

| GANPAT UNIVERSITY                                                                                                                  |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
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| FACULTY OF ENGINEERING & TECHNOLOGY                                                                                                |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
| Programme                                                                                                                          |                                                                                                                                                                                                                                                                | Master of Technology |                  |             |       | Branch/Spec.                                                       | Electronics and Communication Engineering – Embedded Systems |     |           |
| Semester                                                                                                                           |                                                                                                                                                                                                                                                                | I                    |                  |             |       | Version                                                            | 1.0.0.0                                                      |     |           |
| Effective from Academic Year                                                                                                       |                                                                                                                                                                                                                                                                |                      | 2026-27          |             |       | Effective for the Batch admitted in                                |                                                              |     | July 2026 |
| Course Code                                                                                                                        |                                                                                                                                                                                                                                                                | 3ES1105              |                  | Course Name |       | Embedded Security and Communication Protocols for Embedded Systems |                                                              |     |           |
| Teaching Scheme                                                                                                                    |                                                                                                                                                                                                                                                                |                      |                  |             |       | Examination Scheme (Marks)                                         |                                                              |     |           |
| (Per week)                                                                                                                         | Lecture (DT)                                                                                                                                                                                                                                                   |                      | Practical (Lab.) |             | Total |                                                                    | CE                                                           | SEE | Total     |
|                                                                                                                                    | L                                                                                                                                                                                                                                                              | TU                   | P                | TW          |       |                                                                    |                                                              |     |           |
| Credit                                                                                                                             | 3                                                                                                                                                                                                                                                              | 0                    | 1                | -           | 4     | Theory                                                             | 50                                                           | 50  | 100       |
| Hours                                                                                                                              | 3                                                                                                                                                                                                                                                              | 0                    | 2                | -           | 5     | Practical                                                          | 25                                                           | 25  | 50        |
| Pre-requisites                                                                                                                     |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
| Fundamentals of Embedded Systems, Computer Networks, Data Communication, Embedded C Programming, and Microcontroller Architecture. |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
| Course Outcomes                                                                                                                    |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
| On successful completion of the course, the students will be able to:                                                              |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
| CO1                                                                                                                                | Design secure embedded systems.                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
| CO2                                                                                                                                | Implement embedded communication protocols.                                                                                                                                                                                                                    |                      |                  |             |       |                                                                    |                                                              |     |           |
| CO3                                                                                                                                | Develop secure IoT applications. Analyse vulnerabilities in embedded devices.                                                                                                                                                                                  |                      |                  |             |       |                                                                    |                                                              |     |           |
| CO4                                                                                                                                | Build industry-ready, secure embedded solutions.                                                                                                                                                                                                               |                      |                  |             |       |                                                                    |                                                              |     |           |
| Theory Syllabus                                                                                                                    |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |
| Unit                                                                                                                               | Content                                                                                                                                                                                                                                                        |                      |                  |             |       |                                                                    |                                                              |     | Hrs.      |
| 1                                                                                                                                  | <b>Introduction to Embedded Security:</b><br>Basics of Embedded System Security, Threats, Vulnerabilities and Attacks, Secure Boot Process, Hardware Security Concepts, Trusted Execution Environment (TEE), Security in IoT Devices.                          |                      |                  |             |       |                                                                    |                                                              |     | 10        |
| 2                                                                                                                                  | <b>Cryptography for Embedded Systems:</b><br>Fundamentals of Cryptography, Symmetric Encryption (AES, DES), Asymmetric Encryption (RSA, ECC), Hash Functions and Digital Signatures, Key Management Techniques, Lightweight Cryptography for Embedded Devices. |                      |                  |             |       |                                                                    |                                                              |     | 8         |
| 3                                                                                                                                  | <b>Communication Protocols for Embedded Systems:</b><br>UART, SPI, I2C Protocols, CAN and LIN Protocols, Modbus and Industrial Communication, USB and Ethernet Basics, BLE, ZigBee and LoRaWAN Overview.                                                       |                      |                  |             |       |                                                                    |                                                              |     | 10        |
| 4                                                                                                                                  | <b>Secure Communication in Embedded Systems:</b><br>Secure Socket Layer (SSL/TLS), Secure MQTT Communication, Authentication and Authorization, Secure Firmware Updates (OTA), Network Security in IoT, Intrusion Detection in Embedded Networks.              |                      |                  |             |       |                                                                    |                                                              |     | 8         |
| 5                                                                                                                                  | <b>Embedded Network Design &amp; Applications:</b><br>Automotive Embedded Communication, Industrial IoT Communication, Smart Home and Healthcare Applications, Edge Device Security, Case Studies on Secure Embedded Systems.                                  |                      |                  |             |       |                                                                    |                                                              |     | 9         |
| Practical Content                                                                                                                  |                                                                                                                                                                                                                                                                |                      |                  |             |       |                                                                    |                                                              |     |           |

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| Practical, assignments and tutorials are based on above syllabus |                                                                                                                                                                                                                       |
| Text Books                                                       |                                                                                                                                                                                                                       |
| 1                                                                | Secure Embedded Systems – David Kleidermacher                                                                                                                                                                         |
| Reference Books                                                  |                                                                                                                                                                                                                       |
| 1                                                                | Computer Networks – Andrew S. Tanenbaum.                                                                                                                                                                              |
| 2                                                                | IoT Fundamentals – David Hanes.                                                                                                                                                                                       |
| 3                                                                | Embedded Systems Security – David Singh.                                                                                                                                                                              |
| ICT/MOOCs Reference                                              |                                                                                                                                                                                                                       |
| 1                                                                | <a href="https://www.youtube.com/watch?v=wkgZk6hgEJs&amp;list=PLbRMhDVUMngfulSvKL0cT-tn8ULtERsWk&amp;index=2">https://www.youtube.com/watch?v=wkgZk6hgEJs&amp;list=PLbRMhDVUMngfulSvKL0cT-tn8ULtERsWk&amp;index=2</a> |
| 2                                                                | <a href="https://www.youtube.com/watch?v=sACVot8QFWY&amp;list=PLbRMhDVUMngfulSvKL0cT-tn8ULtERsWk&amp;index=4">https://www.youtube.com/watch?v=sACVot8QFWY&amp;list=PLbRMhDVUMngfulSvKL0cT-tn8ULtERsWk&amp;index=4</a> |

| Mapping of CO with PO and PSO : |     |     |     |     |     |     |     |     |     |      |      |      |      |      |      |
|---------------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|------|------|------|
| Cos                             | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | PSO1 | PSO2 | PSO3 |
| CO1                             | 1   | 2   | 3   | 3   | 3   | 2   | 3   | 2   | 2   | 2    | 3    | 1    | 1    | 1    | 2    |
| CO2                             | 2   | 2   | 2   | 2   | 2   | 3   | 2   | 3   | 3   | 3    | 2    | 2    | 2    | 2    | 1    |
| CO3                             | 3   | 3   | 3   | 3   | 3   | 2   | 2   | 3   | 3   | 2    | 2    | 1    | 1    | 1    | 2    |
| CO4                             | 3   | 1   | 3   | 3   | 2   | 2   | 3   | 1   | 3   | 2    | 2    | 3    | 3    | 2    | 2    |