                                                                                   |           |
|   | 2.2                          | Problem solving and Search Techniques: Problem formulation; Uninformed search- BFS, DFS; Informed search – greedy search, A* algorithm                                |           |
|   | 2.3                          | Knowledge representation and Reasoning( Conceptual introduction)                                                                                                      |           |
|   | 2.4                          | Introduction to Planning and Decision making: Goal-based planning, Basic concepts of utility and rational decision making                                             |           |

|   |                                   |                                                                                                                                                                |           |
|---|-----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| 3 | <b>BASICS OF MACHINE LEARNING</b> |                                                                                                                                                                | <b>10</b> |
|   | 3.1                               | Introduction to Machine Learning: What is Machine Learning? Relationship between AI and ML                                                                     |           |
|   | 3.2                               | Types of ML: Supervised, Unsupervised, and Reinforcement Learning                                                                                              |           |
|   | 3.3                               | Basic Algorithms: <b>(Conceptual Only)</b><br>Supervised – Linear regression, Decision Tree, KNN<br>Unsupervised - K-Means Clustering                          |           |
|   | 3.4                               | Role of Data in ML: Data collection, preparation, and labelling; Features, training data, testing data; Overfitting and underfitting (intuitive understanding) |           |

|                                           |                                                                                                                    |           |
|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------|-----------|
|                                           | <b>INTERDISCIPLINARY AI</b>                                                                                        | <b>10</b> |
|                                           | 4.1 AI in Medicine : Disease prediction, Drug discovery                                                            |           |
|                                           | 4.2 AI in Agriculture: Crop monitoring, Yield prediction                                                           |           |
| <b>4</b>                                  | 4.3 AI in Finance: Fraud detection, Algorithmic trading                                                            |           |
|                                           | 4.4 AI in Humanities and Languages : Chatbots and virtual assistants, Machine translation (e.g., Google Translate) |           |
|                                           | 4.5 AI in Creative Arts : AI-generated music, painting, and writing, Creative tools like DALL·E and MuseNet        |           |
|                                           | <b>Teacher Specific Module</b>                                                                                     | <b>5</b>  |
| <b>5</b>                                  | <i>Directions: Teacher can design this module based on their expertise and demand from the students</i>            |           |
| Space to fill the selected area/ activity |                                                                                                                    |           |

**Essential Readings:**

- Melanie Mitchell, *Artificial Intelligence: A Guide for Thinking Humans*.
- Ajay Agrawal et al., *Prediction Machines*.
- Kate Crawford, *Atlas of AI*
- Stuart Russell and Peter Norvig, *Artificial Intelligence: A Modern Approach*, 3rd Edition, Pearson
- Elaine Rich, Kevin Knight, Shivashankar B Nair, *Artificial Intelligence*, 3rd Edition, McGraw-Hill
- Tom M. Mitchell, *Machine Learning*, McGraw-Hill

**Suggested Readings:**

1. John Haugeland – *Artificial Intelligence: The Very Idea*, MIT Press

2. Dieter Vanderelst – *Artificial Intelligence for Humans*, Beginner-friendly Open Book Series
3. Chris Baker & Mike Hobbs – *Artificial Intelligence: Foundations, Applications and Techniques*, Springer
4. Michael Wooldridge – *A Brief History of Artificial Intelligence: What It Is, Where We Are, and Where We Are Going*, Flatiron
5. Toby Walsh – *Machines Behaving Badly: The Morality of AI*, La Trobe University Press
6. Peter Szolovits (Ed.), *Artificial Intelligence in Medicine*, Westview Press – Selected chapters
7. Yoshua Bengio, *Deep Learning and AI in Healthcare*, MIT OpenCourseWare (online resources)
8. Ahmed Elgammal, *AI in the Arts: Aesthetic and Creative Dimensions*, Springer – Selected readings
9. Ethem Alpaydin, *Introduction to Machine Learning*, MIT Press

## TEACHING LEARNING STRATEGIES

**Lectures:** Theory sessions covering fundamental concepts and principles.

## ASSESSMENT RUBRICS

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 50    |
| Continuous Evaluation   | 25    |

**KU4SECEL E109 Embedded Product Design**

| Semester | Course Type | Course Level | Course Code         | Credits (L+T+P) | Total Hours (L+T+P) |
|----------|-------------|--------------|---------------------|-----------------|---------------------|
| 4        | SEC         | 100          | <b>KU4SECELE109</b> | 2+0+1           | 30+0+30             |

| Learning Approach (Hours/ Week) |           |          | Marks Distribution |     |       | Duration of ESE (Hours) |
|---------------------------------|-----------|----------|--------------------|-----|-------|-------------------------|
| Lecture                         | Practical | Tutorial | CE                 | ESE | Total |                         |
| 2                               | 2         | 0        | 25                 | 50  | 75    | 1.5Hr                   |

**Course Description**

This undergraduate-level course provides a comprehensive introduction to embedded systems, focusing on their architecture, programming, interfacing, and real-world applications. Students will gain hands-on experience in designing and developing embedded systems using microcontrollers and microprocessors, with a strong emphasis on practical implementation and real-time constraints.

**Course Prerequisite:** No prior knowledge of Embedded systems is required

**Course Outcome**

| Sl No | Expected outcome                    | Learning Domains |
|-------|-------------------------------------|------------------|
| 1     | Define and Analyze Embedded Systems | R, An            |
| 2     | Understand System Architectures     | U                |
| 3     | Utilize Sensors and Actuators       | A                |
| 4     | Implement Communication Protocols   | A                |
| 5     | Design Real-World Applications      | C                |

**Remember (R), Understand (U), Apply (A), Analyse (An), Evaluate (E), Create (C)**

|     | PSO1 | PSO2 | PSO3 | PSO4 | PSO5 | PSO6 | PSO7 |
|-----|------|------|------|------|------|------|------|
| CO1 |      |      | 3    | 2    | 2    |      |      |
| CO2 |      |      |      |      |      |      |      |
| CO3 | 2    | 2    |      | 3    | 2    | 2    |      |
| CO4 | 2    | 2    |      | 3    |      |      |      |
| CO5 | 2    | 2    |      | 2    |      |      |      |
| CO6 | 2    | 2    | 3    | 3    | 2    |      |      |

### COURSE CONTENTS

| UNI<br>T | Description                                                                                                 | Hours    |
|----------|-------------------------------------------------------------------------------------------------------------|----------|
| <b>1</b> | <b>Introduction to Embedded Systems</b>                                                                     | <b>6</b> |
| 1.1      | Definition and key characteristics of embedded systems                                                      |          |
| 1.2      | General purpose processor, Single purpose processor , Application specific processor                        |          |
| 1.3      | System Architecture: Microcontrollers & Microprocessors, System-on-Chip (SoC) -Concepts only                |          |
| 1.4      | Real-world applications: smart homes, health monitoring, automation                                         |          |
| 1.5      | Basic concepts of real-time systems: Hard vs. Soft Real-Time                                                |          |
| 1.6      | Overview of the embedded product development life cycle                                                     |          |
| <b>2</b> | <b>I/O , Sensors and Actuators</b>                                                                          | <b>8</b> |
| 2.1      | Digital and analog I/O fundamentals -Concepts only                                                          |          |
| 2.2      | Sensor Interfacing: IR sensor, temperature and humidity SENSOR:DHT11 , Ultrasonic distance sensor (HC-SR04) |          |

|          |                                                                                               |          |
|----------|-----------------------------------------------------------------------------------------------|----------|
| 2.3      | Actuator Control: Buzzer, DC motor                                                            |          |
| 2.4      | Display Devices: Interfacing 16x2 LCD (with I2C module), Interfacing LED display              |          |
| <b>3</b> | <b>Peripherals and interfaces</b>                                                             | <b>8</b> |
| 3.1      | Timers, Counters, and Watchdog timers, PWM                                                    |          |
| 3.2      | Communication protocols: UART, I2C, SPI                                                       |          |
| 3.3      | WiFi, Bluetooth, ZigBee                                                                       |          |
| 3.4      | IoT device management                                                                         |          |
| 3.5      | Switch                                                                                        |          |
| <b>4</b> | <b>Introduction to IDE</b>                                                                    | <b>8</b> |
| 4.1      | MPLAB, Aurdino                                                                                |          |
| 4.2      | Develop a temperature and humidity monitoring system using DHT11 sensor and display readings. |          |
| 4.3      | Create a simple home automation system that controls lights based on ambient light levels.    |          |

### **Essential Readings:**

- *Embedded Systems: Concepts, Design and Programming* by Himanshu B. Dave and Parag H. Dave
- *Embedded Systems: Foundations of Cyber-Physical Systems and the Internet of Things* by Raj Kamal
- *Embedded System Design: A Unified Hardware/Software Introduction* by Frank Vahid and Tony Givargis
- *Introduction to Embedded Systems* by K.V. Shibu
- *Embedded Systems: Architecture , Programming and design* by Raj Kamal

### **Suggested Readings:**

**Real-Time Concepts for Embedded Systems”** By Qing Li, Caroline Yao

The Art of Designing Embedded Systems” By **Jack Ganssle**

### Free/Open Resources

- **Arduino Project Hub:** <https://create.arduino.cc/projecthub>  
Tons of practical projects with code and diagrams.
- **Espressif Docs (ESP32):** <https://docs.espressif.com>  
Best for WiFi/Bluetooth-based IoT projects.
- **All About Circuits:** <https://www.allaboutcircuits.com>  
Theory + tutorials on sensors, interfacing, and electronics.

### TEACHING LEARNING STRATEGIES

**Lectures:** Theory sessions covering fundamental concepts and principles.

**Practical:**

- Study of Microcontroller vs Microprocessor
  - Interfacing IR Sensor
1. **Objective:** Detect object presence using IR sensor.
  2. Blink LED
  3. DHT11 Sensor Interfacing (Temperature & Humidity)
  4. HC-SR04 Ultrasonic Sensor
3. Digital Input - Switch
  10. **Objective:** Turn on LED when switch pressed
  4. Wireless Communication - Bluetooth
  11. **Objective:** Control LED using smartphone.

*Each laboratory experiment should be accompanied by a detailed lab note containing Aim, methodology and results obtained.*

### ASSESSMENT RUBRICS

|                         | Marks |
|-------------------------|-------|
| End Semester Evaluation | 50    |
| Continuous Evaluation   | 25    |